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# Determination of Muscles of Head Acting in Whistling

**S Nalini**

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## Abstract

**Background:** Whistling without using a whistle or fingers considered as a manly skill in our patriarchal society is taught as a means of testing for integrity of facial muscles and Facial nerve for UG students in I MBBS under clinical examination of VII cranial nerve. But this test has been mentioned only in a very few books of clinical examination. This fact raised the need for this study

**Aims and Objectives:** To determine percentage of population who can whistle, muscles of head involved in whistling & gender variation

**Study Design:** A descriptive, cross sectional study by convenient sampling method conducted among 200 UG MBBS students of age group 18 – 25 of GTMC.

**Results:** 80% of participants were able to whistle; Whistling is not a manly skill. An element of social inhibition is there in women to whistle; 90.5% of subjects used muscles innervated by both Facial nerve and Hypoglossal nerves simultaneously.

**Conclusion:** There is subtle knowledge gap between clinicians and non - clinicians probably due to lack of need to update for the later which will become evident to students when they enter clinical side. Hence we, teachers too need to refer clinical subject text books and clinical examination manuals to accept, ignore and criticise as appropriate.

***Keywords:*** *Whistling; Facial nerve; Hypoglossal nerve; blow air test*

## Introduction

Whistling is generally considered a manly skill in many communities of our society which are basically patriarchal. It is a complex skill that requires observation and integration of CNS, Peripheral Nervous System, muscles of Expiration, Vocal cord & Head to perform. Whistling without using a whistle or fingers is one of the tests being taught to under graduate MBBS students to asses Facial nerve functions. Out of five practical Physiology books one book[1] does not mention whistling as a test, one[2] says buccinators is partly responsible with Orbicularis Oculi and others[3,4,5] have included whistling as a test for buccinators; Whereas in staunch contrast, only two [13,14] of ten books of Clinical Examination have mentioned whistling as a test for Facial nerve. One Clinical Medicine book states that action of buccinators is helpful in playing wind instruments & in whistling as do two of Anatomy books[14, 15] directly and one[16] indirectly. Therefore it is assumed that though the Buccinators help in whistling it is not the sole muscle for this action. Hence this study was designed to determine % of population who can whistle, muscles of head involved in whistling and to know whether there is any gender variation in the ability to whistle.

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## Materials & Method

A pilot study was conducted in 10 of our faculty

who were unaware of the aim of the study. They were requested to whistle without using fingers or a whistle, carefully observe what happen in head during whistling and report. . The actions they reported were

Retraction of cheeks

Spouting of Lips

Protrusion & Folding of tongue – in U shape

Out of 10 one said she could not whistle at all even after repeated attempts and one blushed and said this is my first attempt and let me see whether I succeed. Based on their report a form to collect data was designed as follows

**Table 1: Form for Data Collection**

| S. No | Sex | Knows Y/N | **If does not know** | | **Pursing / Protrusion of lips** | | **Retraction of Cheeks** | | **Folding of Tongue** | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Failed | Succeeded | Yes | No | Yes | No | Yes | No |

Institutional ethical committee clearance was obtained; the students were explained of the aim of the study and of the fact how much significance their cooperation in the form of giving honest answers carries in their vernacular language; a written consent was obtained after explaining what they have to do, note and report from those who were willing to participate.

**Exclusion Criteria:** Persons who are suffering from Bell's Palsy, Tongue Tie, Cleft Lip & Palate, Painful mouth conditions such as infected Caries Tooth, Wisdom tooth eruption, Gingivitis, Respiratory and Cardiac Illnesses, CNS disorders, Chest Injury, Costo Chondritis, Residual Poliomyelitis, Kypho – scoliosis & Vocal Cord Lesions

**Screening Procedure:** General Examination, Examination of CVS, RS & CNS

**Study Procedure:**

Participants were requested to whistle without using fingers. Each participant was also observed by a researcher when the subject whistled. Those who knew and who succeeded were enquired on what actions took place. During the study students reported additional actions too. Hence the form to collect data was modified with a column for any additional action. On analysis it was found that all actions involved muscles innervated by Facial and Hypoglossal nerve only. In order to simplify, the format was further modified grouping all the actions of muscles innervated by Facial nerve and all the actions of muscles innervated by Hypoglossal nerve into one column for each and analysed.

**Table 2: Modified Form**

| **S. No** | **Sex** | **Knows Y/N** | **If does not know** | | **Protrusion of lips/ Retraction/ Blowing out and retraction of cheeks alternatively** | **Folding in U Shape / Pushing the tongue to place it behind lower teeth / Folding tip to touch floor and curving lateral edge down** |
|---|---|---|---|---|---|---|
| | | | Failed | succeeded | Y/N | Y/N |

**Statistical Analysis:** Data was analysed and expressed in terms of percentage.

**Table 3: Consolidated & Analysed Data**

| Sex | No of participants | Whistled | | 1st attempt | | Used muscles innervated by Facial Nerve | | Used muscles innervated by Hypoglossal Nerve | |
|---|---|---|---|---|---|---|---|---|---|
| | | No | % | No | % | No | % | No | % |
| Female | 112 | 85 | 76 | 47 | 42 | 83 | 97.6 | 71 | 83.5 |
| Male | 88 | 75 | 85 | 18 | 20.5 | 75 | 100 | 72 | 96 |
| Total | 200 | 160 | 80 | 65 | 32.5 | 158 | 98.8 | 143 | 90.5 |

*Two persons whistled by using only tongue.

80% of participants were able to whistle.

Muscles innervated by both nerves were used simultaneously by 90.5%. Two subjects were able to whistle using tongue alone.

Gender variation in the ability to whistle is insignificant

Females attempting to whistle for the first time were > 200 % to that of males

## Discussion

Buccinator compresses or retracts cheeks against teeth and thus helps to blow out air from mouth. It compresses blown out cheek and raises intra oral pressure [13, 14, 15,18,19,20] an activity important in whistling as well as when playing wind instruments accounting for the name of the muscle (In Latin Buccinator means Trumpeter). Orbicularis Oris by protruding lips forms a slit through which forcibly exhaled air escapes[18].

Action of tongue in whistling is variable. Those who fold the tongue in U shape turning the apex and sides upwards to make the dorsum concave and slightly elongate by narrowing, depress & push the tongue to place it behind lower teeth use the intrinsic muscles - Superior Longitudinal & Transverse and Post fibers of Genioglossus, Hyoglossus & Geniohyoid[15,18,19,20]. Those few who curve the tip of tongue to touch floor make use of anterior fibers of Genioglossus[20]. Thus many tongue muscles intrinsic and extrinsic, all innervated by Hypoglossal nerve act in coordination. Thus 90% subjects require intact and functional Hypoglossal nerve with the muscles innervated to whistle. In fact two subjects were able to whistle using exclusively tongue and one subject informed that he gained the ability to whistle only after he underwent surgery for tongue tie.

Though mono neuropathy of Lower Motor Neuron palsy of Facial nerve especially Bell's palsy is the commonest, unilateral Hypoglossal Nerve palsy is not an uncommon finding[22]. XII nerve palsy is more common cranial mono neuropathy due to metastasis as stated by Walker HK[21]. It occurs also due to causes like post-operative inflammation, impacted tooth, Post Viral, Bacterial infections & vaccination, Auto Immune, even Idiopathic[22] and due to trauma during air way management for General Anaesthesia during surgery[23]. The person will have inability to whistle too though the dominant symptoms will be slurred speech, deviation of tongue and chewing difficulty.

## Conclusion

Paralysis of Hypoglossal nerve will affect one's ability to whistle as do paralysis of Facial nerve.

Whistling is not a manly skill as there is only insignificant sex difference in the % of participants who whistled

Social inhibition may be the reason for significant number of women having had not attempted to whistle earlier

There is a subtle knowledge gap between clinicians and non-clinicians probably due to lack of need to update for the later which will become evident to students when they enter clinical side. Hence we, teachers too need to refer text books and clinical examination manuals of clinical subjects to accept, ignore and criticise as appropriate what has been given in text books and manuals of Physiology.

When clinicians were enquired told that they ask the subjects to "Blow Air" to test Buccinators; neither whistling nor blowing out the Cheeks and noting on tapping whether air escapes as mentioned in two Practical Physiology [4,5] and one Clinical Examination [10] book which shall actually be a test for the function of Orbicularis Oculi – to shut mouth tightly for both inflating as well as holding tight when tapped. Neither whistling nor ability to hold air in vestibule of mouth not letting out when tapped is being used to test integrity of buccinator and Facial nerve is being used by clinicians.

The study suggests that teaching whistling as a test for Buccinator's function of retraction of Cheeks shall be stopped and we, Physiologists shall adapt clinician's "Blow Air" test, and shall modify it. If the subject is asked to blow forcibly on the surface of a square piece of paper held vertically 10 cm in front of mouth which will visibly retract the Cheek it will be an objective test – "Blow Air on Paper" - that allows visualization and tactile sensation of movement of the paper. The action of blowing air does not require action of tongue muscles too.

## Limitations

This study result is based more on subjective observation. It would have been more valid if temporary Hypoglossal nerve paralysis was induced by blocking it with local anaesthetic drug infiltration and the subjects were tested. But this becomes an invasive procedure and is unwarranted. Patients suffering from Hypoglossal nerve lesions are best option but it is not a very common disorder.

**Source of Funding:** Self

**Conflict of Interest:** None

**Ethical Clearance:** Obtained from Institutional Ethical Committee

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# A Comparative Study of QTC in Obese, Non-Obese Hypertensive and Obese Normotensive Males

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## Abstract

**Background:** QTc (corrected QT interval) is an index of physiological variability of ventricular repolarization. Prolonged QTc has been reported in cardiac failure, arterial hypertension, ischaemic heart disease and in obesity.

**Aims and Objectives:** This study was aimed at evaluating the effect of hypertension and obesity on QTc. The objective of the study was to compare the QTc in obese, non-obese hypertensive and normotensive obese male subjects.

**Method:** We compared the QTc in obese-hypertensives (n=15), in nonobese hypertensives (n=15) and in obese-normotensives (n=15), comparable for age and sex. Blood pressure was measured in supine position by mercury sphygmomanometer. Body mass index (BMI), WC (waist circumference) and WHR (waist hip ratio) of all patients were calculated.

**Results**: QTc was longer in obese hypertensives and obese normotensives compared to nonobese hypertensives($p<0.00$). WC and WHR had positive correlation with QTc prolongation in obese hypertensives and obese normotensives.

**Conclusion :** This study indicates that obesity is an important predictor of QTc prolongation than blood pressure. Waist circumference and WHR which reflects abdominal obesity have greater association with QTc prolongation.

***Keywords:*** *hypertension, QT interval, obesity, Bazett's formula*

## Introduction

Electrocardiogram is a useful tool to detect cardiac changes with hypertension.[1] QTc is an index of physiological variability of ventricular repolarization and an increase of QTc is a possible risk factor for ventricular arrhythmias and sudden death.[2]

Hypertension is defined as persistent elevation in blood pressure ≥ 140/90 mmHg. The prevalence of hypertension in India is 23.10 % men and 26.60% women.[3] Prevalence of hypertension in South India is found to be 20% according to 2007 CURES study.[4] It is recognized as a common cardiovascular disease and a major risk factor for congestive heart failure, ischemic heart disease, chronic renal failure and stroke. cardiac damage is a common early complication of hypertension.[1]

Obesity has been reported as the cause of QT interval prolongation. QTc prolongation has also been associated with abnormalities of insulin and glucose metabolism with a preponderance to make age, hypertension, diabetes mellitus, hypercholesterolemia, fibrinogen and BMI. There was significant association between BMI and electrocardiographic values such as P wave and QTc dispersion which were increased.[5]

Prolonged QTc is an index of sympathetic over activity under several cardiac conditions and previous studies have shown that increased sympathetic activation is present in both obesity and hypertension particularly when two conditions coexist.[2]

This study was aimed at evaluating the effect of hypertension and obesity on QTc.

## Objectives

To compare the QTc in obese, non-obese hypertensive and normotensive obese male subjects.

## Materials and Method

This study was conducted in Sri Manakula Vinayagar medical college hospital Madagadipet, Puducherry. This was a hospital-based case control study. This study was approved by the Institutional Ethics committee, Sri Manakula Vinayagar medical college hospital.

The sample size was 45 subjects aged 35-55 years and they were divided into three groups

15 obese hypertensive male subjects of 35-55 years of age- Group 1

15 obese normotensive male subjects of 35-55years of age – Group2

15 non-obese hypertensive male subjects of 35-55years of age – Group3

**Inclusion criteria**

1. Male subjects 35 -55 years of age.

2. Obese Hypertensive subjects having blood pressure ≥140/90 mmHg (according to WHO criteria)

3. Non-obese Hypertensive subjects having blood pressure ≥140/90 mmHg (according to WHO criteria)

4.Obese normotensive subjects having blood pressure ≤120/80mmHg.

**Exclusion criteria**

H/o cardiovascular disease

H/o respiratory disease

H/o drug, Medications

H/o renal disease

H/o endocrine disease

1. Measurement of Blood pressure:

Blood pressure was measured by a mercury sphygmomanometer in supine position. Blood pressure was measured two times. The average of two readings was taken as correct systolic and diastolic blood pressure.[6]

The classification of blood pressure is as follows

Normal BP: <120/80 mmHg

Prehypertension: 120-139/ 80-89 mmHg

Stage I Hypertension: 140-159 / 90-99 mmHg

Stage II Hypertension: > 160/100 mmHg.

2. Body weight:

Body weight was measured while the subject minimally clothed and without shoes, standing steady on a weighing scale and it was recorded to the nearest 0.1kg.[7]

3. Height:

Height was measured to the nearest 0.1 cm while the subject was standing barefoot in erect position with a wall mounted stadiometer.[7]

4. Body mass index:

BMI was measured by weight in kilograms divided by square of height in meters (kg/m2).

(BMI in the range of 18.50 to 24.99 kg/m2 is considered to be normal.[7]

5. Waist circumference:

Waist circumference was measured in centimeters over light clothing at a point mid-way between the lower rib and iliac crest.[7]

6. Hip circumference:

Hip Circumference was measured in centimeters over light clothing at the widest girth of the hip. For waist and hip circumference two consecutive readings were made at each site on a horizontal plane without compression of the skin. The mean was taken as the final reading. [7]

7. Waist Hip Ratio: It was calculated by dividing waist circumference by hip circumference.[7]

8. Electrocardiography

ECG is the graphical record of electrical activity of heart obtained by placing electrodes on the surface of the body that records voltage differences generated by the heart. Using a standard 12 conventional ECG lead,

the difference in potential was recorded. QT interval was measured from the earliest onset of QRS complex to the terminal portion of the T wave where it meets the baseline. QT interval was measured by computerized measurements from limb lead II. RR interval from the preceding cardiac cycle was measured from the peaks of the R waves to correct the QT interval for heart rate (QTc). QT intervals was corrected with Bazzet's formula which was done by the computer. ($QTc=QT/\sqrt{RR}$).[2]

Based on European regulatory guidelines to stratify baseline QTc prolongation (ms) in men:

Normal QTc prolongation ≤ 430ms

Borderline QTc prolongation 431–450ms

Abnormal QTc prolongation ≥ 451ms.[8]

## Statistical analysis

The data collected were entered and analyzed using software Statistical Package for the Social Science 16.0 (SPSS 16.0). All parameters were presented as mean ± standard deviation (mean ± SD). Comparison of parameters between various groups was done with student 't' test. Correlation analysis was done with Pearson's correlation method. A linear regression analysis was performed to evaluate the independent predictors of QTc. A p value of less than 0.05 was considered statistically significant.

## Results

The results were presented as mean ± standard deviation in table 1. Table 1 summarizes the descriptive statistics of anthropometric measurements, ECG recordings and blood pressure among the three groups. The mean values of QTc were significantly increased in obese hypertensives in comparison with the obese normotensives and nonobese hypertensives ($p<0.05$).

Table 2, 3 and 4 shows the correlation of anthropometric indicators with QTc. WHR, WC and BMI were found to be positively correlated with QTc among the obese hypertensives. WC was found to be positively correlated with QTc among the obese normotensives.

A linear regression analysis was performed to evaluate the independent predictors of QTc. Regression analysis with QTc as a dependent variable showed a linear relationship with WC and WHR among the obese hypertensives (Table 5). Regression analysis with QTc as a dependent variable showed a linear relationship with WC among the obese normotensives (Table 6).

**Table 1- Comparison of anthropometric indicators and various other parameters between the three groups**

| **Parameters** | ***Group1 Obese hypertensives N=15*** | **Group 2 Obese normotensives N=15** | **Group 3 nonobese hypertensives N=15** | **P value** |
|---|---|---|---|---|
| Age (years) | 46.00 ± 6.26 | 46.86 ± 5.16 | 44.86 ± 6.22 | 0.652 |
| Height (m) | 1.45 ± 0.07 | 1.43 ± 0.08 | 1.51 ± 0.08 | 0.024 |
| Weight (Kg) | 68.06 ± 6.04 | 67.33 ± 6.85 | 53.46 ± 5.33 | <0.001 |
| BMI ($kg/m^2$) | 32.07 ± 1.68 | 32.71 ± 1.43 | 23.28 ± 1.31 | <0.001 |
| HC (cm) | 106.80 ± 4.75 | 107.80 ± 6.59 | 97.80 ± 5.01 | 0.006 |
| WC (cm) | 99.60 ± 9.23 | 97.13 ± 6.22 | 80.33 ± 4.67 | 0.000 |
| WHR | 0.92 ± 0.05 | 0.90 ± 0.03 | 0.82 ± 0.03 | 0.000 |
| Systolic Bp(mmHg) | 156 ± 6.13 | 115 ± 4.48 | 154 ± 5.05 | 0.000 |
| Diastolic Bp(mmHg) | 102 ± 7.55 | 72 ± 7.16 | 101 ± 6.87 | 0.000 |
| QT (millisec) | 364.40 ± 27.06 | 370.47 ± 34.50 | 324.27 ± 53.19 | 0.05 |
| QTc (millisec) | 465.53 ± 34.49 | 434.13 ± 21.71 | 375.93 ± 57.52 | 0.00 |

Data are presented as Mean ±SD. BMI=Body Mass Index, HC=Hip circumference, WC=Waist Circumference, WHR=Waist Hip Ratio, Bp=Blood pressure. * $p<0.05$ is considered statistically significant.

**Table 2- Correlation of QTc with various parameters among the obese hypertensives**

| Parameters (n=15) | P value | R value |
|---|---|---|
| BMI | 0.01* | 0.635 |
| WC | 0.00* | 0.967 |
| WHR | 0.00* | 0.869 |

Pearson correlation analysis was performed to analyze the data. * p<0.05 is considered statistically significant. BMI=Body Mass Index, HC=Hip circumference, WC=Waist Circumference, WHR=Waist Hip Ratio

**Table 3- Correlation of QTc with various parameters among the obese normotensives**

| Parameters (n=15) | P value | R value |
|---|---|---|
| BMI | 0.95 | 0.017 |
| WC | 0.00* | 0.910 |
| WHR | 0.85 | 0.050 |

Pearson correlation analysis was performed to analyze the data. * p<0.05 is considered statistically significant. BMI=Body Mass Index, HC=Hip circumference, WC=Waist Circumference, WHR=Waist Hip Ratio

**Table 4- Correlation of QTc with various parameters among the obese hypertensives**

| Parameters (n=15) | P value | R value |
|---|---|---|
| BMI | 0.35 | 0.255 |
| WC | 0.63 | 0.134 |
| WHR | 0.28 | 0.255 |

Pearson correlation analysis was performed to analyze the data. * p<0.05 is considered statistically significant. BMI=Body Mass Index, HC=Hip circumference, WC=Waist Circumference, WHR=Waist Hip Ratio

**Table 5: Linear regression analysis to find the effect of QTc on WC, WHR and BMI among the obese hypertensives cases**

| Independent variables | Non standardized coefficients B value | Standardized coefficients β | P value |
|---|---|---|---|
| *BMI* | *13.14* | *0.635* | 0.07 |
| WC | *3.64* | *0.967* | *0.00** |
| WHR | *51.68* | *0.869* | *0.00** |

* p<0.05 is considered statistically significant. BMI=Body Mass Index, HC=Hip circumference, WC=Waist Circumference, WHR=Waist Hip Ratio

**Table 6: Linear regression analysis to find the effect of QTc on WC, WHR and BMI among the obese normotensives cases**

| Independent variables | Non standardized coefficients B value | Standardized coefficients β | P value |
|---|---|---|---|
| *BMI* | *0.265* | *0.017* | *0.95* |
| WC | *3.175* | *0.910* | *0.00** |
| WHR | *29.75* | *0.050* | *0.85* |

* p<0.05 is considered statistically significant. BMI=Body Mass Index, WC=Waist Circumference, WHR=Waist Hip Ratio

## Discussion

Ventricular repolarization is most commonly assessed electrocardiographically by measuring the corrected QT interval (QTc) and either QT or QTc dispersion.[9] Known causes of

QTc prolongation include the congenital long QT syndromes, the Brugada syndrome, electrolyte disturbances (hypokalemia, hypomagnesemia, hypocalcemia), selected drugs (e.g., certain anti-arrhythmic drugs, phenothiazines, tricyclic antidepressants, erythromycin in combination with certain antihistamines, pentamidine, and certain anti-malarials), liquid protein and starvation diets, hypothyroidism, central nervous system lesions, severe bradycardia, mitral valve prolapse, acute myocardial

infarction, and possibly obstructive sleep apnea. [10, 11]

Multiple studies of obese subjects have reported prolonged QTc, suggesting an association between obesity and delayed ventricular repolarization. Seyfeli *et al*. reported that mean QTc and QTc dispersion values were significantly longer/greater in 42 obese than in 25 lean women.[12] Study by Rita M showed a significant, but weak positive correlation between BMI and QTc in 50 normotensive severely obese subjects.[13] BMI correlated positively and significantly with QTc and QTc dispersion in Seyfeli's study and independently predicted QTc.[12] In a study of 122 men including 59 with uncomplicated obesity and 63 lean controls QTc correlated positively and significantly with BMI and waist circumference.[5]

QT interval prolongation is associated with ventricular arrhythmia and sudden cardiac death.[14] It has also been shown to be associated with increased mortality in ischemic heart disease and diabetic nephropathy.[15, 16] Obesity has been reported as the cause of QT interval prolongation. However, studies conducted in patients with uncomplicated obesity have demonstrated no effect of weight gain on cardiac repolarization.[17]

Pontrolli AE suggested that QTc was higher in morbidly obese subjects, with or without hypertension, and in lean hypertensive subjects than in lean controls. Sustained and prolonged haemodynamic burden is required to induce structural changes of the left ventricle as it happens in long-lasting obesity and in hypertension.[18]

The standard clinical correction is to use the Bazett's formula which calculates the heart rate-corrected QT interval of QTC with the formula of $QTC = QT/\sqrt{RR}$.[19] QT interval in women is longer compared with men because of the effect of sex hormones on cardiac electrophysiology.[20]

Linear regression analysis also showed a linear relationship between WC and QTc among obese hypertensives and normotensives and also a linear relationship between WHR and QTc among obese hypertensives. This indicates that abdominal obesity can be used to predict changes in QTc.

Increased QTc dispersion can therefore serve as non-invasive marker of increased cardiovascular risk and can therefore be an effective screening for reduction of cardiovascular morbidity and mortality in obese individuals. Therefore, aggressive control of blood pressure, appropriate lifestyle modification campaign may be the best form of preventive strategy to reduce the frequency of prolonged QTc in subjects with obesity and hypertension

From the present study, it is evident that abdominal obesity can cause significant increase in QTc, which indicates that WC and WHR can be used as parameters to predict changes in QTc. A large-scale study is warranted to further validate the findings of the present study.

There are multiple limitations to this study. These include the small sample size and the absence of data derived from newer measures of ventricular repolarization such as transmural dispersion of repolarization. Polysomnography was not performed in most patients; thus, we were unable to assess the role of obstructive sleep apnea on ventricular repolarization in normotensive severely obese patients. Several metabolic factors that might influence ventricular repolarization like plasma insulin levels, free fatty acids, and catecholamines were not measured.

## Conclusion

This study indicates that obesity is an important predictor of QTc prolongation than blood pressure. Waist circumference and WHR which reflects abdominal obesity have greater association with QTc prolongation. QTc can be used in routine screening of the obese and hypertensive patients for cardiac complications and prognosis.

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# Effect of Yoga on Respiratory Endurance Test in Medical Students

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## Abstract

**Introduction:** Yogic practices can be considered to be a very good exercise for maintaining proper health and also has a profound effect on the lung functions of an individual. They are also used as psycho-physiological stimuli to increase the physiological functions and human performance. The present work is undertaken as there was no reported data on comparison of pranayama & suryanamaskar practitioners in various pulmonary endurance functions. **Materials & Method:** The present study was conducted at MNR Medical College & Hospital, Sangareddy. The Institute Ethical Committee approved the study protocol. Informed consent was taken from all the subjects. The study was conducted with 80 subjects (aged between 18 to 20 years), under the supervision of a qualified yoga trainer. Inclusion Criteria: Medical students of age between 18-20 years, Only volunteers who are interested in practicing Yoga, Non alcoholic & non smokers. Exclusion criteria: Previous experience of yoga training and physically challenged persons. **Results:** The MVV, 40 mm endurance and chest expansion were significantly increased ($p<0.005$) in the pranayama group (Group-II) and suryanamaskar group (Group-III). But the RR was significantly decreased ($p<0.005$) in pranayama (Group-II), suryanamaskar (Group-III) and combined group (Group-IV) than control group (Group-I), ($p<0.005$). **Conclusion:** The regular practice of pranayama and Suryanamaskar practice induces more beneficial effects than physical exercise which mostly affects skeletal muscles. To meet the modern life style which is full of challenges and stress, an all-round personality development has become mediatory for the student, this aspect of relaxation and detachment is lacking in our education system and it is this new dimension (yoga) that needs to be added to the curriculum.

***Keyword:*** *pranayama, suryanamaskar(SN), respiratory endurance, peak expiratory flow rate, vital capacity*

## Introduction

Yoga is an ancient science of technique exercise associated with a set of principles and practices. Yogic lifestyle modification leads to remarkable improvement in the subjective wellbeing and can make an appreciable contribution to primary prevention and management of lifestyle diseases in day-to-days life[1]. Suryanamaskar and pranayama have been shown to reduce the resting respiratory rate; increase vital capacity, Timed Vital Capacity, Maximal Voluntary Ventilation, Breath Holding Time, Maximal Inspiratory Pressure and Maximal Expiratory Pressure[2]. Yogic exercises are popular all over the world in these days which increase longevity and have therapeutic and rehabilitative actions[3]. Asanas involved in surya namaska, a component in the yogic system tunes the range of flexibility of the practitioners. Hence selective package of yogic exercises (pranayama and suryanamaskar) would prove a positive impact among the student population in executing the skills for the better performance in their education as wholesome shaping of human body and mind[4]. Govindarajulu (2003) observed the effects of Yoga practices on flexibility and cardio respiratory endurance on high an out school girls where he found significant improvement on those selected variables after the training period[5].

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There was enough literature on the effect of pranayama and suryanamaskar on pulmonary functions. In view of this, the present study was designed to evaluate the effects of combined yoga training on respiratory efficiency functions in healthy individuals aged 18 to 24 years.

## Aim & Objectives

To investigate the effect of suryanamaskar practice on various respiratory endurance tests i.e. MVV (L/min), chest expansion, RR/Min and 40mm/sec after six months of training programme.

## Materials & Method

This study was conducted in the Department of Physiology, MNR Medical College Hospital &hospital, Sangareddy, Telangana. After approval of Institutional Human Ethical Committee, eighty medical students between the age group of 18 to 24 years (20 ± 2 years) of both the sexes were selected. Informed and written consent were taken from all the participants involved in the study. The duration of the study was six months. 80 normal medical students of MBBS were randomly selected and included in our study. The participants were divided into four groups namely; control, pranayama, suryanamaskar and combined group of pranayama and suryanamaskar.

**Table 1: Equal distribution of participants into groups for the 6 months duration of the study**

| S. No | Groups | No. of participants | Duration of training |
|---|---|---|---|
| 1 | Group-I (before yoga group) | 20 | - |
| 2 | Group- II (Pranayama) | 20 | 6 months |
| 3 | Group-III (Suryanamaskar group) | 20 | 6 months |
| 4 | Group-IV (Combined group of pranayama & suryanamaskar) | 20 | 6 months |

General characteristics (age, body weight, height, and body mass index: BMI) were observed in subjects. All subjects were assigned to learn the whole yoga protocol and were explained in detail by the investigator. On the first day of study, subjects came to the training room and endurance tests were assessed using standard test. These were pre yoga exercise values. After six months of yoga training, the same tests were conducted which were designated as the post yoga values. **Inclusion criteria:** Medical students of age between 18-24 years. Only volunteers who were interested in practicing Yoga. Non alcoholic & non smokers. **Exclusion Criteria:** Previous experience of yoga training. History of major medical illness in the past e.g., Tuberculosis, Hypertension, Diabetes mellitus, Bronchial asthma etc. History of major surgery in the recent past.

All tests were carried out in the laboratory of the Department of Physiology, MNR Medical College & Hospital, Sangareddy. The laboratory environment was, quiet the temperature was between 33 0C–35 0C and the lighting subdued. The study did not involve intravascular instrumentation at any stage. The participants were explained in detail about the study protocol and written informed consent was obtained from them. The subjects were advised to come at 4 pm completely relaxed with empty bowel and bladder. All subjects who were included in the study (yoga group) were advised to refrain from smoking and alcohol during the entire study period.

All the subjects were asked to practice daily for about one hour. Yoga classes started with a brief prayer. Preparatory practices like breath-body coordination and joint loosening exercises were undertaken for 10 minutes. The duration of the study was six months; the yoga training was performed for 30 min, daily for 5 days a week. This was followed by 30 minutes of either pranayama (Group-II) or suryanamaskar (Group-III) or combined Group (pranayama and suryanamaskar).

At the end of yoga training exercise, attendance was taken and the subjects were motivated to practice regularly. Some of the classes were preceded by talk on diet and lifestyle modification in controlling chronic lifestyle disorders.

### Endurance Test

**MVV (Maximum Voluntary Ventilation):** was measured by asking the subject to breathe as deeply and rapidly as possible for 15 seconds into the computerized spirometer model, RMS 401with the Helios software and the results in L/min were recorded in sec.

**40 mm Endurance Test:** After a deep expiration, the subjects were asked to inspire to the maximum. A clip was applied to the nose and the subject asked to expire into the mercury manometer up to the level of 40mm and to maintain it as long as possible. The maximum possible maintenance time were recorded in sec.

**Chest Wall Expansion:** The degree of expansion of chest was measured by placing an inch tape just below the nipple around the chest with its mark at the middle of the sternum. Instruction was given to the subjects to breath in and out as deep as possible. Readings were taken after 2 or 3 breaths. Measurement of the chest circumference was done at the end of deep inspiration and expiration and values were expressed in centimeters.

**Respiratory rate (RR):** The right palm was placed over the upper part of abdomen of the subject and the number of respirations in one minute was counted.

## Results

*Statistical analysis*

All the values obtained before and after performing Pranayama, Suryanamaskar and combined pranayama, suryanamaskar yogic exercises were expressed as mean ± SD. The data were analyzed by SPSS 16. 0 version one way ANOVA followed by paired t test (Dennett's test) which was used to compare pre and post training results. P values of less than 0.05 were accepted as significant difference between the compared values. Comparison of respiratory endurance in pranayama, suryanamaskar and combined pranayama and suryanamaskarar procedures

The MVV, 40 mm endurance and chest expansion were significantly increased ($p<0.005$) in the pranayama group (Group-II) and suryanamaskar group (Group-III). But the RR was significantly decreased ($p<0.005$) in pranayama (Group-II), suryanamaskar (Group-III) and combined group (Group-IV) than control group (Group-I), ($p<0.005$).

**Table 2: Comparison of respiratory endurance in pranayama, suryanamaskar and combined pranayama and suryanamaskarar procedures.**

| S.No | Parameters | Before yoga (Group-I) (n=20) (Control) | After Pranayama (Group -II) (n=20) | After Surya namaskar (Group -III) (n=20) | Combined Group- (Group-IV) (n=20) |
|---|---|---|---|---|---|
| 1 | RR/min | 18.14 ± 1.57 | 16.03 ± 1.46* | 15.59 ± 0.32* | 14.0 ± 1.69* |
| 2 | MVV (L/min) | 97.01 ± 1.15 | 107.23 ± 0.91* | 110.83 ± 1.45* | 110.10 ± 1.67* |
| 3 | 40mm endurance | 25.95 ± 0.57 | 26.19 ± 1.23* | 27.09 ± 0.52* | 27.02 ± 1.51* |
| 4 | Chest expansion (cm) | 2.27 ± 0.57 | 3.00 ± 0.52* | 3.79 ± 0.91* | 3.01 ± 1.14* |

Values are expressed as mean ± SD; *$p<0.05$ significant, **$p<0.001$ highly significant

## Discussion

Pranayama and suryanamaskar practice showed a significant improvement in MVV. These findings concur with the study conducted by **Joshi, et al** in 1992 who reported a statistically significant increase in MVV. The RR was significantly decreased in the post yoga group ($p< 0.05$) than the pre yoga group[6].

Practicing Pranayama and suryanamskara for few weeks, there was a new pattern of breathing which was slower than its basal rhythm leading to decrease in respiratory rate. Yogic practices also improved respiratory muscle endurance. 40mm endurance time, also a showed statistically significant improvement, indicates better respiratory endurance in post yoga group after regular practice of pranayama and suryanamaskar. At the end of 6 weeks Yoga training, chest wall expansion significantly increased ($p < 0.05$) in middle level of the thoracic cage (4th intercostal space) when compared to their pretest values. Combined Pranayama and

suryanamaskar training improved respiratory capacity especially chest wall expansion and lung volumes. This study agrees with previous reports in Indian adolocent children (**Mandanmohan et al., 2003**) supports the benefit of Yoga as an alternative exercise for health and treatment of some common respiratory disorders[7].

**Rajesh et al (2004)** found a significant improvement in all pulmonary function with a significant decrease in RR could be mainly due to regulated, slow, deep and controlled breathing for prolonged period during pranayama practice leading to increase in the strength and endurance of expiratory as well as inspiratory muscles and contributing to enhanced voluntary control of breathing. As a technique, pranayama can assume rather complex forms of breathing, but the essence of the practice is slow and deep breathing. Such breathing is economical because it reduces dead space ventilation. It also refreshes air throughout the lungs, in contrast with shallow breathing that refreshes air only at the base of the lungs[8].

**Bhutkar et al (2008)** showed a statistically significant improvement in SBP, DBP, FEV1, PEFR, MVV, lung compliance and airway resistance as compared to baseline in CAD patients after 3months of regular practice of pranayama and asanas[9].

Regular yogic practices strengthen the respiratory muscles; increase the excursions of diaphragm and lungs as well as thoracic compliance. Also yogic practices decrease airway resistance. All these factors contribute to improvement in the various lung function tests after regular practice of SN. Yogic practices also improve respiratory muscle endurance. 40mm endurance test, which also showed statistically significant improvement, indicates better respiratory endurance in both the groups after regular practice of SN. Yogic asanas and pranayama have been shown to reduce the resting respiratory rate and increase vital capacity, timed vital capacity, maximum voluntary ventilation, breath holding time and maximal inspiratory and expiratory pressures. Regular practice of suryanamaskar together with pranayama enhances the strength and force of contraction of respiratory muscles like diaphragm and upper abdominal muscles resulting in improvement of MVV and PEFR according to **Joshi et al (1992).**

Increase in inspiratory and expiratory pressures suggests that yoga training improves the strength of expiratory and as well as inspiratory muscles. Respiratory muscles are like skeletal muscles. Yogic techniques involve isometric contraction which is known to increase skeletal muscle strength. Breath holding time depends on initial lung volume. Greater lung volume decreases the frequency and amplitude of involuntary contractions of respiratory muscles, thereby lessening the discomfort of breath holding (**Mandanmohan et al., 2003**). During yoga practice, one consistently and consciously over-rides the stimuli to respiratory centers, thus acquiring control over the respiration. This, along with improved cardio-respiratory performance may explain the prolongation of breath holding time in yoga trained subjects.

Hence daily practice of both Suryanamaskar and pranayama could also be part of physical fitness and life style modification program in maintaining better physical and mental health[10].

## Conclusion

Pranayama is an ancient yoga technique. The regular practice of Pranayama integrates the mind and the body. It differs from other forms of exercises as it mainly focuses on the sensations in the body. Pranayama thus acts directly on the various functions of the body and affords benefits in a positive way. Our study showed that the pulmonary function test values improved after short term (6 months) pranayama practice. Regular, slow and forceful inspiration and expiration for a longer duration during the pranayama practice, leading to strengthening of the respiratory muscles. Pranayama training causes improvement in the expiratory power and decreases the resistance to the air flow in the lungs. Pranayama training causes an increase in the voluntary breath holding time. This may be due to acclimatization of the chemoreceptors to hypercapnoea. Pranayama is a type of yogic breathing exercise. This resultant effect of pranayama can be used as lung strengthening tool to treat many lung diseases like asthama, allergic bronchitis, post pneumonia recoveries, tuberculosis and many occupational diseases.

**Ethical Clearance**- Institutional Ethics Committee (IEC) approval was taken prior to the study.

**Source of Funding-** Nil

**Conflict of Interest -** None.

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# Assessment of Bronchomotor Tone in Normal and Overweight/Obese Normal Subjects

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## Abstract

**Background:** Obesity in children and young adults is on a stupendous rise over the last decade globally making the individual highly susceptible to various diseases. Pulmonary functions are well reported complications of obesity in adults with reduced lung volume & expiratory flow rates being the most frequent reported abnormalities. **Methodology:** This cross sectional analytical study was undertaken in the research lab of the Department of Physiology, M.K.C.G. Medical College over a period of 12 months on 300 students to determine baseline anthropometric measurements and pulmonary function tests using spirometry. Independent 't' test and multiple linear regression in SPSS 20.0 is used to statistically ascertain the aforementioned objective stated in the background. **Results:** VC, ERV, TV, dynamic pulmonary functions; $FEV_{1,}$ $MEF_{25}$along with PIF and $MIF_{50}$ showed statistically significant decline in overweight/obese individuals. The aforementioned findings of VC, ERV &$FEV_1$ showed a similar diminished trend in overweight/obese individuals on further evaluation using multiple linear regression analysis. **Conclusion:** Overall most of the pulmonary functions tests showed compromised status in overweight/obese individuals with VC, ERV, TV, $FEV_{1,}$ $MEF_{25}$, PIF and $MIF_{50}$ exhibiting statistically significant reduction. Mechanistically, this can be attributed to the presence of adipose tissue around the rib cage, in the abdomen and visceral cavity loading the chest wall leading to small airway collapse and subsequent lowering of pulmonary function tests.

***Keywords:*** *Pulmonary function test, Obesity,*

## Introduction

Globally, the epidemic of obesity in children and young adults is rapidly increasing, rising by more than 30% over the past decade with it's prevalence in India ranges from 10% to 40% [1.] It is classically characterized by increased body fat (BF), associated with dyslipidemia, insulin resistance, cell organelles stress, and vascular inflammation. Increased weight makes obese individual highly susceptible to various diseases.

In general obesity results from greater energy intake than expenditure *with* greater amount of energy from food enter the body than required the body weight increases, and this excess energy is stored as fat thus causing excessive adiposity (obesity). The etiology of obesity is multifactorial and complex with genes determining food intake whilst lifestyle and environmental factors. The rapid rise in obesity off late vehemently suggests the key role of lifestyle and environmental factors because genetic changes could not have occurred so rapidly.

The American Heart Association has reported greater prevalence of hypertension amongst obese individuals. Chronically augmented sympathetic activity is one of the possible mechanisms underlying the pathophysiology

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of hypertension in obese population. The potential abnormalities predisposing these individuals perhaps include enhanced baseline sympathetic activity as well as demented response to sympathetic stimuli.

Pulmonary functions are well reported complications of obesity in adults with reduced lung volume & expiratory flow rates being the most frequent reported abnormalities. Studies exhibited an inverse relationship between BMI and FVC, FEV1. Other parameters such as expiratory and inspiratory flow rates (PEF, MEF50, PIF and MIF50) and MVV also decrease linearly with increasing BMI. Decreases in expiratory flows are most likely to occur once decreased FVC causes flow to move to a lower position on the maximal flow-volume curve.

Paucity of studies available on the pulmonary functions in young obese adults compel us to take the present study with an aim to investigate the derangement of pulmonary function tests in young obese medical students of M.K.C.G.Medical College, Berhampur

## Methodology

**Study design:** This cross sectional analytical study was undertaken to investigate the derangement of sympathetic autonomic parameters and pulmonary functions in young obese students of M.K.C.G. Medical College, Berhampur, Orissa. The research was carried out in the research lab of the Department of Physiology, M.K.C.G. Medical College over a period of 12 months after obtaining written consent from all participants and approval by the institutional ethics committee.

**Sample population**: 300 participants were included in the analysis after excluding subjects with history of asthma or any other past/concurrent pulmonary illness, ,history of smoking, symptoms of atopy/allergy. They were divided into 2 groups of 150 each as per the WHO criteria of obesity; BMI of <25 kg/$m^2$ (Normal) and >25 kg/$m^2$overweight/obese

**Sample size:** A sample size of 150 for each group was calculated through Cohen flexible algorithm using Fischer's 'F' distribution by comparing means between two group(s) with 'α'=0.05, 'β'= 80%, 'F'= 0.7 / 2 * 1 = 0.35 and effect size (es) which is difference b/w the two groups / 2 * within the group SD = 0.7

**Pulmonary function test analysis using spirometry:** A baseline spirometry was done in which both static and dynamic lung function parameters were recorded. All the spirometric measurements were done using FLOWHANDY ZAN 100USB spirometer using ZANsoftware GP1.3.xx based on windows. Before performing the spirometry, the subjects were explained how to perform the test, also there were live demonstration how to perform the test.The subject was comfortably seated with the Flowhandy 100 USB perfectly positioned at his/her mouth level. The subject was connected to ClarityMed PMS 320 cardiac monitor for simultaneous recording of pulse, blood pressure and oxygen saturation of arterial blood ($SpO_2$). The nose-clip was tightly applied and the subject breathed in and out to the tightly placed mouthpiece through his/her mouth. With the recording system on, the subject had to breathe slowly at least 6-8 times at a rate of about 30 breaths /minute with depth around 0.5 – 1.0 L. After that, the subjects inspired slowly to his total lung capacity and then expire as quick and deep as possible; the expiration must last at least for 6 seconds. A computerised spirometer was used. Flowhandy ZAN 100 USB is an open spirometry system.

## Statistical Analysis

Dataset was analyzed using SPSS (Statistical Package for the Social Sciences; version 20.0 for Windows). Independent 't' test was used for comparing continuous variables (anthropometric indices and pulmonary function test parameters) between the groups. Furthermore, multiple linear regression analysis is used to ascertain the findings of the Independent 't' test.

## Results

**Table 1: Independent't' test for the comparison of pulmonary function test parameters among non-obese and obese subjects**

| S. no | Pulmonary function test parameters | | Non-obese (n=150) Mean ± SE | Obese (n=150) Mean ± SE | 'p' value |
|---|---|---|---|---|---|
| 1. | Static Lung Volume & capacities | Vital capacity (L/min) | 4.00 ± 0.05 | 3.80 ± 0.05 | <0.01 |
| | | Expiratory reserve volume | 1.27 ± 0.03 | 1.18 ± 0.03 | <0.01 |
| | | Inspiratory reserve volume | 2.09 ± 0.04 | 2.00 ± 0.04 | >0.01 |
| | | Tidal Volume | 0.59 ± 0.2 | 0.70 ± 0.01 | <0.01 |
| | | Inspiratory capacity | 2.70 ± 0.04 | 2.68 ± 0.03 | >0.01 |
| 2. | Dynamic Lung Volume & capacities | FVCex | 3.95 ± 0.62 | 3.89 ± 0.61 | >0.01 |
| | | $FEV_1$ | 3.54 ± 0.49 | 3.47 ± 0.54 | <0.01 |
| | | $FEV_1$/IVC | 89.78 ± 0.41 | 89.07 ± 0.39 | >0.01 |
| | | $FEV_1$/FVC | 89.78 ± 0.41 | 89.07 ± 0.38 | >0.01 |
| | | $MEF_{25}$ | 7.63 ± 0.06 | 7.33 ± 0.05 | <0.01 |
| 4. | Mean Expiratory Flow | $MEF_{25-75}$ | 4.44 ± 0.07 | 4.42 ± 0.08 | >0.01 |
| | | $MEF_{50}$ | 5.15 ± 0.08 | 5.14 ± 0.08 | >0.01 |
| 5. | PIF | | 4.47 ± 0.11 | 4.32 ± 0.11 | <0.01 |
| 6. | $MIF_{50}$ | | 4.24 ± 0.11 | 4.17 ± 0.11 | <0.01 |

**Values are Mean ± SE; Independent 't' test: 1. Compared with Non-obese: *p < 0.05, **p < 0.001;**

Table 1 shows comparative analysis of pulmonary function test parameters among non-obese and obese subjects using Independent 't' test. Obese subjects exhibit a decline in all the measured static lung volumes and capacities with vital capacity (VC), expiratory reserve volume (ERV), and tidal volume (TV) significantly reduced ($p<0.01$) in obese as compared to non-obese individuals. A similar pattern of diminished however insignificant dynamic lung volumes and capacities of FEVex, $FEV_{1,}$ $FEV_{1/}$IVC, $FEV_1$/FVC and $MEF_{25}$ is again observed in obese subjects with only $FEV_1$ and $MEF_{25}$delineating a statistically significant waning pattern. The mean expiratory flow parameters of $MEF_{25-75}$ and $MEF_{50}$showed no significant between the two groups despite being minutely on a lower side in obese individuals. They also exhibited significant decline in PIF and $MIF_{50.}$

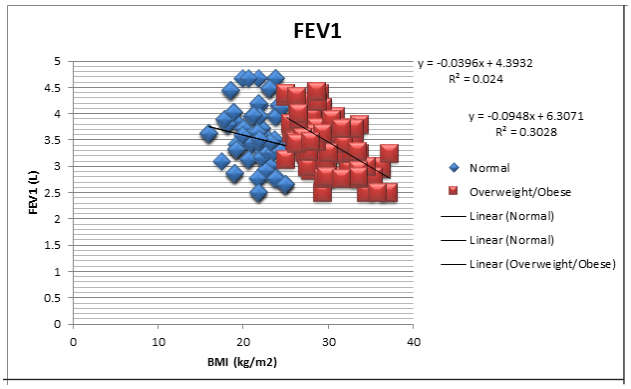
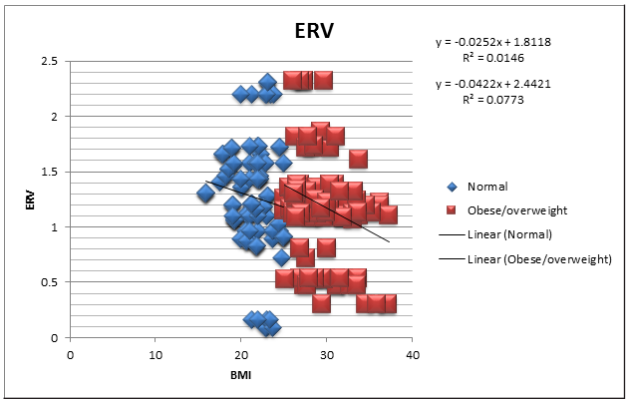
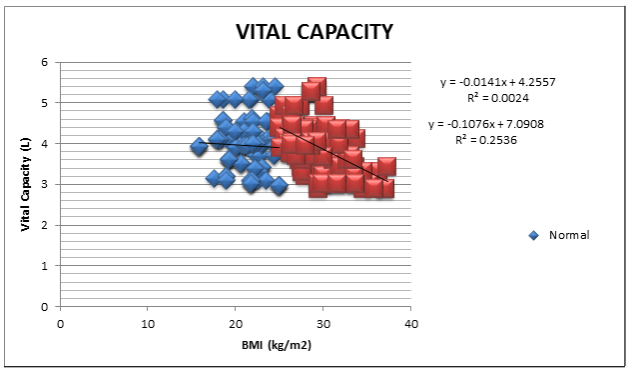



**Fig-1 compares dependency of forced expiratory volume in first second ($FEV_1$) on BMI between non-obese and overweight/obese subjects using multiple linear regression analysis. Among overweight/obese subjects, the slope of best fitted regression line 'β' was estimated as -0.09 which means that average baseline $FEV_1$ deccreases by -0.09 L or 9ml for every 1 kg/m² increase in BMI. Furthermore, a value of $R^2$=0.28 vehemently explains 28% of $FEV_1$ on BMI.**




**A similar dependency of expiratory reserve volume (ERV) on BMI between non-obese and overweight/obese subjects using multiple linear regression analysis is depicted in Fig-2. Among overweight/obese subjects, the slope of best fitted regression line 'β' was estimated as -0.03 which means that average baseline ERV decreases by -0.03 L or 3 ml for every 1 kg/m² increase in BMI. Furthermore, a value of $R^2$=0.03somewhat explains 3% dependency of ERV on BMI.**




**Again, Fig-3 shows multiple linear regression analysis of vital capacity (VC) on BMI between non-obese and overweight/obese subjects. Among overweight/obese subjects, the slope of best fitted regression line 'β' was estimated as -0.10 which means that average baseline VC decreases by -0.10 L or 10 ml for every 1 kg/m² increase in BMI. Furthermore, a value of $R^2$=0.21 to a great extent explains 21% dependency of VC on BMI.**

## Discussion

Obesity was thought to have an influence on lung functions and in turn somewhat correlated with compromised pulmonary function test parameters. Amongst overweight and obese subjects we exhibited a significant decrease in TV, ERV, VC, and $FEV_1$ as compared to normal individuals. A waning trend in IRV & IC was found in overweight and obese subjects but this reduction is statistically insignificant. Our results are in concordance with the findings of many other studies that have shown various lung volume and capacities especially ERV, $FEV_1$ and VC decreases with increase in BMI [1, 2, 6, 8].

The aforementioned results are in close proximity with many previous studies. For example a study conducted by Richard L Jones et at showed decrease in ERV from a predicted 118% to 55% when BMI increased from 20 kg/m² to 30 kg/m² . A similar comprise in FRC from 112% predicted at 20 kg/m² to 84% predicted at 30kg/m² BMI[1]. Similar findings are reiterated in a study done by Zerah F et al, showing significant decline in pulmonary functions i.e. TLC, VC, $FEV_1$, FRC and ERV with rising obesity[8].

Unlike most of the studies exploring pulmonary function tests in obese subjects, we measured and compared inspiratory flow rates in the form of PIF and $MIF_{50}$ between overweight/obese and normal individuals. Cases exhibited a significant decline in both PIF and $MIF_{50}$. Rubenstein et al reported reduced FRC, TLC, ERV, FVC, FEV1 and MEF ratio at low lung volumes and increased RV, RV/TLC ratio and airway resistance in marked obese, non smoker.[4] . Ray and associates studied respiratory function in young obese subjects and found reduced VC, ERV, TLC, FRC and MVV[24] . Our study showed the effect of BMI on lung volumes and it will help the clinicians to interpret PFT results with normal airway function. About 0.5% decrease in VC, TLC & RV can be expected for each unit increase in BMI.

It's postulated that presence of adipose tissue around the rib cage, in the abdomen and visceral cavity loads the chest wall subsequently reducing the functional residual capacity (FRC) [25]. This reduction in FRC and expiratory

reserve volume is detectable, even at a modest increase in weight [25]. However, obesity has little direct effect on airway calibre which means spirometric variables decline in proportion to the lung volumes rarely falling below the normal range[25]. Both $FEV_1$ and FVC declined equally (in terms of percentage predicted), $FEV_1$ to FVC ratio was found normal whereas static lung volume was found decreased reiterating that this reduction is due to restriction as opposed to air flow obstruction.

Lazarus et al. reiterated the fact that $FEV_1$ to FVC ratio decreases with increasing BMI in overweight and obese individuals[19]. In morbidly obese subjects (defined as individuals with a body weight (in kilograms) to height (in centimetres) ratio greater than 0.9 kg/cm), Biring et al found a reduction in mid-expiratory flows and the $FEV_1$ to FVC ratio. Obese and overweight individuals most often exhibit marked reduction in the expiratory reserve volume (ERV) reason being the mass loading effect of obesity which consequently diminish FRC. With reduced FRC and a constant RV, decline in ERV is evident. It is appreciated maximum in supine position once the diaphragm ascends in the chest and lungs bearing the weight of lower thorax and abdomen[26].

Spirometry is usually normal in mild obesity but expiratory flow, $FEV_1$ and forced vital capacity (FVC) reduce subsequently with elevated BMI particularly in morbid obesity. Sahebjami et al. showed reduction in $FEV_1$, FVC and maximal inspiratory flow rate in obese subjects along with significance association with low MVV[15].

## Conclusion

Spirometric abnormalities in person with mild to moderate obesity pose somewhat a restrictive defect whereas severe and morbid obesity represents true air flow obstruction. The mechanistic basis can be related to small airway collapse due to decreased lung volumes with increasing obesity or it may be independent.

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**Conflicts of Interest:** Nil

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# Influence of Smart Phone Addiction on Depression and Aggression in Medical Students

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## Abstract

To determine the relationship of smart phone addiction with depression and aggression scores. **Materials & Method;** Cross sectional observational data was collected from 205 young adults in the age group 18-25 years who uses smartphone more than 6 months. Smartphone addiction was assessed using scale-SV questionnaire. Beck Depression Inventory is widely used self-rated instrument to assess depression. Buss–Perry Aggression Scale(BRAQ) is a 29 item self-report measure of subject's present level of aggressiveness. **Results:** Spearman correlation coefficients were used to evaluate the relationship among the different variables. Multiple linear regression was used to assess the relationship between mental health problems (depression, aggression) and smartphone addiction score, after controlling for the effects of confounders. From this data smartphone addiction emerged as an independent predictor for aggression & depression in young adults($P < 0.001$).

**Conclusion:** In conclusion, smartphone addiction symptoms has a potential influence on the mental health factors (Depression & aggression) among young adults.

***Keywords:*** *Smartphone addiction, Depression, Aggression, young adults.*

## Introduction

The popularity of smart phones usage is increasing rapidly leading to its overuse. Addiction consists of elements such as engagement in the behavior to achieve appetitive effects, preoccupation with the behavior, temporary satiation, loss of control, and suffering negative consequences as continous use of something for the sake of relief or stimulation,which often causes cravings when it is absent.[1]

A new kind of health disorder among young adults, "smartphone's addiction/abuse/misuse" is now a herculean task for health policy makers globally to think on this rapidly emerging issue.Smartphone addiction which is a type of behavioural addiction has been defined as the overuse of smartphones to the extent that it disturbs users' daily lives. This might lead to behavioural difficulties, reduced performance in school or work, decreased real-life social interaction, neglect of personal life, mental preoccupation, mood modifying experiences and leading to relationship disorders.[2]

The age group of 25-34 is found to have the highest Smartphone usage rate of 62%.[3] 53% youngsters are currently driving Smartphone's market in India The number of smartphone users worldwide is projected to amount to nearly 2.7 billion by 2019. With a rise in smartphone ownership globally, China will have highest number of smartphone users, 1.3 billion, in 2018, followed by India with 530 million users. The US being in third, with 229 million users.[4]Aggression is apparent, harmful, social interaction which is intended to inflict damage or other unpleasantness upon another individual.[5] It includes aggression-related feelings such as anger or hostility, and aggression-related behaviors such as physical or verbal aggression.[6] In Depression an

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individual cannot control the emotions, and symptoms last for a long time. If left untreated, depression can lead to serious incidents and fatalities.[7]

Since smart phone usage has become a trend in present society especially in young adults and excessive usage has an effect on psychological behavior, hence there is a need to study the influence of smart phone addiction on depression and aggression in this particular vulnerable group to take necessary preventive measures.

**Objectives;**

1. To determine the Smart phone addiction in young adults using Smart Phone Addiction questionnaire.
2. To determine Depression score in young adults using Becks Depression inventory in smart phone users.
3. To determine Aggression in young adults using Buss Perry questionnaire in smart phone users.
4. To determine the relationship of smart phone addiction with depression and aggression scores.

## Material and Method

This is a descriptive cross sectional study carried out in 205 young adults in the age group of 18-25years. Institutional ethical clearance & informed consent was obtained**.** Subjects with history of sleep disorders, psychological disorders neurological and endocrine disorders was excluded from the study.

The data was collected by self-administering the questionnaire to the students which was consist of two parts. First part recorded the demographic information including age,gender,smart phone usage,time spent on smartphone usage, facebook, whatsapp,webusage, education purpose,Email. Second part consists of Smartphone addiction scale-SV questionnaire was given to young adults to know whether they are Smartphone addictors or non-addictors.[8] Beck Depression Inventory is widely used self-rated instrument to assess depression. It contains 21questions being scored on Likert scale from 0 to 3. A score of 0 to 13 indicates minimal depression, 14 to 19 mild depressions, 20 to 28 moderate depressions and 29 to 63 severe depressions. The inventory has shown high internal consistency.[9]

Buss–Perry Aggression Scale(BRAQ) is a 29 item self-report measure of subject's present level of aggressiveness. Participants mark responses on a 5 point scale ranging from 1 (extremely uncharacteristic of me) to 5 (extremely characteristic of me). BRAQ consists of four subscales: physical aggression (PA), verbal aggression (VA), the emotional component of anger (A) and hostility (H). Each question is based on a 7-point Likert scale scoring from one to seven (''extremely uncharacteristic of me''to''extremely characteristic of me''). For each student, score of each subscale of aggression will be calculated. Total aggression score also will be calculated.[10]

## Statistical analysis

Statistical analyses was performed using the Statistical Package for Social Sciences (SPSS) version 20 for Windows. Descriptive statistics for the total sample were performed. Quantitative and qualitative measurements were summarized as mean ± standard deviation and n (%), respectively. Spearman correlation coefficients were used to evaluate the relationship among the different variables. Multiple linear regression was used to assess the relationship between mental health problems (depression, aggression) and smartphone addiction score, after controlling for the effects of confounders. Preliminary analyses were conducted to ensure no violation of the assumptions of normality, linearity, multicollinearity and homoscedasticity. Model 1 was unadjusted, showing the main effect of smartphone addiction level (total SAVS score-independent variable) on depression/anxiety (Dependent variables); Model 2 was adjusted for smartphone addiction score,& duration of usage of phone. Model 3 was our fully adjusted model in which Smartphone addiction score, Duration of usage of smart phone, Webusage ,Education purpose, Email ,Facebook ,Whatsapp usage, were controlled for. A p-value $< 0.05$ was considered statistically significant.

## Results

Out of 205 questionnaires distributed majority participants were females(53.7%) .Their age range from 18-25 years with a mean age of 19.13± 1.16 years. Frequency distribution of time spent on smart phone perday,apps installed, apps uninstalled, email usage, education purpose, facebook,games, text messages, webusage & whatsapp usage in young adults was done. 62% of them used smart phones more than 3 hours /

day.46.8% of them used smartphone daily for webusage and 29.8% of them used smart phone for education purpose once per week.59.5% of them used smartphone daily for facebook usage & 95.6% of them spent daily on whatsapp usage.

**Table-1: Frequency distribution of Smartphone addiction, Becks depression scale and Bussy Perry aggression scale in young adults(n=205)**

| Variable | | N (%) |
|---|---|---|
| Smart phone addiction | Non adductors | 166(81%) |
| | Addictors | 39(19%) |
| Becks Depression score | Minimal depression | 112(54.6%) |
| | Mild | 70(34.1%) |
| | Moderate/severe | 23(11.2%) |
| Bussy Perry Aggression score | Normal | 152(74.1%) |
| | Aggressive | 53(25.9%) |

Table-1 shows 81% were smart phone non addictors and 19% were addictors. In Becks depression score 54.6% of young adults had minimal depression,34.1% mild and 11.2% moderate to severe depression. In Bussy Perry aggression score, 74.1% of them were normal and 25.9% of them showed aggressive behavior.

**Table -2: Spearman's rank correlation analysis of duration of Smartphone usage with web usage, education purpose, e-mail, facebook. whatsapp, & Smart phone addiction score**

| Variable | Duration of usage of smart phone | |
|---|---|---|
| | R | P |
| **Web usage** | 0.065 | 0.356 |
| **Education** | -0.069 | 0.323 |
| **E-mail** | 0.046 | 0.514 |
| **Facebook** | 0.142 | 0.043 |
| **Whatsapp** | 0.048 | 0.498 |
| **Smart phone addiction score** | 0.379 | 0.001** |

Duration of smart phone usage shows a significant positive correlation with the smart phone addiction score(r=0.379,p<0.001)

**Table-3; Spearman's rank correlation analysis of Becks depression score and Bussy perry Aggression score with,duration of smart phone usage, web usage, education,E-mail,Facebook,Whatsapp, Smart phone addiction score.**

| Variable | Depression | | Aggression | |
|---|---|---|---|---|
| | r | P | r | P |
| **Smart phone addiction score** | 0.345** | 0.001 | 0.316** | 0.001 |
| **Duration of smart phone usage** | 0.230** | 0.001 | 0.179* | 0.01 |
| **Web usage** | 0.076 | 0.279 | 0.111 | 0.114 |
| **Education** | -0.066 | 0.350 | -0.22 | 0.755 |
| **E-mail** | 0.038 | 0.587 | 0.112 | 0.111 |
| **Face book** | 0.170* | 0.015 | 0.116* | 0.018 |
| **Whatsapp** | 0.019 | 0.785 | 0.003 | 0.968 |

Table -3 shows Correlation between Depression & smart phone addiction score showed a significant positive correlation (r=0.345,p<0.001) and also showed significant positive correlation for aggression with smart phone addiction score (r=0.316,p< 0.001). Both depression and aggression scores shows significant positive correlation for facebook usage among the young adults.

**Table- 4: Assocciation between smartphone addiction & Becks depression score as assessed by multiple linear regression analysis**

| BD score | Unstandardized β | SE | Standardized β | pvalue | $R^2$ |
|---|---|---|---|---|---|
| **Model -1** | Constant:4.606,F(df:1,203)=25.186,p<0.001 | | | | |
| Smartphone addiction score | 0.274 | 0.055 | 0.332 | <0.001 | 0.110 |
| **Model -2** | Constant :3.987,F(df:2,202)=15.667,p<0.001 | | | | |
| Smartphone addiction score | 0.222 | 0.058 | 0.269 | <0.001 | 0.134 |
| Duration of usage of smart phone | 1.418 | 0.600 | 0.167 | <0.019 | |
| **Model-3** | Constant :2.461,F(df:7,197)=4.795,p<0.001 | | | | |
| Smartphone addiction score | 0.2016 | 0.061 | 0.249 | 0.001 | 0.146 |
| Duration of usage of smart phone | 1.325 | 0.611 | 0.156 | 0.031 | |
| Webusage | 0.248 | 0.451 | 0.046 | 0.584 | |
| Education purpose | 0.463 | 0.469 | -0.070 | 0.325 | |
| Email | 0.049 | 0.488 | 0.009 | 0.920 | |
| Facebook | 0.376 | 0.390 | 0.072 | 0.336 | |
| Whatsapp usage | 0.218 | 1.023 | 0.015 | 0.832 | |

Multiple linear regression was used to assess the ability of smart phone addiction to predict two mental health problems (depression & aggression), after controlling for the influence of confounding variables.

Table-4: In the unadjusted model (Model 1), higher depression (total BDS scores) were found to be significantly associated with higher smartphone addiction score, whereby the total BDS score increases by about 4.606 units for each unit increase in smartphone addiction score, and with smartphone score explaining about 11% of the variance in total BDS score, respectively.

Smartphone addiction score,& duration of usage of phone were entered in Model 2, increasing the variance in BDS explained by the independent variables (smartphone addiction score & duration of usage of phone ) to 13%. After additional entry of the independent variables that pertain to smartphone use habits in the final model (Model 3) (Smartphone addiction score, Duration of usage of smart phone,Webusage, Education purpose, Email, Facebook,Whatsapp usage), the total variance explained by the model as a whole increased to 14.6% , $p < 0.000$, respectively.

In the final model in which smartphone addiction score was entered as the main independent variable in model 1, higher BDS score was found to be significantly associated with higher duration of smartphone usage ,smartphone addiction score with the highest beta value ($\beta = 0.249$, $p < 0.001$) followed by duration of smartphone usage ($\beta = 0.156$, $p < 0.001$), (Table 4).

**Table -5: Assocciation between smartphone addiction & BPAS score as assessed by multiple linear regression analysis**

| BPAS | Unstandardized β | SE | Standardized β | pvalue | $R^2$ |
|---|---|---|---|---|---|
| **Model -1** | Constant:61.104, F(df:1,203)=22.368,p<0.001 | | | | |
| Smartphone addiction score | 0.54 | 0.116 | 0.315 | <0.001 | 0.099 |
| **Model -2** | Constant :60.376,F(df:2,202)=12.067,p<0.001 | | | | |
| Smartphone addiction score | 0.485 | 0.125 | 0.280 | <0.001 | 0.107 |
| Duration of usage of smart phone | 1.668 | 1.283 | 0.093 | 0.195 | |
| **Model-3** | Constant :53.572,F(df:7,197)=3.950,p<0.001 | | | | |
| Smartphone addiction score | 0.470 | 0.129 | 0.270 | 0.001 | 0.123 |
| Duration of usage of smart phone | 1.437 | 1.304 | 0.081 | 0.272 | |
| Webusage | 0.202 | 0.962 | -0.018 | 0.834 | |
| Education purpose | 0.622 | 1.001 | -0.044 | 0.535 | |
| Email | 1.384 | 1.039 | 0.115 | 0.185 | |
| Facebook | 0.480 | 0.832 | 0.043 | 0.564 | |
| Whatsapp usage | 0.918 | 2.181 | 0.030 | 0.674 | |

Table- 5: In the unadjusted model (Model 1), higher aggression (total Busperry Aggression scores) were found to be significantly associated with higher smartphone addiction score, whereby the total Busperry Aggression score increases by about 61.104 units for each unit increase in smartphone addiction score with overall significance(F=22.638,p<0.001) and with smartphone score explaining about 10% of the variance in total BDS score, respectively.

Smartphone addiction score,& duration of usage of phone were entered in Model 2, increasing the variance in Busperry Aggression score explained by the independent variables (, smartphone addiction score & duration of usage of phone ) to 11% ,p<0.001. After additional entry of the independent variables that pertain to smartphone use habits in the final model (Model 3) (Smartphone addiction score,Duration of usage of smart phone,Webusage ,Education purpose, Email ,Facebook ,Whatsapp usage), the total variance explained by the model as a whole increased to 12.3% , $p < 0.001$, respectively.

In the final model in which smartphone addiction score was entered as the main independent variable in model 1, higher Busperry Aggression score score was found to be significantly associated with ,smartphone addiction score with the beta value ($\beta = 0.270$, $p < 0.001$) (Table-5 ).

## Discussion

The present study examined the association while controlling simultaneously for the effects of all the confounding variables such as (Duration of usage of smart phone, Webusage, Education purpose, Email, Facebook, Whatsapp usage) for depression & aggression.

Most of the participants used smartphone for >3 hours/day(62%) & 95.6% of them spent their time daily on whatsapp usage.Among the participants the prevalence of smartphone addiction was 19%, mild depression 34.1% & aggression was 25.9%.

In our study duration of smartphone usage shows a significant positive correlation with smartphone addiction score. ,which is consistent with other studies done among the college students.[11] Result from this study found 45.0% of students spent 4-6 hours a day to use the smartphone. The findings of this study supported by Hatice et al. who found 40.1% of students spend 4 to 6 hours a day on smart phone.[12]

The present study shows a significant positive correlation between depression & smartphone addiction score,duration of smart phone usage & facebook usage among the participants ,which is comparable in the study done by Kim etal.[13] The time spent on smartphone usage is of serious concern as it hampers academic performance in young adults.[14]In another study, depression emerged as a significant independent positive predictor of smartphone addiction.[15]

In the present study shows a significant positive correlation between aggression & smartphone addiction score,duration of smart phone usage & facebook usage among the participants ,which is comparable in the study done by Kang etal.[16]This might of be of serious concern as it may lead to sleep disturbances, & in between the usage of smartphone getting more aggressive if they get disturbed & becomes unresponsive.Thus the cycle moves on where the social interaction decreases.[17]

In our study, smartphone addiction score emerged as independent positive predictor of depression & aggression. Our findings shows similar results from multiple studies which looked at the relationship between smart phone addiction, & depression, aggression & impulsion among college students.[18] Preoccupation with use of smartphone for longer duration for various uses as mentioned above,their will be increase tendencies towards aggression ,which might lead to physical harm to others. Thus increased access to smartphone for various usages like facebook,whats app usage etc.. can lead to difficult to withdraw from it, leading anger,stress & depression. All this might lead to arguments,poor academic performance, isolation & fatigue.[19]

According to a study excessive smart phone users experienced difficulty in expressing emotions and had higher level of interpersonal anxiety than their counterparts. Smartphone abuse and addiction canbecome cause of an accident and ruining the personal or social life. [20]

## Conclusion

In conclusion, smartphone addiction symptoms has a potential influence on the mental health factors (Depression & aggression) among young adults. Smart phone addiction emerged as an independent risk factor risk factor for depression & aggression. Thus it is important bring in preventive measures,so that they can move towards positive stress coping and psycho-behavioural management techniques .

**Conflicts of Interest**---NIL

**Source of Funding** ----Self

**Ethical Clearance**---Taken from Institute ethics committee (order No.DMC/KLR/IEC/ 11/2016-17) SDUMC

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# A Study to Evaluate the Effectiveness of Open Book Tests Over Close Book Tests and Perception of Medical Students in Physiology

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## Abstract

**Introduction**: At present, the Medical knowledge is expanding and changing rapidly and there is increasing need to concentrate on education based on competencies. Closed book exam is an established approach to assessment in medical education which is widely accepted method of superficial learning. Adding open book test to the formative assessment can assist in handling this growth of knowledge.

**Objectives:** To evaluate the effectiveness of open book test on student's performance in summative assessment and to know the perception of students on open book test.

**Methodology**: The study was conducted on I MBBS students (n=150), who were divided into 2 groups, Group I: subjected to open book test for 4 weeks and Group II : subjected to closed book tests for 4weeks. There was a cross-over of the two groups and Group I were subjected to the closed book test and Group II students were subjected to open book tests. The mean marks obtained in summative assessment were statistically compared. Perception of the students was taken through feedback questionnaire.

**Results**: The mean marks obtained by the students (n= 141) in the summative assessment after open book test (Mean± SD =26.37±6.235) are statistically significant than those after closed book tests(mean± SD =24.09± 6.3513(p value< 0.005).

**Conclusion:** 71% of students recommended open book tests for the formative assessment. Hence, adding open book test to the medical curriculum along with regularly used closed book test are expected to stimulate deep learning.

***Keywords***: *Open book tests, Closed book test, formative assessment, deep learning, medical education.*

## Introduction

At present, the medical education has to deal with two important trends: The first is that the medical knowledge is expanding and changing rapidly[(1)]and second is there is increasing need to concentrate on education based on competencies and integration of knowledge, skill and attitudes. It is neither possible for the medical students to master all the knowledge nor desirable to remember this growing information and by the time they have done so, this knowledge would have expanded or changed in content. Therefore, it is important that medical students are able to use and manage knowledge when dealing with new problems and situations appropriately. The medical colleges also have the responsibility to manage this growing amount of knowledge by looking for doctors who have a variety of skills and attributes along discipline based knowledge and skills. The learning outcomes are now formulated as competencies- integrating knowledge, skills and attitudes based on the new curriculum for undergraduates going to be introduced by the Medical Council of India from 2019 . This change in learning objectives implies change in assessment, because assessment drives students learning behaviour[(2-4)]. Two types of learning approaches are consistently distinguished in literature: Deep learning and surface learning. Closed book

test(CBT) is an established approach to assessment in medical education which is widely accepted method of superficial learning. It basically tests how well a student recalls his knowledge.

Open Book Tests (OBTs) permit the use of different kinds of course related resource materials during the exam under test conditions. While studying for open book test, students read and think rather than read and memorize. Therefore, it is expected to stimulate deep learning[5,6] and to assess higher cognitive levels. Students have to find the right information at the right moment and apply this information properly. Adding open book tests to the formative assessment program in the medical curriculum can assist in handling this growth of knowledge[7]. Additionally, open book tests might be the format that best suits these developments as they are expected to stimulate deep learning and reduce the need for cramming and memorization of facts which is considered preferable to surface learning approach[8,9]. Using open book tests along with the traditional close book test might help in assessing a broader body of knowledge than when using only close book tests.

## Aim of the Study

-To know the perception of students on Open book tests compared to closed book test.

-To evaluate whether open book tests significantly impacted student's performance in summative assessment.

## Materials and Methodology

After obtaining the Institutional Ethics Committee clearance and written consent from the head of the department of physiology and the students, this study was conducted in first year medical students of 2017-18 batch (n=150) at Kamineni Academy of Medical Sciences, L B Nagar, Hyderabad. Study design: Cross-sectional study

The students were divided into 2 groups.

Group I: 75 students

Group II: 75 students

In order to compare the influence of open book versus closed book tests, I focused our study on 4 examinations conducted once every week after covering 4 topics in didactic lectures in physiology. Group I students (n= 75) were subjected to open book test at the end of every week for 4 weeks on the topic covered in didactic lectures in the respective weeks followed by discussion in small groups of 7-8 students and each small group was provided with a facilitator who was subject expert in the given topic and Group II students (Control group, n=75) were subjected to closed book test on the same topic once every week for 4 weeks on the same topics. At the end of 4 weeks, a summative assessment was conducted for both group I and group II students. Both open and closed book tests were conducted in the form of theory exams containing short analytical type of open-ended questions which assessed comprehension and application with a time limit. The marks of the summative assessment of both group I and group II were compared statistically.

There was a cross-over of the two groups and this time Group I students(n=75) were subjected to the closed book test and group II students (n=75) were subjected to open book test followed by small group discussions, each small group of 7-8 students provided with a facilitator, at the end of every week in the topics covered in didactic lectures. At the end of 4 weeks, another summative assessment in the form of theory exam was conducted for both the group I and group II students and the marks of the students of both the groups were compared statistically and analyzed.

Perception of the students of both the groups (Group I and Group II) on open book test and closed book test was taken using a pre-validated standard feedback questionnaire consisting of 10 questions using 5 point likert scale and 4 themes for free comments (table 1). The data was entered in MS office and analyzed by software SPSS 19.0 statistically and compared using paired t-test. The values $p < 0.005$ was considered as significant.

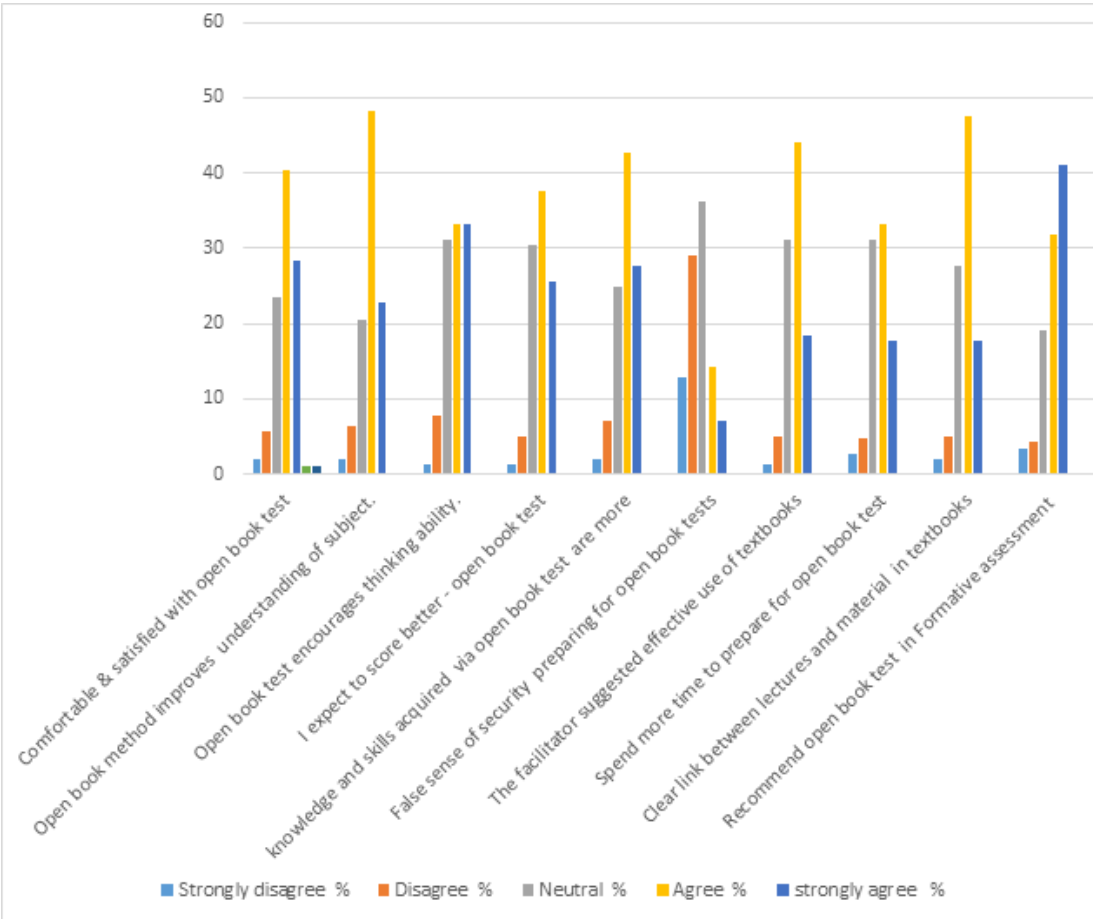
## Results

The Results of the study show that the mean marks obtained by the students (n=141)(7 students were absent for the test) in the summative assessment after open book test (Mean± SD = 26.37±6.235) are statistically significant than those obtained by the students in summative assessment after closed book tests(Mean ± SD= 24.090±6.3513) (P value < 0.005)(table 1). This shows that open book tests are a better discriminator among the students than closed book tests.

**Table 1: Comparison of Mean marks of Summative assessment after Open book test and Close book test ( n=141)**

| | Mean | Std. Deviation | Std. Error Mean | T value | Significance (P value) |
|---|---|---|---|---|---|
| Total marks after closed book test | 24.090 | 6.3513 | 0.5330 | | 0.000 |
| Total marks after open book test | 26.37 | 6.235 | 0.523 | -8.903 | |

The results of the feedback from the student's feedback questionnaire show that open book tests received the highest rating for the assessment of conceptual knowledge. Majority of the students i,e: 22% strongly agreed and 48% of them agreed that open book method improves understanding of the subject and most of the students ,43% agree and 27% strongly agree that knowledge and skills obtained about the topic is more via open book test and will help them in clinical practise. A major portion, 41% strongly agreed and 32% agreed for recommending open book test approach in formative assessment before the summative assessment (Graph 1). 37% of the students agreed and 25% strongly agreed that they expect to score better in the relevant topic as a result of open book test. Many of the students 44% agreed and 18% strongly agreed that the small group discussions after open book tests were very useful and the facilitators provided suggestions on how to effectively use textbooks. 20% of the students agreed that they do not have any false sense of security preparing for open book tests.




**Graph 1: Responses of the students on feedback questionnaire on 5 point likert scale (n=141)**

There are some drawbacks of the open book tests. The results of the study show that 50% of the students agreed that they spend more time working on problems and exercises to prepare for open book test.

The students indicated through their free comments that many of the students felt that the concept of open book test is innovative and open book tests improves better understanding of topic and correlation. Most of the students commented they were able to make connections not only on that particular topic but also beyond that area covered in didactic lectures and they felt that open book tests should be implemented as a routine before internal assessment.

## Discussion

Present day students have grown up with technology who are accustomed to multi-tasking and can deal with information differently compared with the past. Perhaps, the traditional way of learning is no longer appropriate for today's students.

The results of the study show that mean marks of the students obtained in summative assessment after OBTs (Mean± SD = 26.37±6.235) are statistically significant than those obtained after CBT(Mean ± SD= 24.090±6.3513). This shows that OBTs are a better discriminator among students than closed book tests. While the literature on the benefits of OBT versus CBT is highly variable, the results of our study are similar to the results obtained in the study done by P.A. Phiri.[10]

Open-book tests seem to represent the professional setting better than closed-book test, because students have full access to their references to find answers to the questions and solutions for the given problems, just as they would in practise. Majority of the students in my study agreed that open book method improves understanding of the subject and that conceptual knowledge and skills obtained about a particular topic is more via open book test which will help them in their clinical practise. Similar results were obtained in the study done by Bouman and Reichelman[11] who compared essay questions from closed and open book test and concluded that open book tests provide opportunity to stimulate deeper understanding and assess this.

Through the free comments, the students in this study indicated that open-book tests offered an opportunity to apply knowledge they gained during the course in a creative manner and they were able to demonstrate a true understanding of the topics covered in didactic lectures. Students also indicated that they experience less stress before and during an open book test and open book test reduce the need for cramming and memorization of factual material. These results are in congruence with those in study done by Tussing L[12]

In this study, many of the students also indicated that open-book tests offered an opportunity to apply knowledge they gained during the course in a creative manner and they were able to demonstrate a true understanding and a clear link between the topics covered in didactic lectures and the text books as also suggested by Theophilides C[13] in their study. In addition, open book tests seem to represent the professional setting better than closed book tests because students have full access to their references to find answers to the questions and answers for the given problems, just as they do would do in clinical practise.

There are some disadvantages of open book tests. Several previous studies revealed that students underestimate the time and effort needed to prepare for open-book tests. The results of this study also show that the students agreed that they spend a considerable less amount of time preparing and writing, consulting notes and texts for the OBT. These results are in accordance with the results of other studies done by Kountselini MK[14] and Lubawy W.[15]

## Conclusion

Open book tests are not generally accepted in public examinations but there are no clear reasons for that. In this study, 41% of students strongly recommended and 32% of the students recommended open book tests for the formative assessment. In my opinion, students who prepared for OBTs seem to develop high-order thinking and study the course material in-depth. Hence, they scored more marks in summative assessment. OBTs should not be thought as an alternative to CBTs but their value may be expanding beyond what is measured by CBT.

Adding open book tests to the formative assessment program in the medical curriculum can assist in handling the expanding and constantly changing knowledge as they are expected to stimulate deep learning and reduce the need for cramming and memorization of facts which is considered preferable to surface learning approach.

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**Ethical Clearance**: Taken from institutional ethics committee

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# Comparative Analysis of CMAP Amplitudes of Electro-physiologically Evaluated Facial Muscles in Facial Palsy Patients

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## Abstract

**Background:** The study describes the retrospective analysis of compound motor action potential (CMAP) amplitudes in 50 cases (25 males & 25 females) of facial nerve palsy seen in our neurophysiology Laboratory during last two years.

**Methodology:** Clinically diagnosed cases of facial nerve palsy encountered at neurophysiology laboratory went under facial nerve conduction studies. Patients evaluated for CMAPs of orbicularis occli, Nasalis and Orbicularis oris muscles were analyzed

**Results:** Study included 50 male and female (n=25 each) patients of unilateral facial palsy with the mean age of 33.98 ± 14.13 yr. CMAP amplitudes of all the three muscles on affected side were significantly (p value <0.0001) lower compared to that of normal side. CMAP amplitudes in males and females were not significantly different over both affected and normal side muscles. ANOVA of affected and normal side muscles of all the patients showed significantly (p value <0.05) different CMAP amplitudes among both affected side and normal side muscles.

**Conclusion:** It was concluded that CMAP amplitudes are significantly reduced on the affected side in facial palsy patients and they do not reflect any gender differences. CMAP amplitudes show an increasing trend from orbicularis occuli, nasalis to orbicularis oris muscle.

***Keywords:*** *Facial palsy, Bell's palsy, electro-physiology, Compound motor action potential (CMAP), Facial Muscles, Orbicularis occuli, Nasalis, Orbicularis oris.*

## Introduction

Facial paralysis occurs as a consequence of wide array of disorders and heterogeneous etiologies, including congenital, traumatic, infectious, neoplastic, and metabolic causes[1]. Nerve conduction studies of facial nerve are considered as the most reliable tool for the diagnosis of facial paralysis and assess the facial nerve degeneration[2,3]. There is a spectrum of electrophysiological abnormalities in facial palsy cases[4].

Electro-physiological studies are helpful in localizing the lesion and assessing the prognosis of recovery. CMAP of orbicularis occuli, nasalis and orbicularis oris are recorded to assess facial nerve conduction. Latency measurements of facial nerve are not as useful as the CAMP amplitude to assess the prognosis of facial nerve lesion[5].

We aimed to retrospectively assess the CMAP amplitudes of electro-physiologically evaluated of facial palsy patients.

## Material and Method

The study was conducted at Gajara Raja Medical College, Gwalior, MP, India. 50 unilateral peripheral facial paralysis cases, with equal number of males (n=25) and females (n=25) were selected. Thus, total 100 facial nerves of 50 subjects were tested of which 50 nerves were on the side of facial palsy (affected side) and another 50 nerves were of normal side.

Data of CMAP amplitudes in bilateral orbicularis occuli, nasalis and orbicularis oris muscles was retrieved. CMAP amplitudes of all the subjects for each of the above muscles on affected side were grouped (affected CMAP

amplitude). Similar grouping was done on normal side (normal CMAP amplitude). The CMAP amplitudes of each of the three muscles were then compared between the above groups (affected vs. normal side comparison).

Further, in-house comparison of CMAP amplitudes among facial muscles of affected side was done. Similar comparison was done for normal side muscles.

Paired t test, unpaired t test and One-way repeated-measures ANOVA were used for statistical analysis. p value of less than 0.05 was considered statistically significant. All statistical analysis was done using Graphpad Prism 5.01 software for Windows (Graph-Pad Software, Inc., USA).

## Results

The study was conducted at Department of physiology and Department of Neurology, Gajara Raja Medical College (GRMC) and associated Jaya Arogya Hospital (JAH) Gwalior, M.P., India. This was a cross sectional retrospective study done on subjects affected with peripheral facial paralysis.

Study included 50 male and female (n=25 each) patients of facial palsy. The mean age of the patients was 33.98 ± 14.13 yr. All the selected patients had unilateral facial palsy.

CMAP amplitudes of affected side were compared with that of normal side. CMAP amplitudes of all the three muscles on affected side were significantly lower compared to normal side (Table 1, Figure 1).

CMAP amplitudes of males and females were compared for affected and normal sides respectively. No significant (p value >0.05) difference was observed between males and females for either of the above two sides (Table No. 2).

We also made an in-house comparison of the CMAP amplitudes of all three facial muscles on affected and normal sides respectively. One-way repeated-measures ANOVA followed by post hoc Bonferroni's Multiple Comparison analysis of affected side showed that CMAP amplitudes of orbicularis occuli & nsalis, orbicularis occuli & orbicularis oris and nasalis & orbicularis oris were significantly different with p values of <0.001, <0.001 and <0.05 respectively. Similarly above mentioned analysis of normal side showed that CMAP amplitudes of orbicularis occuli & nsalis, orbicularis occuli & orbicularis oris and nasalis & orbicularis oris were significantly different with p values of <0.001 for all the three measurements. Further, significantly lowest amplitude was of orbicularis occuli and the significantly highest amplitude was of the orbicularis oris muscle with the nasalis amplitude in between the two. Moreover, similar trend of observation was observed over normal side (Figure 2 and 3).

**Table No. 1 – Comparison of CMAP amplitudes of facial muscles on affected side and unaffected side in facial palsy patients (n=50)**

| Muscles tested | Affected Side (n=50) | Unaffected Side (n=50) | p Value |
|---|---|---|---|
| Orbicularis Occuli (CMAP amplitude in mV) | 1.374 ± 0.73 | 2.014 ±0.74 | < 0.0001* |
| Nasalis (CMAP amplitude in mV) | 1.886 ± 0.94 | 2.83 ± 1.11 | < 0.0001* |
| Orbicularis Oris (CMAP amplitude in mV) | 2.224 ± 1.16 | 3.464 ± 1.37 | < 0.0001* |

*p Value <0.05 was considered significant

**Table No. 2 - Comparsion of CMAP amplitudes of facial muscles on affected side and unaffected side in facial palsy patients (n=50)**

| Muscles tested | In the side of facial palsy (Affected side) | | | Normal Side (Unaffected Side) | | |
|---|---|---|---|---|---|---|
| | Males (n = 25) | Females (n = 25) | p value | Males (n = 25) | Females (n = 25) | p value |
| Orbicularis Occuli (CMAP amplitude in mV) | 1.52 ± 0.79 | 1.22 ± 0.65 | >0.05 | 2.14 ± 0.69 | 1.89 ± 0.78 | >0.05 |
| Nasalis (CMAP amplitude in mV) | 1.90 ± 0.90 | 1.87 ± 0.99 | >0.05 | 2.90 ± 1.13 | 2.76 ± 1.11 | >0.05 |
| Orbicularis Oris (CMAP amplitude in mV) | 2.16 ± 1.20 | 2.28 ± 1.14 | >0.05 | 3.61 ± 1.28 | 3.32 ± 1.46 | >0.05 |

*p Value <0.05 was considered significant

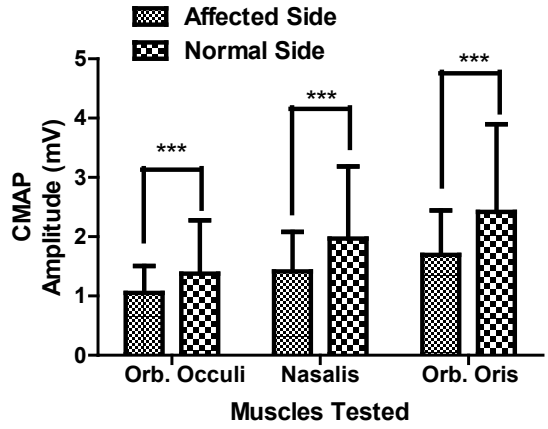


**Figure 1 – Figure shows significantly higher CMAP amplitudes in normal side compared to affected side (*represents significant difference * = p<0.05; ** = p<0.01; *** = p<0.001.)**

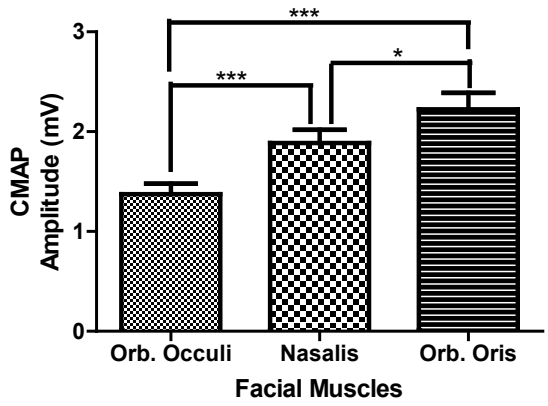


**Figure 2 – Figure shows significant difference of CMAP amplitudes of the facial muscles over affected side of all the patients (*represents significant difference * = p<0.05; ** = p<0.01; *** = p<0.001.)**

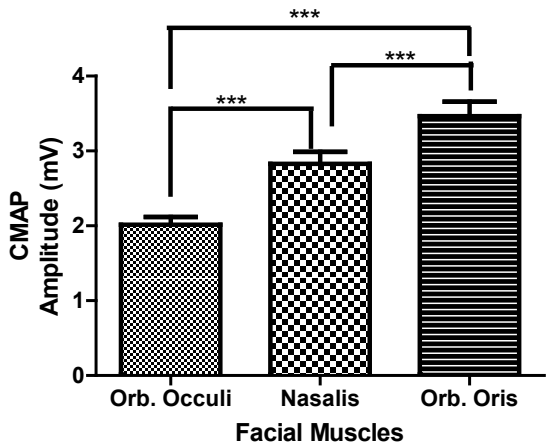


**Figure 3 – Figure shows significant difference of CMAP amplitudes of the facial muscles over normal side of all the patients (*represents significant difference * = p<0.05; ** = p<0.01; *** = p<0.001.)**

## Discussion

This study retrospectively analyzed the CMAP amplitudes of facial nerve in neurophysiologically diagnosed facial palsy patients. In this study equal number of males and female patients (total cases n=50) of facial palsy were analyzed. All the patients had unilateral facial palsy and CMAP amplitudes of orbicularis occuli, nasalis and orbicularis oris muscles were recorded on affected and normal side

We observed that CMAP amplitudes of facial nerve over all the above mentioned muscles were significantly (p value <0.0001) lower in affected side compared to normal side. Previous studies have also found that

electro-diagnosis significantly confirms the facial nerve palsy[6–10].

We observed no significant difference in facial nerve CMAP amplitudes of males and females on either of the sides. No difference in normal side indicates that the strength of contraction of facial muscles is similar in males and females. Further, no difference in affected side indicates that the facial palsy similarly affects the facial nerves of males and females. However, HB Jacob (1954) found that strength of orbicularis occuli is higher in males[11]. The method of strength evaluation was quite different in their study and their study involved voluntary muscle contraction.

In-house comparison of the CMAP amplitudes showed significantly different CMAP amplitudes over both affected and normal sides individually. Further, amplitude order from low to high was; orbicularis occuli < nasalis < orbicularis oris. This comparison of CMAP amplitudes has not been done previously. Most of the CMAP amplitude studies either quote amplitude changes in percentage or have measured amplitude of only one muscle[12–14] and hence comparisons are not possible. This finding shows that in any patient if an investigator gets different amplitude order across the three muscles then it may reflect the either the abnormality of muscle or of the nerve branch supplying that muscle.

## Conclusion

We conclude that CMAP amplitudes are significantly reduced on the affected side in facial palsy patients and they do not reflect any gender differences. Increasing order of CMAP amplitudes was observed as orbicularis occuli < nasalis < orbicularis oris muscles across the facial muscles.

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**Ethical approval:** Study is approved by institutional Ethics Committee.

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# Effect of Visual Evoked Potential in Myopic Individuals

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## Abstract

**Background:** Visual evoked potentials (VEPs) are electrical potential differences recorded from the scalp in response to visual stimulus. Refractive errors blur the stimuli, causing defocus and tend to affect the VEP parameters [1] . Among the refractive errors, the incidence of myopia is increasing globally, due to the increased usage of illuminated electronic screens.

**Objective:** To study the changes in latency of VEP waves in myopic individuals and to compare them with normal healthy controls.

**Methodology:** 30 individuals with myopia in the age group 18-35 years were selected from Ophthalmology OPD and VEP was recorded in the Neurophysiology Lab, Chengalpattu Medical College and were compared with 30 age and gender matched healthy controls. The data was statistically analyzed with student independent unpaired 't' test using SPSS 23.0 version.

**Results:** As compared with controls the VEP latencies were significantly increased in myopic individuals (p<0.05).

**Conclusion:** Uncorrected myopia per se can cause prolongation of VEP latencies. So routine VEP recording should be done after correction of myopia to avoid false positive results.

***Keywords:*** *Refractive error, Myopia, Visual Evoked Potentials.*

## Introduction

According to the National Programme for Control of Blindness (NPCB), uncorrected refractive errors are the second most common cause of avoidable blindness in India, accounting for 19.7percent of the total cases of blindness.[2] Globally, uncorrected refractive errors are the major cause of visual impairment.[3]Among the refractive errors, the prevalence of myopia is increasing globally, with a recent study estimating that around 30% of the current population is myopic.[4,5] Myopia is defined as a condition in which the spherical equivalent objective refractive error is ≤ -0.05 diopter (≤ -0.05 D) in either eye.[4]The increase in prevalence of myopia is particularly more in children and young adults, who spend less time outdoors and more time with illuminated electronic gadgets like computers and smart phones.[6]

Visual evoked potentials (VEP) are electrical potential differences recorded from the scalp in response to visual stimuli.[7] A normal VEP denotes the integrity of the visual pathway . VEP consists of two negative waves (N) and a positive wave (P). The waves are $N_{75}$, $P_{100}$ and $N_{145}$, wherein 75,100 and 145 are the latencies in millisecond. Of these, $P_{100}$ is the most consistent and least variable peak.[8] The latency is a more reliable and generally a more useful parameter than the amplitude.[9]

The aim of this study is to evaluate the changes in latency of VEP waves in myopic individuals and to study the correlation between increasing refractive error and latency of $P_{100}$.

## Materials and Method

Thirty stableMyopic individuals of both genders in the age group of 18-35 years were selected from the Ophthalmology Outpatient Department of Chengalpattu Medical College.VEP was recorded in the Neurophysiology Lab, Department of Physiology,

Chengalpattu Medical College. The VEP recordings were compared with 30 age and gender matched healthy individuals from the Master Health Checkup Programme. This Case Control study was conducted after obtaining approval from the Institutional Ethics Committee. Written and informed consent was obtained from all the participants. Following a clinical examination, the visual acuity was tested using Snellen's chart and the refractive error was assessed using autorefractometer.

**Inclusion Criteria:**

Age: 18-35 years

Both genders

Refractive error [Myopia ≤ -0.05 D] [4]

**Exclusion Criteria:**

Age<18 years and >35 years

Other refractive errors [ hypermetropia, astigmatism]

H/O color blindness, glaucoma, cataract, optic neuritis and any other eye pathology

H/O seizures, eye surgery, demyelinating diseases

H/O diabetes mellitus, hypertension, thyroid abnormalities

Known smokers, alcoholics, tobacco chewers

Subjects on barbiturates, neuroleptics, antidepressants

PROCEDURE:

Prerequisites:

Thorough hair washing before the experiment, to render scalp grease free.

Application of oil or any other hair products should be avoided.

Mydriatics and myotics should not used for a minimum of 12 hours before the procedure.

Removal of glasses or contact lenses during the procedure.

VEP was recorded using Physiopac [Neuroperfect EMG 2000]. The stimulus given was Pattern reversal using a checkerboard monitor.

Technical settings:

Low cut filter: 2Hz

High cut filter: 100Hz

Sweep duration: 350ms

Sweep sensitivity: 10 µV

Number of epochs: 200

After giving proper instructions, the subjects were asked to sit straight at a distance of 100cm from the stimulus monitor, in a dark room.

Three standard disc electrodes were placed on the scalp, according to the 10-20 International System of EEG electrode placement.

Recording electrode Oz – 3 cm from the inion

Reference electrode Fz – 12 cm from the nasion

Ground electrode Cz – over the forehead.

After cleansing the skin in the area of electrode placement using spirit, the electrodes were fixed using electrode paste.

The subjects were asked to fix their gaze at the red point in the centre of the monitor and monocular stimulation was done.

The latencies of $N_{75}$, $P_{100}$ and $N_{145}$ were recorded.

The collected data were analysed with IBM.SPSS statistics software 23.0 version using student independent unpaired sample 't' test and Pearson's correlation.

$p < 0.05$ was taken as significant.

$p \leq 0.01$ was taken as highly significant.

## Results

**Table 1: Comparison of basic parameters between controls and cases**

| PARAMETER | CONTROLS (n=30) MEAN±SD | CASES (n=30) MEAN±SD | p VALUE |
|---|---|---|---|
| AGE | 19.8±1.56 | 19.8±1.27 | 1.000 |
| HEIGHT in cm | 167.3±8.7 | 166.77±11.3 | 0.838 |
| WEIGHT in kg | 60.27±10.95 | 58.73±11.37 | 0.597 |
| BMI | 21.53±3.46 | 21.01±3.18 | 0.548 |

The basic parameters of age, height, weight and BMI matched between controls and cases.

**Comparison of VEP parameters between controls and cases**

**Table 2: VEP recordings of right eye**

| VEP PARAMETER | CONTROLS MEAN±SD | CASES MEAN±SD | pVALUE |
|---|---|---|---|
| LATENCY OF $N_{75}$ [ms] | 73.9±5.61 | 79.75±6.43 | <0.01 |
| LATENCY OF$P_{100}$ [ms] | 100.22±3.11 | 110.7±4.41 | <0.01 |
| LATENCY OF $N_{145}$ [ms] | 145.59±12.54 | 156.58±11.15 | <0.01 |

**TABLE 3: VEP recordings of left eye**

| VEP PARAMETER | CONTROLS MEAN±SD | CASES MEAN±SD | p VALUE |
|---|---|---|---|
| LATENCY OF $N_{75}$ [ms] | 74.59±5.12 | 79.99±5.16 | <0.01 |
| LATENCY OF $P_{100}$ [ms] | 100.98±2.79 | 110.87±4.14 | <0.01 |
| LATENCY OF $N_{145}$ [ms] | 145.82±11.57 | 157.37±12.26 | <0.01 |

There was a highly significant increase in the latencies of N75, P100 and N145 in myopic individuals when compared to the controls for both right and left eye.

## Discussion

Visual evoked potential is a non- invasive study that measures the evoked response to visual stimuli.[10] Visual cortex is activated primarily by central visual field. VEP depends on the functional integrity of central vision at any level of visual pathway including the eye, retina, optic nerve, optic radiation and occipital cortex.[11] Myopia is a dioptric condition of the eye in which, with the accommodation at rest, incident parallel rays come to a focus anterior to the light sensitive layer of the retina.[9] In pattern reversal VEP, the stimulus contains clear contours which are markedly affected by any optical blur,[8] caused by refractive errors like myopia. In this study, latencies of VEP waves were recorded for individuals with myopia and was compared with normal controls. There was a significant increase in the latency of $P_{100}$ in myopic individuals compared to the controls. This was consistent with Kothari *et al*,[12] wherein it was established that myopia significantly increases the latency of $P_{100}$ and decreases the amplitude. Collins *et al*,[13] illustrated that induced refractive error significantly increased both absolute and relative latency of $P_{100}$. Winn B J *et al*,[14] observed that simulated refractive errors caused significant centrally located abnormalities, blurring the stimulus.

In our study, the mean latency of $P_{100}$ was significantly prolonged in myopic individuals and as there was a strong positive correlation between increasing refractive error and the latency of $P_{100}$. This is because refractive errors like myopia causes optical blurring of the stimulus, resulting in defocus, which causes prolongation of latency.

This signifies that myopia per se can cause prolongation of $P_{100}$ latency. The prolongation of $P_{100}$ is a clinically significant tool in diagnosis of conditions like optic neuritis and demyelinating diseases like multiple sclerosis. Hence while doing routine diagnostic VEP testing, myopia should be corrected to avoid false positive results.

## Conclusion

There is significant delay in the wave pattern of VEP recorded in subjects with myopia. There is significant prolongation of the latency of P100, N75 and N145 in the study group compared to the controls. The change

in amplitude of the waves was not recorded. This study did not include the recording of VEP after the correction of myopia, which would have given a better insight into the impact of blurring vision on the recording of visual evoked potentials. To conclude correction of refractive errors is essential before VEP recordings for clinical investigation.

**Limitations:**

Small Sample size.

The correlation between uncorrected and corrected refractive error was not studied.

**Conflict of Interest**: None

**Source of Funding**: None

**Ethical Clearance**: The study was approved by the Institutional Ethical Committee, Chengalpattu Medical College, Chengalpattu.

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# Effects of 40 days of Pranayama Training in Hypertensive Subjects

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## Abstract

Hypertension is the most important modifiable risk factor for coronary heart disease, stroke, congestive heart failure, end-stage renal disease and peripheral vascular disease. It accounts for a major part of morbidity and mortality due to cardiovascular diseases (CVD). Relaxation and stress relieving methods like Pranayama, Meditation has been shown to be capable of lowering blood pressure This study was undertaken to scientifically sdetermine the effects of Pranayamas namely anulomaviloma and Bhramari etc for mental relaxation and their effects on blood pressure with the help of following parameters viz. Heart rate, Bloodpressure (systolic + Diastolic blood pressure) in the hypertensive subjects and to compare the effects of Pranayama in two groups i.e. Group A, subject to Pranayama and with control Group B, who will not be subjected to any kind of Pranayama training. The mean BP profile parameters for patients after 40 days of Yoga were SBP 134.21±7.02 (mmHg), DBP 84.92±6.39 (mmHg), Pulse rate76.00±3.43 (beats/min) & Respiratory rate12.83±1.01 (resp./min).The corresponding values for controls were SBP 157.00±7.50 (mmHg), DBP 94.04±3.25 (mmHg), Pulse rate 76.71±7.62 (beats/min) & Respiratory

rate 14.42±2.24 (resp./min) respectively. The variation in respect of SBP not statistically significant. P>0.05. At the outset, before commencement of Yoga exercise the SBP

was160.46±7.02 (mmHg), DBP was 96.63±3.83 (mmHg), Pulse rate was 80.83±6.18 (beats/min), & Respiratory rate was15.33±1.49 (resp./min). After 20 days of commencement of Yoga exercise SBP became 153.58±6.65 (mmHg), DBP 91.50±5.41 (mmHg), Pulse rate

became 79.25±4.68 (beats/min)& Respiratory rate was15.04±1.04 (resp./min)and after 40 days of Yoga exercise SBP turned out to be 134.21±7.00 (mmHg), DBP84.92±6.39 (mmHg), Pulse rate 76.00±3.43 (beats/min),and Respiratory rate 12.83±1.01 (resp./min).While the

variations in all these parameters except for the Pulse rate (beats/min) was statistically highly significant as P<0.001, Pulse rate changes were also statistically significant P=0.004. Thus, we conclude that yogic practices combined with antihypertensive drugs were found effective in reducing BP & PR in resting condition and during stimulus induced conditions as well in mild to moderate hypertension. It reduced the requirement of the dose of antihypertensive drugs in majority of the hypertensive patients. Specifically it was found to affect cardiovascular autonomic regulation and tends to normalize it.

***Keywords:*** *Hypertension Pranayama Blood pressure respiratory rate*

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## Introduction

Hypertension is the most important modifiable risk factor for coronary heart disease, stroke, congestive heart failure, end-stage renal disease and peripheral vascular disease.[1] It accounts for a major part of morbidity and mortality due to cardiovascular diseases (CVD).[2]As per

World Health Organization (WHO), CVD will be the largest cause of death and disability in India by 2020[3] and nearly half of this mortality will be in young and middle-aged individuals. According to JNC-7(Joint National Committee 1997) the definition of hypertension is SBP as

140mmHg or higher or DBP as 90mmHg or higher or both and is estimated that it is effecting approximately 1 billion worldwide Whereas <120mm of Hg as SBP and <80mm of Hg as DBP is considered as normal blood pressure.[4]Currently, Indians experience CVD deaths at least a decade earlier than their counterparts in countries with well-established market economies.[5] Out of so many risk factors for essential hypertension, stress is one of modifiable risk factors as recently reviewed by WHO scientific group. Yoga is an ancient science in this Pranayama plays a very important role in hypertension. Relaxation and stress relieving methods like Pranayama, Meditation has been shown to be capable of lowering blood pressure. There has been evidence that slow and regular breathing i.e. Pranayama technique for a certain time everyday has been known to have a effect over cardio-vascular reflex control system. Numerous approaches are available for stress management that can decrease this patient's suffering and enhance their quality of life.[6] Pranayama breathing has shown to alter autonomic activity as it increases parasympathetic activity.[7] If hypertensive patients could adopt a simple relaxation technique that would reduce stress and its physiological effects, they may be able to control their BP better, decrease the requirements for antihypertensive drugs and respond better during such physiologically stressful events. Studies have shown a decrease in BP with pranayama.[7]This study was planned to examine the assess the effect of Pranayama for a period of 40 days for lowering blood pressure is to bring internal awareness of breathing and therapeutic benefits of Pranayama over stress level. This study was undertaken to determine the effects of Pranayamas namely anulomaviloma and Bhramari etc for mental relaxation and their effects on blood pressure with the help of following parameters viz. Heart rate, Bloodpressure (systolic + Diastolic blood pressure) in the hypertensive subjects and to compare the effects of Pranayama in two groups i.e. Group A, subject to Pranayama and with control Group B, who will not be subjected to any kind of Pranayama training.

## Materials and Method

**Materials:-**

The study population was drawn from patients who presented to department of Physiology at Santosh Medical College. There were 50 patients, who were diagnosed and selected for study. All 50 patients were had hypertension and divided into 2 groups,

Group A: consisted 25 patients who were practiced 40 days pranayama for the period of 40 days,

Group B: consisted 25 patients with hypertension those were not doing any pranayama practice.

## Methodology

A written consent was taken from all potentially eligible subjects and excluded from the study if they were not matched with inclusion criteria of the study. After taking detailed history, all subjects were having high blood pressure, non-alcoholic, non-smokers, not taking any drug other than antihypertensive medicine and were having similar dietary habits, physical and mental activities in working and home atmosphere. 40days Yoga Training was given to the subjectsin the morning hrs for 45min at 8:00 A.M to 8:45 A.M and two times in a week. Subjects were advised to come empty stomach for YOGA Training. The parameters were measured on 1st day and every month for 3 months of the study in both study and control group. The study group was asked to take yoga training along with anti-hypertensive drug treatment. The schedule ofyoga training was explained to all participants and after three days practice session, the actual practice of yoga was introduced.

The training includes Surya Namaskar for 5 minutes, rest for 5 minutes, Bhramari Pranayama for 5 minutes, Sukha Pranayama for 5 minutes, Nadisodhan (Anulom Vilom) for 5 minutes, rest for 5 minutes, Chandra nadi Pranayama for 5 minutes, Shavasana for 5 minutes and 'OM' meditation for 05 minutes. Blood pressure was measured in both arms using a mercury sphygmomanometer after a 15 minute rest. The average value was recorded as the patient's BP. Hypertension was being defined as the systolic blood pressure>140 mmHg and diastolic blood pressure>90 mmHg.

Statistical analysis:- Data was analyzed using Statistical Package for Social Sciences version 23 (SPSS Inc., Chicago, IL). ). Results for continuous variables

are presented as mean ± standard deviation, whereas results for categorical variables are presented as number (percentage).

The level $P < 0.05$ was considered as the cutoff value or significance.

## Observations and Results

There were 50 patients, who were diagnosed and selected for this study. All 50 patients were had hypertension and divided into 2 groups;

Group A: consisted 25 patients who were practiced 40 days pranayama for the period of 40 days;

Group B: consisted 25 patients with hypertension those were not had any pranayama practice.

The following observations were made:-

**Table 1:- Demographic profile of patients before Yoga**

| | **Group A [n=25] [Mean±S.D.]** | **Group B [n=25] [Mean±S.D.]** | **P Value** |
|---|---|---|---|
| Weight | 66.46±11.31 | 65.13±8.62 | 0.582 |
| BMI | 25.27±4.10 | 25.90±4.43 | 0.454 |

**Table 2:- Distribution of Mean BP profile parameters before Yoga**

| **Parameters** | **A[Mean±S.D.]** | **B[Mean±S.D.]** | **P Value** |
|---|---|---|---|
| SBP [mmHg] | 160.46±7.02 | 160.71±8.46 | 0.912 |
| DBP [mmHg] | 96.63±3.83 | 96.58±3.55 | 0.962 |
| Pulse rate | 80.83±6.18 | 78.88±8.57 | 0.371 |
| Respiratory rate | 15.33±1.49 | 15.25±1.33 | 0.845 |

**Table 3:- Distribution of demographic profile of patients after 40 days of Yoga**

| **Parameters** | **Group A[n=25] [Mean±S.D.]** | **Group B[n=25] [Mean±S.D.]** | **P Value** |
|---|---|---|---|
| Weight | 62.96±10.24 | 63.33±8.27 | 0.891 |
| BMI | 23.94±3.68 | 25.17±4.21 | 0.287 |

**Table 4:- Distribution of Mean BP profile of patients after 40 days of Yoga**

| **Parameters** | **A[Mean±S.D.]** | **B[Mean±S.D.]** | **P value** |
|---|---|---|---|
| SBP [mmHg] | 134.21±7.02 | 157.00±7.50 | <0.001 |
| DBP [mmHg] | 84.92±6.39 | 94.04±3.25 | 0.213 |
| Pulse rate | 76.00±3.43 | 76.71±7.62 | 0.679 |
| Resp. Rate | 12.83±1.01 | 14.42±2.24 | 0.003 |

**Table 5:- Changes in demographic profile before and after Yoga exercises [Case group]**

| Parameters | Before yoga | After 20 days of yoga | After 40 days of Yoga | P value |
|---|---|---|---|---|
| WEIGHT | 66.46±11.31 | 65.46±10.70 | 62.96±10.24 | 0.513 |
| BMI | 25.27±4.10 | 24.87±3.77 | 23.94±3.68 | 0.475 |

**Table 6:- Changes in BP profile of patients before and after Yoga [Case Group]**

| Parameters | Before yoga | After 20 days | After 40 days | P value |
|---|---|---|---|---|
| SBP[mmHg] | 160.46±7.02 | 153.58±6.65 | 134.21±7.00 | <0.001 |
| DBP[mmHg] | 96.63±3.83 | 91.50±5.41 | 84.92±6.39 | <0.001 |
| Pulse rate | 80.83±6.18 | 79.25±4.68 | 76.00±3.43 | 0.004 |
| Resp. rate | 15.33±1.49 | 15.04±1.04 | 12.83±1.01 | <0.001 |

## Discussion

Yoga is an ancient science in this Pranayama plays a very important role in hypertension. Relaxation and stress relieving methods like Pranayama, Meditation has been shown to be capable of lowering blood pressure. There has been evidence that slow and regular breathing i.e. Pranayama technique for a certain time everyday has been known to have a effect over cardio-vascular reflex control system. Numerous approaches are available for stress management that can decrease this patient's suffering and enhance their quality of life.[6]

Patients of age between 30-45 years were selected for the study. There were 50 patients, who were diagnosed and selected for this study. All 50 patients were had hypertension and divided into 2 groups, Group A: consisted 25 patients (mean age 38.88±4.12) of 17 male & 8 female who were practiced 40 days pranayama for the period of 40 days, Group B: consisted 25patients (mean age 37.05±4.01) 15 male & 10 female with hypertension those were not had any pranayama practice.

Blood pressure is mainly dependent on cardiac output and total peripheral resistance. The possible mechanism is believed to be sympathetic nervous system over activity and consequent increase in peripheral vascular resistance. In addition, direct pressure effect by the sympathetic nervous system and catecholamine released from the adrenal medulla may also be involved. Hypothalamus is also closely related to limbic system which plays an important role in emotional and instinctual behavior. Since many manifestations of emotional changes like anger involve sympathetic responses, all these parts of the brain are likely to have some effect on the blood pressure. Stress too is likely to influence blood pressure through these pathways. Since, cerebral cortex is necessary for all voluntary actions, voluntary reduction of stress may be achieved by training the cerebral cortex. In the present study, the mean values of pulse rate, systolic blood pressure and diastolic blood pressure were recorded low in study group than in control group after the intervention. It is well known that yoga training decreases PR and BP. Environmental conditions and variety of behavioral factors such as stress, anxiety, affective and attitudinal dispositions of the individual influence the cardiovascular responses. Our findings of decrease in BP, and PR after yoga training are consistent with the findings of Rayet al.[8] that yoga training increases muscular endurance, delays onset of fatigue and enables one to perform work at lesser VO2 max. An exaggerated cardiovascular reactivity to the stressors is known to be a risk factor for cardiovascular diseases whereas reduced reactivity is an indicator of fitness. The result revealed that both Yoga intervention and drugs treatment helped. However, only mild and moderate cases of hypertension may be controlled easily without drugs. Severe case may need pharmacological intervention. The physical and physiological responses in the form of immediate effects of Kapalbhati Kriya or Ujjayi Pranayama of 15 minutes practice period show a gradual adaptive response over the 12 weeks training period. In the beginning the magnitude of these changes is much more but as one developed more and more mastery, these immediate changes reduce. But the neurophysiologic responses to these practices in the form of alterations in the EEG and in the subjective feeling of mental quietude and restful alertness instead of becoming less, actually become more and more intense. This indicates that the body learns to be more efficient and effective in dealing with any physical or physiological stress as one progress in Pranayama and thus makes the inner energy more easily and in more quantity accessible for the inner psychospiritual transformation. All these observations confirm the various claims about the various effects of Pranayama, as well as the significance of its various technical components including the part of inner awareness and also the need to practice it for the

fairly long time. It also shows that part form the many beneficial effects on the body, the practice of Pranayama trains the mind by reducing its restlessness and prepares it for the higher spiritual experiences of yoga.[9]

## Conclusion

The mean BP profile parameters for patients after 40 days of Yoga were SBP 134.21±7.02 (mmHg), DBP 84.92±6.39 (mmHg), Pulse rate76.00±3.43 (beats/min) & Respiratory rate12.83±1.01 (resp./min).The corresponding values for controls were SBP 157.00±7.50 (mmHg), DBP 94.04±3.25 (mmHg), Pulse rate 76.71±7.62 (beats/min) & Respiratory rate 14.42±2.24 (resp./min) respectively. The variation in respect of SBP not statistically significant. P>0.05. At the outset, before commencement of Yoga exercise the SBP was160.46±7.02 (mmHg), DBP was 96.63±3.83 (mmHg), Pulse rate was 80.83±6.18 (beats/min), & Respiratory rate was15.33±1.49 (resp./min). After 20 days of commencement of Yoga exercise SBP became 153.58±6.65 (mmHg), DBP 91.50±5.41 (mmHg), Pulse rate became 79.25±4.68 (beats/min)& Respiratory rate was15.04±1.04 (resp./min)and after 40 days of Yoga exercise SBP turned out to be 134.21±7.00 (mmHg), DBP84.92±6.39 (mmHg), Pulse rate 76.00±3.43 (beats/min),and Respiratory rate 12.83±1.01 (resp./min).While the variations in all these parameters except for the Pulse rate (beats/min) was statistically highly significant as P<0.001, Pulse rate changes were also statistically significant P=0.004. Thus, we conclude that yogic practices combined with antihypertensive drugs were found effective in reducing BP & PR in resting condition and during stimulus induced conditions as well in mild to moderate hypertension. It reduced the requirement of the dose of antihypertensive drugs in majority of the hypertensive patients. Specifically it was found to affect cardiovascular autonomic regulation and tends to normalize it.

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# Heart Rate Variability among Long Distance Bus Drivers after a Night Shift

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## Abstract

**Introduction:** Most of the fatal accidents were found to be due to fatigue among the drivers. Long distance bus drivers are more prone to fatigue following driving and hence increase in the risk of road traffic accident among them. Techniques such as Electroencephalography (EEG), Electrooculography (EOG) and Electrocardiography (ECG) were used to detect fatigue among the drivers during and after driving. Heart rate variability (HRV) assessment in drivers was found to be a useful tool to detect fatigue and drowsiness. Data on HRV and fatigue among bus drivers post night shift is scarce in the literature.

**Method:** HRV was assessed during resting state among 12 long-distance bus drivers immediately after their night shift. HRV was also assessed among non-bus drivers who were not involved in shift works. Obese, Hypertensive and diabetic patients were excluded from the study. Time domain and frequency domain measures of HRV were compared between bus drivers and non bus drivers.

**Result:** Baseline heart rate and blood pressure were normal in both the groups. All the time domain and frequency domain measures were found to be normal in both the groups. Though time domain measures such as SDNN, rMMSSD, NN50, pNN50 were increased and frequency domain measures such as LFnu and LF/HF ratio were decreased in study group, they were not statistically significant.

**Conclusion:** There seems to be an increase in parasympathetic activity among long-distance bus drivers probably due to fatigue because of prolonged driving overnight.

***Keywords:*** *Heart rate variability; Long Distance Drivers; Fatigue*

## Introduction

Driver fatigue has been found to be one of the major problem in road safety [1]. One of the factors of road traffic accidents is found to be fatigue and drowsiness among the long distance drivers [1,2]. Fatigue is the loss of efficiency of the driver to drive a vehicle due to prolonged driving, sleep deprivation and exhaustion. It is estimated by The Royal society for prevention of accidents that 20% of fatal accidents in Australia are due to fatigue among the drivers [3]. Several studies have included various methods such as Electroencephalography (EEG), electrooculography and Electrocardiography (ECG) for detection of fatigue [2]. Heart rate variability (HRV) is defined as the measure of beat to beat variation in heart rate due to the result of adaptive changes caused by the sympathetic and parasympathetic nervous system. It is calculated by analyzing the time series R–R intervals in ECG [4]. HRV can be evaluated using time domain measures and frequency domain measures. Time domain measures can be assessed with calculations from standard deviations from R-R intervals. Frequency domain analysis is

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based on Fast Fourier Transformations of the signals from time domain to frequency domain. Power spectral density (PSD) analysis provides the basic information of how power (i.e., variance) distributes as a function of frequency. Low frequency (LF) component of HRV power spectrum is influenced by both sympathetic and parasympathetic activity whereas high frequency (HF) component is influenced by parasympathetic activity. Thus, the LF: HF ratio is considered to be a measure of sympathovagal balance [4, 5].

Several studies have studied the changes in physiological parameters while driving to detect fatigue[6]. Verser el al studied the nocturnal effects of driving and reported that 2 hours of continuous nocturnal driving were sufficient to produce driving impairment [7]. Vehicle Crash rate was higher in drivers with excessive drowsiness compared to alert individuals [8]. A state of reduced mental alertness which affects the cognition and driving performance been found to be influenced by fatigue [2]. Inadequate sleep, sleep loss, disrupted sleep and disturbances in circadian rhythm were the attributed reasons for fatigue among long distance drivers [9,10]. Assessment of HRV for the detection of fatigue while driving were studied by several studies and were found to be an useful tool for the detection of fatigue while driving [4]. Assessment of HRV is found to be a cost effective tool to detect fatigue than other methods. While most of the studies have assessed the heart rate variability of drivers during driving, in this study we assessed the heart rate variability post night duty. We intended to study the influence of overnight driving for long distance bus drivers on HRV. We hypothesized that there would be decrease in HRV for drivers after an overnight shift of driving for more than 12 hours. The aim of our study was to assess HRV in bus drivers and to compare it with non-bus drivers.

## Methodology

The study was approved by Institutional Ethics Committee. Participants between 30 and 55 years were included in the study. Twelve apparently healthy bus drivers were recruited who had at least one year experience of long distance bus driving. Twelve healthy subjects who were non bus drivers were recruited as control group. Obese (BMI $\geq$ 30 Kg/m$^2$), Hypertensive (SBP $\geq$ 140 mm Hg and /or DBP $\geq$ 100 mm Hg) and Diabetic patients were excluded from the study.

The study was conducted in a temporarily set lab in Pondicherry Road Transport Corporation (PRTC) office, Puducherry. Participants in study group were asked to report to the lab after their night shift. Participants in control group (non bus drivers) were asked to report to the lab when they come for regular work in the morning. They were instructed to come in fasting state and to refrain from tea or coffee before the test.

After obtaining the informed consent, their age, height and body weight were recorded. Body Mass Index (BMI) was calculated using Quetelet's index [11]. Baseline blood pressure of all the subjects was recorded in sitting posture using Omron (SEM 1 Model, Omron Healthcare Co. Ltd, Kyoto, Japan).

After 15 minutes of supine rest on a couch in AFT lab, ECG was recorded for 5 minutes for short-term HRV analysis following the standard procedures as practiced in the laboratory. HRV was recorded by using BioHarness AcqKnowledge 4.1 version and analyzed by Kubios HRV 2.00 software. Recommendation of the Task Force on HRV was followed for recording and analysis [8].

Following parameters were derived

**Time domain measures**:

a) Standard deviation of normal-to-normal RR intervals (SDNN)

b) Root mean square successive difference (RMSSD)

c) Number of pairs of adjacent N-N intervals differing by more than 50 ms (NN50 count)

d) The proportion of NN50 to the total number of NN intervals (pNN50)

**2. Frequency domain measures:**

a) Total power (TP)
b) Very low frequency power (VLF)
c) Low frequency power (LF)
d) Normalized low frequency power (LFnu)
e) Normalized high frequency power (HFnu)
f) Ratio of low frequency power to high frequency power (LF-HF ratio)

## Statistical Analysis

All data were expressed as Mean and Standard Deviation. Comparison of HRV indices between bus

drivers and the control group using Mann Whitney U Test since they were non parametric data. Data was analyzed using SPSS 17.

## Results

Subject Characteristics of bus drivers and control group are represented in Table 1. Subjects were between 30 and 50 years of age in study group and between 30 and 55 years of age in control group. 10 out of 12 subjects were found to be overweight (BMI $\geq$ 25 Kg/$m^2$) in both the groups. None of the subjects were obese. Baseline Heart rate and Blood pressure in all the subjects were found to be normal.

Table 2 shows the time domain measures of HRV in both the groups. All the time domain measure SDNN, RMSSD, NN50 and pNN50 were found to be in normal range in both the groups. Though not statistically significant, the time domain measures SDNN, rMSSD, NN50 and pNN50 show an increase in the bus drivers group.

Table 3 shows the frequency domain measures of HRV. Frequency domain measures such as TP, VLF, LF, HF and LF/HF were found to be within normal range in both the groups. There was no statistically significant difference in frequency domain measures TP, VLF, LFnu, HFnu and LF/HF ratio between the bus drivers and the control group. Though not statistically significant, LFnu and LF/HF ratio were reduced in the bus drivers. There was also an increase in TP and HFnu observed in the bus drivers.

## Discussion

In this study, HRV indices seems to be within normal range in both the groups. Yet, the frequency domain indices, LF and HF values are comparatively higher in study group. LF component represents both the sympathetic and parasympathetic tone. HF component in specific represents the parasympathetic tone of the autonomic nervous system [12,13]. An increase in HF component has been observed in the study group. The LF/HF ratio seems to be decreased in the study group than the control group which may be contributed by the increased parasympathetic tone on the study group. Also increase in the time domain parameters such as RMSSD, SDNN, NN50 and pNN50 were also seen in bus drivers indicating an increase in the parasympathetic tone.

Sato et al [14] studied 24 hrs HRV on long distance driving truck drivers which revealed that there were parasympathetic predominance among the truck drivers. This parasympathetic predominance was attributed to the fatigability of the drivers due to prolonged driving overnight. Driving with increase in parasympathetic activity were also found to induce drowsiness and also deteriorate the attentiveness of the drivers [14]. Adverse events especially road traffic accident were reported to be high among long distance automobile drivers due to fatigue [15]. Many studies has used indices of HRV as a tool for detecting the fatigue and drowsiness in drivers[6,9].

Adams et al assessed ambulatory blood pressure and ECG before, during and after the night shifts among physicians working in emergency department, in which they reported that there was a significant decrease in LF/HF ratio which indicated an increase in vagal tone post night shift compared to pre night shift [16]. Freitas et al assessed the influence of day night shift on the circadian pattern on HRV and reported that LF/HF ratio was lowest during post shift work compared to pre and during shift work among nurses [17].

In this study, increase in parasympathetic tone among bus drivers could be due to the disturbance in circadian rhythm, irregular shift works or fatigue due to overnight driving in the study population [14]. This effect may due to the sleep debt due to the night shift work nature leading to physical and mental fatigue specifically leading to parasympathetic overdrive amongst the drivers denoting catchup of the lost sleep period. Our study is the first of its kind amongst drivers in Puducherry region.

We conclude that there seems to be a slight increase in parasympathetic activity after night shift among the bus drivers. There is a need to extend our understanding on driver fatigue by performing long term HRV during long distance driving along with other sensors such as Electroencephalogram (EEG) and electro oculogram (EoG).

**Limitation**: Assessment of their fatigue score and Sleepiness scale would have given us more insights regarding the contents of this study. We intend to continue this study in a larger population and have a better understanding so that this could alert the drivers to take adequate rest after driving.

**Table 1: Subject Characteristics of Study and Control group. (Mean ± SD)**

| Subject Characteristics | Bus Drivers | Control |
|---|---|---|
| **Age** | 40 ± 7 | 44 ± 8 |
| **BMI** | 27.34 ± 3.58 | 27.11 ± 3.11 |
| **Heart Rate** | 74.67 ± 11.84 | 75.58 ± 10.08 |
| **SBP** | 121.58 ± 11.60 | 122.75 ± 11.09 |
| **DBP** | 75.25 ± 7.02 | 75.75 ± 8.28 |

BMI - Body Mass Index (11), SBP – Systolic Blood Pressure, DBP – Diastolic Blood Pressure

**Table 2: Frequency Domain parameters of HRV in study and Control Group. (Mean ± SD)**

| HRV Parameters | Bus Drivers | Control | P value* |
|---|---|---|---|
| **Total Power** | 1244.33 ± 780.92 | 808.64 ± 471.01 | 0.149 |
| **VLF** | 676.05 ± 580.61 | 414.45 ± 378.04 | 0.184 |
| **LF** | 268.41 ± 147.02 | 219.91 ± 204.28 | 0.248 |
| **HF** | 299.19 ± 215.42 | 173.73 ± 96.48 | 0.133 |
| **LF/HF ratio** | 1.20 ± 1.01 | 1.35 ± 0.95 | 0.419 |
| **LF nu** | 49.03 ± 14.30 | 52.38 ± 12.15 | 0.236 |
| **HF nu** | 50.89 ± 14.28 | 47.37 ± 12.01 | 0.371 |

TP - Total power, VLF - Very low frequency power, LF - Low frequency power, LFnu - Normalized low frequency power, HFnu - Normalized high frequency power, LF-HF ratio - Ratio of low frequency power to high frequency power
* Mann Whitney U test was done to compare bus driver and control group.

**Table 3: Time Domain Parameters of HRV in study and Control Group. (Mean ± SD)**

| HRV Parameters | Bus Drivers | Control | P value* |
|---|---|---|---|
| **SDNN** | 38.71 ± 14.19 | 33.20 ± 13.55 | 0.298 |
| **RMSSD** | 32.04 ± 17.31 | 21.38 ± 6.02 | 0.112 |
| **NN50** | 40.67 ± 47.49 | 10.33 ± 9.50 | 0.139 |
| **PNN50** | 14.16 ± 17.36 | 2.88 ± 2.91 | 0.132 |

SDNN - Standard deviation of normal-to-normal, RMSSD -RR intervals Root mean square successive difference (RMSSD) , NN50 count - Number of pairs of adjacent N-N intervals differing by more than 50 ms, pNN50 - The proportion of NN50 to the total number of NN intervals

* Mann Whitney U test was done to compare bus driver and control group.

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# To Evaluate Auditory Evoked Potentials in Non Alcoholic Liver Cirrhosis Subjects Attending a Tertiary Care Hospital: A Cross Sectional Study

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## Abstract

**Introduction:** There is a definite relationship between the brain and the liver that has been known and the patients with liver cirrhosis frequently experience neurological problems. The commonest and most widely recognized is the syndrome of Hepatic Encephalopathy (HE). HE is generally taken as that refer to a collection of neuropsychiatric, neuropsychological and neurological disturbances that may arise as a complication of liver cirrhosis and which is reversible. The present study was designed to evaluate the involvement of central nervous system in non alcoholic liver cirrhosis by using auditory evoked potentials to assess conduction in auditory pathway. **Materials and Method:** 20 non alcoholic liver cirrhotic subjects were selected and 10 age and gender matched healthy subjects with normal liver functions from the Master Health Check Up. AEP Recording was done in electrophysiology laboratory of Physiology using Neuro Perfect Plus Medicaid Polyrite. **Results** :The parameter for the study was absolute wave latencies which was considered the important cortical wave latencies. Results were analysed by student's independent t-test using Statistical Package for Social Sciences 11.5 version. P value was calculated to test the statistical significance. The level of significance chosen for the study was 1% ($p < 0.01$). **Conclusion:** The finding of absolute wave latency prolongation in clinically non encephalopathic non alcoholic cirrhotic patients signify the presence of MHE. Therefore the ethanol induced demyelination thought to be the basic cause of AEPs is also over ruled. AEP is such a simple non invasive technique to be used as a prognostic marker and in follow up of even comatose patients. The emergence of MHE is significantly correlated with the severity of liver functions.

***Keywords:*** *non alcoholic liver cirrhosis Auditory Evoked Potentials Neuropathy*

## Introduction

There is a definite relationship between the brain and the liver that has been known and the patients with liver cirrhosis frequently experience neurological problems. The commonest and most widely recognized is the syndrome of Hepatic Encephalopathy (HE). HE is generally taken as that refers to a collection of neuropsychiatric, neuropsychological and neurological disturbances that may arise as a complication of liver cirrhosis and which is reversible. Minimal hepatic encephalopathy is the term now has replaced the previous terms of Latent or sub clinical hepatic encephalopathy. The older terms seems not to reflect the significant effects that influence the liver cirrhotic patient's life[1].There is really a need to evaluate the liver cirrhotic patients who are showing to be completely free from hepatic encephalopathy The very true incidence and prevalence of HE in the cirrhotic patients is difficult to establish, because of the considerable heterogeneity in etiology and disease severity. It is also difficult to diagnose the more subtle forms of HE such as stage I

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and minimal HE[2]. The clinical electro diagnosis involves the recording, display, measurement and interpretation of action potentials arising from the central nervous system eg: evoked potentials. Evoked potentials are visual, auditory, somatosensory and P 300 event related have been proposed to be diagnostic techniques in evaluation and assessment of the brain related functional impairments like dementia, encephalopathy etc,. Halliday[3] stated evoked potentials can reflect neurotransmitter changes [4] in cortical and sub cortical neurons. Despite the controversy, Evoked Potentials remain an attractive possibility for the diagnosis of minimal HE. Brainstem Auditory Evoked Potentials (AEP) has extended the possibility of objective testing of hearing functions. This is an effective and simple method that requires less co operation of the patient and also measures specific part of the auditory pathway. It is not significantly altered by the consciousness, literacy, much common drugs and environmental factors.

## Materials and Method

The present study was designed to evaluate the involvement of central nervous system in non alcoholic liver cirrhosis by using auditory evoked potentials to assess conduction in auditory pathway. In this cross-sectional study, the liver cirrhotic patients from liver clinic who had etiology of not using alcohol were considered. Ethical approval from the Institutional Ethical Committee was obtained for the study. 20 non alcoholic liver cirrhotic subjects were selected and 10 age and gender matched healthy subjects with normal liver functions from the Master Health Check Up. ( case control ratio was 2:1)

**Inclusion Criteria:** Age group was 30 to 50 years, both genders, diagnosed liver cirrhosis subjects due to Hepatitis Virus B,D and E, Wilson's disease and cryptogenic aetiology.

**Exclusion Criteria :** Smokers, alcohol intake within last 6 weeks, occupational history with continuous noise back ground, hearing impairment, external or middle ear diseases, systemic diseases like diabetes mellitus, hypertension, primary psychiatric disorders, complete drug history of antibiotics to rule out ototoxic drugs, cardiac and renal disease , cochlear implant/ cardiac pacemaker.

The study subjects were allowed to relax and be comfortable. A clinical history about the liver cirrhosis was collected. The complete procedure and objectives of the study was explained to the subjects in their regional language. The written and informed consent was obtained before subjects entered the study. The complete examination of external ear was done for both ears, wax was removed and tests for hearing done. The basic parameters of subjects like height, weight, pulse including body temperature were recorded. Auditory evoked potentials were first recorded in few normal subjects of both genders with age ranging from 30- 50 years. In order to establish reliability of the method, several repetitions of brainstem auditory evoked potential recording were performed on different days and at different hours. After this preliminary investigation, BAEP in 20 nonalcoholic liver cirrhosis subjects were recorded. The subjects were instructed clearly to have shampoo head bath, avoid oil on hair, hair spray and metal accessories especially ear studs. Auditory evoked potentials comprise of 5 or more peaks within 10 ms of the stimulus [5].The gold plated copper disc (1 cm) electrodes filled with conducting paste for recording AEPs were used. The electrode impedance was kept below 5 kΩ. The BAEP is recorded from the ipsilateral ear referred to the vertex. Two channels recorded from ipsilateral and contra lateral mastoid processes were referred to as Oz and Cz respectively and ground as Fz. Vertex is the suitable location since waves II – V has good amplitude with little muscle artifact. AEPs were recorded using an amplification of 200,000-500,000. 2000 trials were averaged to get a good quality recording. A 10 ms epoch after the click stimulus is averaged, amplified and displayed on the computer monitor. The low filter is set at 100 Hz and high filter at 3000 Hz. AEPs were produced by a brief click stimulus, which is usually a square wave pulse of 0.1 ms duration. The pulse moves the ear phone diaphragm away from the subject's ear which is a rarefaction phase stimulus. Wave I amplitude is greater with rarefaction compared to condensation stimulus. Since recognition of wave I is very important, rarefaction click polarity was chosen. Clicks were usually presented 10- 70 times per second. A click rate of 11Hz was used. The click stimulates not only the ipsilateral ear, but also travels by bone and air conduction to stimulate the contra lateral ear at an intensity of 40- 50 dB lower than the ipsilateral ear. White noise at 30- 40 dB blocks the stimulation of contra lateral ear thus prevents false AEP responses. Recording was done in electrophysiology laboratory of Physiology using Neuro Perfect Plus Medicaid Polyrite. The left

and right ears were tested separately in the uniform laboratory temperature , in sitting posture reclined on a chair with their feet placed on wooden board. The body temperature was measured since hypo or hyperthermia may cause alterations in latencies of both absolute and inter peak. The disc electrodes were placed on scalp by 10- 20 standard system with conducting jelly. The skin and electrode impedance were checked. Since the potentials recorded are in far field, well displaced from the site of impulse generation, the wave forms recorded were very weak and hence amplified. This amplification is achieved by improving the signal: noise ratio. The automatic artefact rejection was used. The sweep velocity was 1 ms. The click acoustic stimuli at a rate of 11 pulse per second at an intensity of 90 dB hearing level to the ear stimulated and masking sound (white noise) of 40 dB in non stimulated ear was given through head phone supplied by Medicaid[6,7,8]. The continuous 1000 auditory click responses were summated, averaged and displayed. All the techniques of measurement, duration, instruments including research laboratory temperature were maintained uniformly throughout the study [9].The wave latency I, II, III, IV and V, inter peak latency I-III, I- V, III- V and amplitudes of waves were measured. The wave pattern in BAEP recording is 5 or more peaks within 10 ms of stimulus. Initial five peaks have clinical value [10]. The succeeding peaks VI- VIII are quite variable and are not clinically useful. In normal subjects waveform IV- V forms complex. Absolute amplitudes are too variable to be of any clinical use even in inter ear comparison. Hence the absolute wave latencies are taken into consideration in this study.

## Findings

The total non alcoholic cirrhotic patients were 20 and they were age, gender matched with 10 healthy controls. All the data were expressed as mean ±SD .The study had a ratio of 2:1 ratio of cases with the control. The mean age was 44.00 ± 4.86 with BMI as detailed in table.1. There was no statistical difference between non alcoholic liver cirrhosis subject group and controls with regards to age and BMI. Auditory evoked potentials of both the ears were tested. The absolute and interpeak wave latencies were measured. The parameter for the study was absolute wave latencies which was considered the important cortical wave latencies. Results were analysed by student's independent t- test using Statistical Package for Social Sciences 11.5 version. P value was calculated to test the statistical significance. The level of significance chosen for the study was 1% ($p < 0.01$).

Interpretation: There is considerable prolongation of the important Absolute Wave latency III and V in nonalcoholic liver cirrhosis subjects which is statistically significant.

**Table 1: Baseline characteristics of nonalcoholic liver cirrhosis subjects and controls:**

| Baseline characteristics | Cirrhosis subjects n = 20 Mean ± SD | Controls n = 10 Mean ± SD | P Value |
|---|---|---|---|
| Age(yrs) | 44.00 ± 4.86 | 42.00 ± 4.16 | 1.00 |
| Height(cms) | 156.70 ± 10.25 | 153.70 ± 11.25 | 1.00 |
| Weight(Kgs) | 66.87 ± 9.22 | 60.87 ± 8.22 | 1.00 |
| BMI(Kg/m$^2$) | 27.14 ± 1.95 | 27.14 ± 1.95 | 1.00 |

BMI = Body mass Index

* P ≤ 0.05 Significant

**Table 2 : Left ear Absolute latencies of nonalcoholic liver cirrhosis subjects and control group:**

| Variables Wave Latency (ms) | Cirrhosis subjects n = 20 Mean ± SD | Controls n = 10 Mean ± SD | P Value |
|---|---|---|---|
| I | 1.44 ± 0.05 | 1.44 ± 0.05 | 0.62 |
| II | 2.72 ± 0.12 | 2.721 ± 0.12 | 0.76 |
| III | 3.78 ± 0.16 | 3.56 ± 0.07 | < 0.001 * |
| IV | 4.98 ± 0.09 | 4.89 ± 0.07 | 0.06 |
| V | 5.90 ± 0.34 | 5.66 ± 0.07 | < 0.001 * |

* P ≤ 0.05 Significant

**Table 3: Right ear Absolute latencies of nonalcoholic liver cirrhosis subjects and control group:**

| Variables Wave Latency (ms) | Cirrhosis subjects n = 20 Mean ± SD | Controls n = 10 Mean ± SD | P Value |
|---|---|---|---|
| I | 1.45 ± 0.05 | 1.44 ± 0.05 | 0.20 |
| II | 2.71 ± 0.13 | 2.72 ± 0.12 | 0.61 |
| III | 3.68 ± 0.16 | 3.54 ± 0.07 | < 0.001 * |
| IV | 4.89 ± 0.08 | 4.88 ± 0.07 | 0.41 |
| V | 5.89 ± 0.35 | 5.66 ± 0.07 | 0.001 * |

* $P \leq 0.05$ Significant

## Discussion

In the above study, AEP recorded in 20 non alcoholic cirrhosis subjects who fulfilled selection criteria and compared with 10 age and gender matched controls. Both the ears tested individually. These potentials reflect functional integrity of the sensory tract (auditory pathway) in the brain and help in identifying the sites impaired due to neurotoxic factors. Absolute wave latencies were considered mainly. In patients with minimal HE usually there will be no neurological findings detected but there may be subtle changes brought out by neuropsychological and neurophysiologic testing. The true prevalence of minimal HE in cirrhotic patients is variable, but expected to be more [11-14].Many studies have shown that these patients have poor quality of life and daily routine living activities [15]. There is no single method which will accurately measure the severity of HE. The techniques involved for assessing mental state involves consciousness, orientation, behavior , literacy and intellectual functions etc [15 ,16] Patients with MHE appeared to have no clinical symptoms. But they are vulnerable to overt HE. So the present study observed that the absolute wave latencies were much prolonged especially middle latencies (III, V) indicating the central neuropathy.

The liver supplies certain nutrients that the brain itself cannot produce. Liver also cleanses the blood off the substances that can damage the brain cells (neurotoxins). Although the brain is protected from neurotoxic substances by Blood Brain Barrier (BBB) , certain neurotoxins penetrate BBB by damaging it. So the previous studies were not clear in standing delineated the influence of alcohol on AEP and the real pathology of liver cirrhosis affecting the brain potentials considerably. The following hypothesis is derived supporting our study which is evidenced by prolongation of central absolute latencies especially. The detoxifying function of liver carried out through the portal vein in normal functioning liver. The main cause for the neurological deterioration is because of porto systemic shunting. There is lack of detoxification by liver and toxic substances rise in general circulation and increase the level of neurotoxins. These toxins first damage the nerve cells and second bring about the changes in structure of supporting glia especially astrocytes.

The essential functions of astrocytes are to take up neurotransmitters released by neurons and minerals as K which is released during brain energy metabolism. Astrocytes eliminate neurotoxins. The improper functioning of astrocytes leads to abnormal astrocytes as Alzheimer type II astrocytosis which cause physiological or functional delay in potentials. There is also loss of cerebral biochemical homeostasis on reason out that compromise of detoxifying function of cirrhotic liver.Since the astrocytes are1/3 rd of cortical volume, regulation of BBB, maintains brain neurons electrolytes and homeostasis with special effects of detoxification by itself. The prolongation results also from the cerebral overloading of neurotoxins such as ammonia, glutamate[17,18]. The levels of ammonia increases in central nervous system due to astrocyte damage also affects nerve signal transmission, brain energy metabolism and alteration in expression of gene that encodes key proteins.

**Drawbacks:**

The study has to improve the sample size to stand a better way to generalize the results into the whole population. A follow up study is needed to record AEP during every visit of the cirrhotic subjects get their viral load checked, status of oesophageal varices etc, too and to correlate with the parameters.

## Conclusion

The finding of absolute wave latency prolongation in clinically non encephalopathic non alcoholic cirrhotic

patients signify the presence of MHE. Therefore the ethanol induced demyelination thought to be the basic cause of AEPs is also over ruled. AEP is such a simple non invasive technique to be used as a prognostic marker and in follow up of even comatose patients. The emergence of MHE is significantly correlated with the severity of liver functions. The non alcoholic cirrhosis patients might be at risk always whenever they perform complex motor activities such as operating heavy machinery or drivers during driving their vehicles.

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# Retrospective Analysis of N75-P100 Amplitudes and P100 Latencies of VEPs in Patients Having One-Sided Visual Problems

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## Abstract

**Background:** VEPs of patients who had unilateral visual problems were retrospectively analyzed. The patients N75-P100 amplitudes and P100 latencies of the affected and normal fellow eye were compared. An alternative way of percentage change in amplitude and latency was also correlated with existing (amplitude ratio and absolute prolongation of latency) ways of analysis.

**Method:** 66 subjects (52 males & 14 Females) selected for study who had either affected left or right eye. Further, mean of N75-P100 amplitudes & mean P100 latencies were compared in affected and normal eye. On the basis of percentage reduction in the N75-P100 amplitude and percentage increase in the P100 latency on affected eye subjects were categorized in to those only with reduced amplitude (Group A), only with increased latency (Group B) or with both reduced amplitude & increased latency (Group C).

**Results:** Out of 66 patients (mean age 39.50±19.06 yr), 52 were males (78.79%, mean age 38.04±19.22 yr) & 14 were females (21.21%, mean age 44.93±18.11 yr). The patients had nearly equal frequency of affection in right and left eye, with slight preponderance to left eye (LE- n= 38, 57.58%; RE – n= 28, 42.42%). The amplitude reduction ($p<0.0001$) and latency ($p<0.0001$) prolongation were significant in affected eye. Group A had maximum number of subjects (n=35; 53.03%) followed by Group C (n=21; 31.82%). We observed a significant inverse correlation (Pearson r = -1.00, $p<0.0001$) between amplitude ratio & percentage change method and a significant direct correlation (Pearson r = 0.98, $p<0.0001$) between latency increase and percentage increase of latency.

**Conclusion:** Frequency of unilateral involvement in both the eyes is nearly equal. Reduction of N75-P100 amplitude is the most commonly observed abnormal VEP parameter. Percentage Change method can be utilized in future for such studies.

***Keywords –*** *Visual Evoked Potential (VEP); N75-P100 Amplitude; P 100 Latency; amplitude ratio; latency prolongation; percentage change.*

## Introduction

Visual evoked potentials (VEPs) depicts electrical phenomena occurring during the visual processing and are a graphic illustration of the cerebral electrical potentials generated by the occipital cortex evoked by a defined visual stimulus[1]. VEP is considered as a procedure of diagnostic and prognostic importance in ophthalmology[2].

VEP wave components are designated according to their apparent polarity and peak latency. Negative and positive polarities are designated N and P, respectively. Peak latencies are expressed in milliseconds after stimulus. Peaks N75, P100, and N145 are recorded over the occiput after 75, 100 and 145 ms respectively[3]. N75–P100 amplitude is measured from positive peak of P100 wave to negative peak of preceding N75 wave. The P100

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latency is time of onset of P100 peak after stimulus.

P100 amplitude is considered as the most consistent and reliable wave therefore N75-P100 amplitude and P100 latency can be used as the best parameter for evaluating VEP[3,4].

VEP provides a sensitive indication of abnormal conduction in the visual pathway[5,6]. Increase in conduction time attributed to demyelination can be detected by measuring the P100 latency. Abnormalities in the amplitude of VEP are caused by axonal lesion in the pathway. Hence VEPs are widely used in investigating demyelinating diseases, optic neuritis, and other optic neuropathies[6,7].

As there are large differences in VEP among individuals, earlier studies involved comparison of the results for two eyes in the same individual rather than using absolute values of amplitude or latency period[8,9]. Hence, it is difficult to assess visual function with VEP in cases where both eyes have visual pathway disturbance or functional visual loss combined with visual pathway disability[8]. Previous studies have compared the bilateral eye VEP amplitude, in patients having unilateral eye affection, using amplitude reduction or amplitude ratio i.e. affected/normal eye amplitude and VEP latency in terms of absolute prolongation of latency in ms in affected eye compared to normal eye[10–13].

Hence we designed a study to retrospectively analyze the N75-P100 amplitudes and P100 latencies of VEPs of patients who presented with diverse visual problems in one of their two eyes. We analyzed N75-P100 amplitudes and P100 latencies of the affected eye and also compared them with that of normal fellow eye of the subjects. We further aimed to validate an alternative method of assessing unilateral VEP abnormalities using percentage decrease of amplitude and percentage increase of latency in affected eye compared to normal eye.

## Material and Method

This study was conducted at Saksham Imaging Diagnostic Center and G. R. Medical College Gwalior, M.P., India. This study involves cross sectional retrospective analysis of 66 subjects having unilateral visual problems. The patients either with bilateral eye affection or with bilateral normal VEP were excluded from the study. The patients below 10 yr of age were also excluded as VEP is variable and under maturation at this stage[14].

The selected patient's data and VEP findings were retrieved. VEPs of normal eye functioned as each subject's internal control. We calculated an N75-P100 amplitude ratio of the affected/normal side for all individuals[10].

Patients were further divided, in to affected left eye or affected right eye on the basis of which of their eye is having visual symptoms and abnormal VEP parameter (Table No.1).

Further mean of N75-P100 amplitudes and P100 latencies of affected and normal fellow eye were compared (Table No.2). Percentage change in amplitude and latency were calculated as follows.

% ↓ in Amplitude* = (Normal eye Amplitude* - Affected eye Amplitude*) X100

Normal eye Amplitude*

% ↑ in latency$^{\#}$= (Affected eye Latency$^{\#}$ – Normal eye Latency$^{\#}$) X 100

Normal eye Latency$^{\#}$

Where-

***Amplitude = N75–P100 amplitude and $^{\#}$Latency = P100 latency**

Subjects having amplitude ratio <0.80 in affected eye or having >10 ms increase in P100 latency in the affected eye were considered abnormal. Subjects were categorized in to those only with reduced N75-P100 amplitude (Group A), those only with increased P100 latency (Group B) and those with both reduced amplitude & increased latency (Group C)(Table No.3 and Figure No.1).

Correlation analysis between subject's amplitude ratio & percentage change in amplitude and increase in latency & percentage change in latency was done to validate this method for future studies (Figure No.2&3).

Bilateral eye comparisons were done using paired t test. $p<0.05$ was considered statistically significant. Spearman Pearson analysis was used for correlation. All statistical analysis was done using Graphpad Prism 5.01 software for Windows (Graph-Pad Software, Inc., USA).

## Results

VEPs of 66 patients, who had unilateral eye visual affection, were analyzed retrospectively. The mean age of the patients was 39.50±19.06 yr. The number of male patients (78.79%, n=52; mean age 38.04±19.22 yr) was higher than the female patients (21.21%, n=14; mean age 44.93±18.11 yr).

The patients had nearly equal frequency of affection in right and left eye, with slight preponderance to left eye (LE- n=38, 57.58%; RE – n=28, 42.42%) (Table No.1).

On affected side the N75-P100 amplitude was significantly reduced ($p<0.0001$) and P100 latency was significantly ($p<0.0001$) increased (Table no.2).

Of the total 66 subjects, 56 subjects had reduced N75-P100 amplitude and 31 subjects had prolonged P 100 latency, where 21 subjects had both reduced amplitude and prolonged latency. Hence 35 (53.03 %) subjects had only reduced N75-P100 amplitude (Group A), 10 (15.15%) subjects had only prolonged P100 latency (Group B) and 21 (31.82 %) subjects had both reduced amplitude & prolonged latency (Group C) (Table No.3 and Figure No.1).

43.78±31.11 % decrease in N75-P100 amplitude (amplitude ratio - 0.5638±0.3082) and 12.52±21.98 % increase in latency (prolongation of 9.397±17.65 ms) were observed in affected eye of all subjects. Approximately 50 % decrease in amplitude was observed in Group A (55.26±23.88 % decrease) and Group C (49.09±20.95 % decrease), whereas nearly 30 % increase in latency was observed in Group B (33.77±20.49 % increase) and Group C (27.79±18.68 % increase) (Table No.3).

There was a significant inverse correlation (Pearson $r = -1.00$, $p<0.0001$) between amplitude ratio and percentage change method (Figure no.2). Further, we also observed a significant direct correlation (Pearson $r = 0.98$, $p<0.0001$) between latency increase in the affected eye and percentage increase of latency in the affected eye (Figure no.3).

**Table No.1 – Patients grouping on the basis of their affected eye having abnormal VEP parameters**

| Affected Eye | Males | Females | Total (% of Total) |
|---|---|---|---|
| **Right Eye** | 22 | 6 | 28 (42.42%) |
| **Left Eye** | 30 | 8 | 38 (57.58%) |
| **Total** | **52 (78.79 %)** | **14 (21.21 %)** | **66** |

**Table No.2 – Comparison of VEP parameters in affected eye and Normal eye of all the subjects**

| VEP parameter | Affected eye (n=66) | Normal Eye (n=66) | Level of significance |
|---|---|---|---|
| N75-P100 Amplitude (μV) | 2.294±1.39 | 4.36±1.98 | <0.0001 |
| P 100 Latency (ms) | 104.7±14.69 | 95.33±17.13 | <0.0001 |

**Table No.3 – Table shows comparative values of VEP parameters in all patients and different groups**

| Groups | Subjects Showing Change of Parameters in affected eye compared to normal Fellow eye (Number of subjects; % of Total) | Affected/normal eye N75-P100 Amplitude ratio (mean ± SD) | % Decrease in Amplitude Compared to Fellow eye (mean ± SD) | Affected - Normal Eye P100 Latency Difference in ms (mean ± SD) | % Increase in in Latency compared to fellow eye (mean ± SD) |
|---|---|---|---|---|---|
| All subjects | All Subjects (n=66; 100%) | 0.5638±0.3082 | 43.78±31.11 | 9.397±17.65 | 12.52±21.98 |
| **Group A** | Subjects Showing Reduced N75-P100 Amplitude (n=35; 53.03%) | 0.4503±0.2332 | 55.26±23.88 | -3.701±10.89 | -2.70±9.59 |
| **Group B** | Subjects Showing Prolonged P100 Latency (n=10; 15.15 %) | 1.076±0.1874 | -7.55±18.74 | 28.13±14.03 | 33.77±20.49 |
| **Group C** | Subjects showing change in Both Amplitude and Latency (n=21; 31.82 %) | 0.5091±0.2095 | 49.09±20.95 | 21.6±11.43 | 27.79±18.68 |

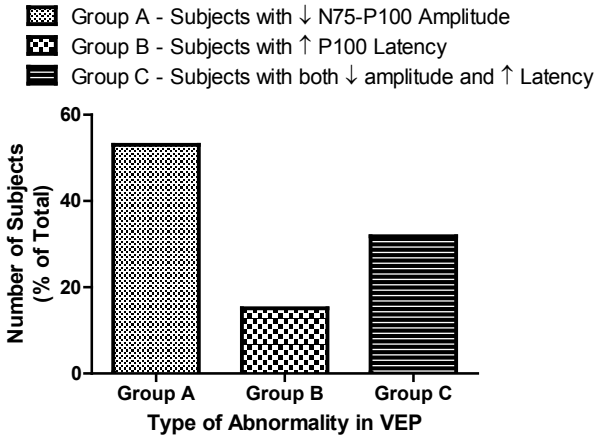


**Figure No.1 – Figure shows proportion of subjects in each group based on percentage of Total number of subjects**

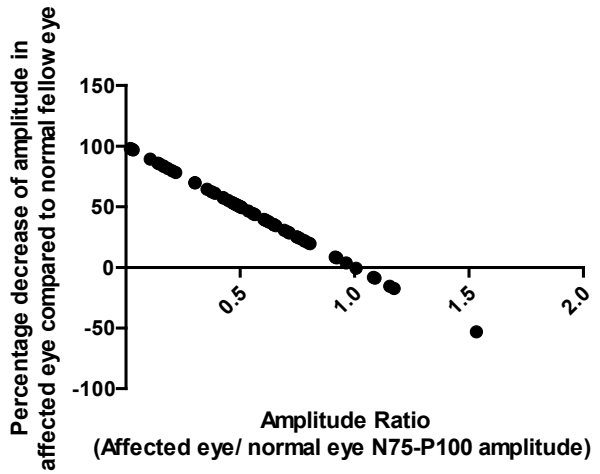


**Figure No.2 – Correlation of previously used amplitude ratio method with percentage decrease in N75-P100 amplitude; n=66 (Pearson r = -1.00, p < 0.0001)**

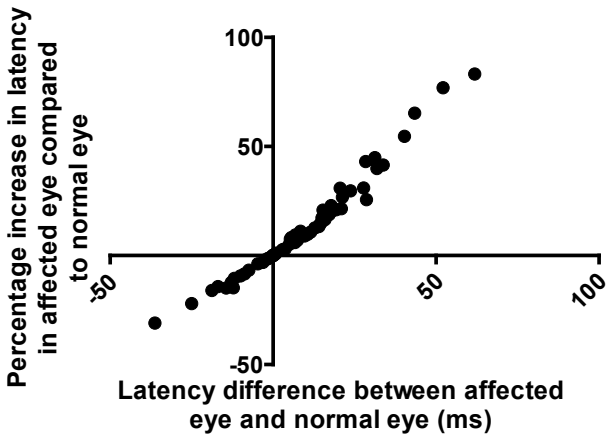


**Figure No.3 – Correlation of previously used affected eye and normal eye latency difference method with percentage increase of latency in affected eye; n=66 (Pearson r = 0.98, p < 0.0001)**

## Discussion

This study retrospectively analyzed the data of 66 patients with unilateral eye various visual problems where 132 VEP recordings (66 eyes with normal VEP and 66 eyes with abnormal VEP) were analyzed.

The male subjects were more than the female participants. Some eye conditions have been found to be more prevalent in males[15], where other reports the females more commonly affected with blindness[16,17]. As this was retrospective analysis of patients referred for VEP, hence this study may not reflect the actual population demographics.

We observed little higher frequency of affection of left eye. There are no any subtle reasons to presume that any one eye is more affected with visual problems than the other[18,19]. This may be an incidental finding due to small sample size.

Previous studies have compared the bilateral eye amplitudes in patients with one affected eye using the amplitude ratio and absolute increase in latency. They obtained amplitude ratio of affected eye by dividing the affected eye amplitude with normal eye amplitude. Further, they compared the bilateral eye latencies in terms of absolute difference of time in ms (10). We utilized the same method and also used and alternative way of comparison in terms of percentage change as mentioned above. This way has not been used in earlier studies reflecting that it is not a reliable way of comparison. Hence, we correlated percentage change method with the previous method and found a promising correlation between the two methods indicating that this method can also be utilized in future for such studies, where comparison is to be done with one normal eye.

N75-P100 amplitude was reduced in more number of the subjects compared to the number of subjects with prolonged latency. The N75-P100 amplitudes are considered the marker of axonal integrity of optic nerve and P100 latencies are considered to be related to demyelination of optic nerve[20,21]. Thus more number of subjects were having axonal lesion of optic nerve as the cause of their reduced vision. Optic neuropathy involving axonal lesion have been previously documented as the most common cause of blindness[22].

Subjects were grouped on the basis of decrease of amplitudes and increase of P100 latencies in the affected

eye compared to normal fellow eye in to three groups; Group A only with reduction of N75-P100 amplitude, Group B only with prolongation of P100 latency and Group C having both reduction of amplitude and prolongation of latency. Maximum numbers of subjects were in the Group A followed by Group C. Group B had the least number of subjects. This suggests that there is possibility of all kinds of lesion in reduction of vision. Further, maximum numbers of cases were due to pathologies causing axonal lesion. Moreover, pathologies which lead to both decrease in amplitude and increase in latency were the next common cause of visual loss and least numbers of cases were due to pure demyelinating causes.

Literature have evidences that there are pathological conditions which decrease amplitude or increase latency or do both i.e. decrease amplitude and increase latency together[10,23–25]. Our study shows the relative frequency of pathological etiologies of axonal, demyelinating and combined axonal and demyelinating lesions in the unilateral visual problems.

## Conclusion

Reduction of N75-P100 amplitude is the most commonly observed abnormal VEP parameter suggesting that maximum number of subjects have axonal lesion of optic nerve as the cause of their reduced vision. Percentage change method is also a valid way of comparing the VEP parameters in bilateral eyes if one of the tow eyes has normal VEP.

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

**Ethical approval:** Study is approved by institutional Ethics Committee.

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# Assessment of Pulse Wave Velocity in Obese Adults using ECG and Finger Tip Photo Pulse Plethysmography

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## Abstract

**Introduction :** The World Health Organization has recently defined obesity as a disease. Obesity is the result of imbalance between food intake and energy expenditure. Obese individuals with excess fat deposition in the abdominal region are at risk for CHD, hence this study was taken up to see if any association is there between obesity and PWV.

**Aim :** 1. To measure the pulse wave velocity (PWV) in obese individuals.

2. To compare if there is any correlation between pulse pressure, PWV and BMI.

**Material and Method:** 68 obese adults were included for the study , 45 males and 23 females. The study was started after getting clearance from IEC. Informed oral consent was obtained from the subjects. Height and weight of the subjects were recorded. All of them were in the age group of 27 to 62 years and had BMI > 30.

Resting blood pressure was recorded, then Lead II ECG was recorded along with left forefinger tip photo pulse for a period of 15 secs. Distance between the R wave and the foot of the finger pulse was measured in msec. The arm span was measured from the left lateral border of sternum to tip of left forefinger which was taken as distance(D) travelled by the pulse. Using $V=\Delta T/D$, PWV was calculated.

**Results :** The mean BP in male and female was 106 ±9 & 94.7 ±4.4 mmHg respectively where as the PWV was 5.8 ± 0.7 mts/sec in male and 5 ± 0.5mts/sec in females which is in normal limits. Analysis of data was done by applying Pearson's Correlation and paired Student T test which revealed there was positive correlation between mean BP versus PWV $r = 0.21$ & BMI versus mean BP $r = 0.26$. P value were highly significant which was $< 0.001$

PWV is influenced by tethering of vessel and stiffening of the arterial wall, so increase in velocity may not be a good index to assess risk factor in all cardiac conditions.

**Conclusion** : PWV is influenced by tethering of vessel and stiffening of the arterial wall, so increase in velocity may not be a good index to assess risk factor in all cardiac conditions unless it is corrected with respect to age and Blood pressure .

***Keywords –*** *pulse wave velocity , obesity, photo pulse plethysmography*

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## Introduction

Obesity is a fast growing global health, social and economical problem. It is also called as disease of 21st century. It develops due to imbalance of energy intake and energy expenditure. Obesity is defined by WHO

as "A Medical condition in which excess body fat has accumulated to the extent that it may have adverse effects on health consequences". The BMI is an attempt to quantify the amount of fatty mass in an individual, and then categorize as underweight, normal weight, overweight, or obese, based on BMI value.[1]

Arterial stiffness is a general term for the elasticity (or compliance) of the arteries. Structural and cellular changes results in hardening or stiffening of the arteries which is called arteriosclerosis. Arterial stiffening is a marker for increased cardiovascular disease risk such as Coronary Heart Diseases. The stiffness of arteries indicates how hard the heart has to work to pump blood through the body.

Obesity is a world-wide epidemic with massive socioeconomic consequences; in particular, it increases the likelihood of associated pathologies including cardiovascular disease, type 2 diabetes, dyslipidemia, and sleep apnea. Early vascular aging and therefore elevated arterial stiffness, an independent marker of cardiovascular events and mortality, has been found to be associated with all these pathologies. Therefore, obesity could be expected to be directly related to increased arterial stiffness. However, conflicting results have been reported in adults, some studies found a positive relationship between obesity and arterial stiffness. Whereas others found no such relationship or even a negative relationship. A recent review indicated that only 13% of the relevant publications reported a positive association between body mass index (BMI ) and PWV. [2]

Vascular stiffness, increases the load on the ventricles, decreases cardiac ejection. Blood ejecting into a stiffer arterial system , generates high end-systolic pressure for the same net stroke volume using greater energy. Chronic ejection into a stiffer vasculature induces cardiac hypertrophy.

Vascular stiffening also changes the manner by which the heart is perfused. Isolated systolic hypertension (defined as systolic blood pressure > 140 and diastolic blood pressure < 90 mm Hg ) and elevated pulse pressure are two clinical manifestations of decreased vascular distensibility (Increases vascular stiffness).

Pulse wave velocity helps in assessment of arterial stiffness. It increases in certain diseases that are associated with increased cardiovascular risk .[3]

Photoplethysmography (PPG) is a non invasive method for the measurement of arterial blood volume changes at a peripheral site where the blood vessels are close to the skin. It is an instrument mainly used to determine and register the variations in blood volume or blood flow in the body which occur with each heartbeat. Here infrared light rays are transmitted through index finger to measure pulse wave.

The plethysmogram waveform represents pulsatile peripheral blood flow, which reflects both peripheral and central hemodynamic. [4]

## Aim

1. To measure the pulse wave velocity (PWV) in obese individuals.

2. To compare if there is any correlation between pulse pressure, PWV and BMI.

## Materials and Method

After getting clearance from ethics committee, informed consent was taken from all the participants and detailed clinical examination was done as per study protocol. All experiments were performed in the Department of Physiology, Narayana medical College, Nellore.

**Participants:**

68 Apparently healthy volunteers were recruited after obtaining Institutional ethical clearance - 45 subjects were males & 23 subjects were females.

**Inclusion criteria**

Age between 25 - 60 years, Male and female (irrespective of menstrual phase) adults with BMI >30 [kg/m$^2$] without past history of diabetes , hypertension, any cardio vascular conditions.

**Exclusion criteria**

Age less than 25 or more than 60 years male and female adults, BMI < 30[kg/m$^2$] , with

past history of diabetes, hypertension, any cardiovascular conditions.

**Parameters recorded -** Height, Weight, BMI, Arm span, SBP, DBP & PWV

### Procedure

The data was collected in the morning hours between 7- 8 am. Informed written consent was taken. Subjects were asked to take rest for 15 minutes after which blood pressure was recorded.

Weight & Height were measured, Body mass index (BMI) was calculated .Standard ECG electrodes were connected to record Lead II ECG and simultaneously Left fore finger Photo pulse was recorded using Audacity software (freeware)by using computers sound card as analog to digital converter.

## Results

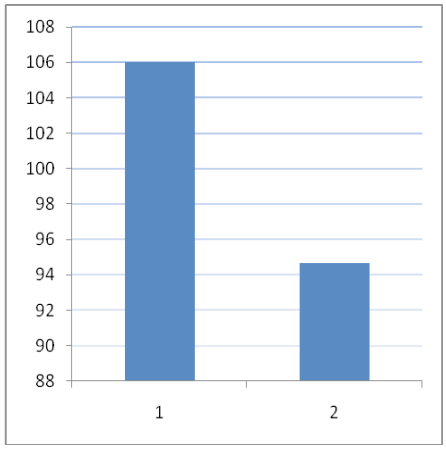
**Table - 1 General characteristics of the subjects**

| Parameters Mean ± SD | Males [ n = 45] | Female [n = 23] |
|---|---|---|
| Age (yrs) | 44 ± 7.4 | 42.2 ± 10.13 |
| Height (cms) | 165.9 ± 6.7 | 155.7 ± 5.3 |
| Weight (Kgs) | 84.95 ±10.44 | 73.92 ± 10.18 |
| BMI | 30.78 ± 2.95 | 30.68 ±3.19 |
| Arm span | 83.2 ± 4.38 | 76.66 ±3.44 |

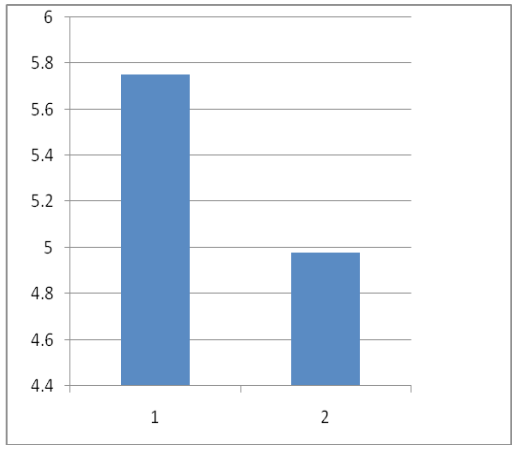
**Table - 2 Cardiovascular parameters of smokers**

| Parameters Mean ±SD | Males [ n = 45] | Female [n = 23] |
|---|---|---|
| SBP (mmHg) | 129.48 ± 13.8 | 113.65 ± 5.03 |
| DBP (mmHg) | 94.2 ± 7.7 | 85.21 ± 5.69 |
| Mean B.P | 105.99 ± 9.03 | 94.69 ± 4.37 |
| PWV (mt/sec) | 5.75 ± 0.65 | 4.98 ± 0.53 |

**Graph – 1 Analysis of data was done by applying Pearson's Correlation and paired Student T test**




Mean B.P(mm Hg). Male & Female




Mean PWV (mts./sec) Male & Female

Normal pulse wave velocity = 5 - 6 mts./ sec

There was Positive correlation between mean B.P with PWV, BMI and Age which were statistically significant.

## Discussion

Arterial stiffening reflects the changes of arterial wall degeneration. It has become clear that, the arterial stiffness is not only determined by structural elements with in vessel wall and distending pressure, but also by functional regulation by the sympathetic nervous system and endothelium of the vessel wall. Increase in arterial stiffness may results in higher systolic blood pressure; lower diastolic blood pressure and wide pulse pressure all conferring greater cardiovascular and total mortality risk. Increased arterial stiffness through an elevation of SBP enhances the left ventricular load and favors cardiac

hypertrophy and through reduction of DBP, results in a decrease in the perfusion pressure of the coronary arteries, thus contributing to myocardial ischemia.

## Conclusion

Endothelial dysfunction is an important risk factor for hypertension because it leads not only to functional alterations, represented by the impaired control of the vascular tonus, but also to structural changes, such as thickening of the intima and media of the vessel wall. The association between endothelial dysfunction and increased blood pressure in obesity comes from studies showing that obese individuals display blunted vasodilatation in response to classical endothelium dependent vasodilators such as acetylcholine in resistance arteries, as well as reduced capillary recruitment in response to reactive hyperemia and shear stress and that the severity of endothelial dysfunction correlates with the degree of visceral adiposity

Measuring arterial stiffness provides good data on the endothelial condition. In our study we have seen increase in PWV which is a early marker of arterial stiffness. Therefore complete understanding the effects of obesity on vascular endothelium is useful in treatment and in preventing deleterious complications.

Over the next few years measurement of arterial stiffness might become an important part of risk assessment. It will become necessary for physicians both in primary care and hospital practice to understand the importance of arterial stiffness and different techniques are available for its clinical assessment.

**Conflict of Interest :-** Nil

**Source of Funding:- Self**

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# Effect of Smartphone Addiction on Motor Efficiency in Upper Limb Assessed by Bimanual Coordination in Young Adults

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## Abstract

**Objectives:**To compare efficiency index by bimanual coordination in smartphone addictors & non-addictors **Materials & Method:** Cross sectional observational data was collected from Professional students in the age group 18-25 years who uses smartphone more than 6 months. Smartphone addiction was assessed using scale-SV questionnaire. Among them 50 smartphone non addictors & 50 addictors . Bimanual coordination of upperlimbs was done by using two hand coordination test apparatus with electric chronoscope & efficiency index was calculated. **Results:** A Mann Whitney U test was conducted to determine whether there was a difference in the score of addiction & nonaddiction. From this data it can be concluded that there was a significantly higher score in smartphone addictors compared to nonaddictors (U=0.500, n1=n2=50, $P <$ 0.001) The effect of smartphone addiction on efficiency index assessed by bimanual coordination were compared using an independent t test .Mean of efficiency index in smart phone non addictors & addictors was 78.90+17.04 & 53.70+18.06 (t=-7.17 p<0.001) ,which is statistically significant.

**Conclusion:** Motor efficiency in upper limb assessed by bimanual coordination in young adults is significantly decreased in smart phone addictors compared to the non-addictors.

***Keywords:*** *Smartphone addiction,bimanual coordination, efficiency index, young adults.*

## Introduction

Smart phone usage among the general population is increasing widely. According to online surveys, almost 30 billion messages were sent per day using whatsapp and 20 billion SMS messages in 2015. Literature reports an adverse impact on the physical and psychological health of the users of mobile and other information technology[1]. Though it has many uses like social, interactions, information retrival & entertainment,but loss of control over smartphone use might lead to negative impacts on our daily life. Among the smartphone users ,young adults are widely using the smartphone & getting addicted to the same.Most of the times students stress on usage of smartphone is hidden & its addiction is not known. The use of these hand-held devices is on the rise. Mobile phone users can able to communicate other than voice by a wide range of text button usage by means of SMS (short message service), whats app, viber, line in, and social networking applications like facebook, twitter and skype[2]. Survey-based research has shown that many respondents would give up brushing their teeth, exercising, wearing shoes, showering, and eating chocolate instead of living without their smartphones for the same period of time . A study conducted by South Korea's university students have also proven the relationship of smartphone addiction to mental health, campus life, personal relations, self-control and life stress[3].

It is a wellknown fact that many young adults suffer from smartphone addiction, which is almost similar to narcomania or alcoholism. Smartphone addiction is defined as a behavior addiction, loss of control by excessive immersion and obsessions to smartphone use, consequent daily disorder by nervousness and

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anxiety , and inclination toward virtual world that feels more enjoyable with smartphone than with friends[4]. As with heavy smartphone usage, the incidence of musculoskeletal disorders of hand, wrist, forearm, arm and neck has been increasing all over the world due to prolonged, forceful, low amplitude, repetitive use of hand held devices[5]. Sustained and gripping and repetitive movements with the thumb and fingers have all been identified as risk factors which may lead to disorders of the thumb and thumb musculature in the forearm. In day to day activities two hands are used together for a number of activities. To achieve this goals our hand movements, have to be finely coordinated & this functional ability depends on the muscle strength, sensation and coordination of the muscles & dexterity[6]. Bimanual movements has to have intralimb coordination, & integration and sequencing of actions between limbs (i.e., interlimb coordination). It is a complex self-organizing system that is subject to both internal (biopsychological) and contextual (task) constraints. corpus callosum of the brain that connects the left and right sides of the brain facilitates communication between the two hemispheres—a process that is essential to interlimb coordination[7].

In an individual various of bimanual coordination is observed ,& most research task items have focused on the patterns of coordination that appear in cyclic movements: like, continuous finger tapping with index fingers of both hands, finger tapping with one hand while tracing a circle with the other hand, or circle drawing with both hands[8].

Repetitive flexing and extending of tendons in hands & wrists particularly when done forcefully and for prolonged periods without rest also can increase pressure in carpel tunnel. Injury to wrist can cause swelling that exerts pressure on median nerves and causes carpel tunnel syndrome[9].

The present study aims to study the effect of smartphone addiction on efficiency index assessed by bimanual hand coordination in young adults.

## Objectives

- To assess smart-phone addiction in young adults by smartphone addiction scale questionnaire
- To determine efficiency index by bimanual coordination in young adults(18-25 years )
- To compare efficiency index by bimanual coordination in smartphone addictors & non-addictors .

## Materials & method

**Design:** Cross sectional observational data was collected from Professional students in the age group 18-25 years who uses smartphone more than 6 months. Institute ethical clearance & Written Informed consent was obtained.

**Sample size:** Sample size was estimated based on the previous study of smartphone addiction at 24.8% & non addictors 57.8% . By using the formula calculated by G* power

$n = (Z_{\alpha/2}+Z_{\beta})^2 * (p_1(1-p_1)+p_2(1-p_2)) / (p_1-p_2)^2$, n1 (smartphone Addictors)=50,n2(Smartphone non-addictors)=50

where $Z_{\alpha/2}$ is the critical value of the Normal distribution at α/2 (e.g. for a confidence level of 95%, α is 0.05 and the critical value is 1.96), $Z_{\beta}$ is the critical value of the Normal distribution at β (e.g. for a power of 90%) and $p_1$-24.8% and $p_2$ - 57.8% are the expected sample proportions of the two groups.

**Interventions:** none

The data was collected by self-administering the questionnaire to the students which consisted of two parts. First part recorded the demographic information including age, sex, education, type of phone used and time spent on smartphone per day & per week. Second part was smartphone addiction scale-SV questionairre given to young adults to know whether they are smartphone addictors or non-addictors[10].

Bimanual coordination of upperlimbs of smartphone adductors & non-addictors was done by using two hand coordination test apparatus with electric chronoscope(Anand agencies ,Pune).The subjects traced the figure on the apparatus with the help of the pointer from start to end using two handles with both hands simultaneously.If the pointer touches the walls of figure on the apparatus it was noted as error (e) committed & was digitally recorded by chronoscope in seconds. They were given trial twice before the actual task to be performed.Time required for completion of the test (T) & error (e) commited during completion of task was noted in seconds[11].Known history of

motor,behavioural,orthopaedic,reported history of learning or neurologic deficits & participants with primary uncorrected visual defect or medical condition that might interfere with ability to carry out motor task were excluded from the study.

**Statistical Analysis:** Descriptive statistics, Independent t test was done to analyze the quantitative data & Mann Whitney U test was conducted to determine whether there was a difference in the score of addiction & nonaddiction. & chi square test was done to analyze categorical variables & $P<0.05$ was considered statistically significant.

## Results

Relationship of smartphone addiction with time spent on smartphone per day,apps installed,apps uninstalled, emailusage, education purpose,facebook, games, text messages, webusage & whatsapp usage. The following sections details the results of cross-tabulations that have established a Significant relationship through Chi-square tests & significant relationship was found with the time spent on using smartphone /day & smartphone addiction($\chi^2$=24.74,p<0.001).Significant relationship was also found between for apps installed,email usage,facebook usage,games text messages.There was no significant relationship on apps uninstalled,education purpose & whats-app usage.

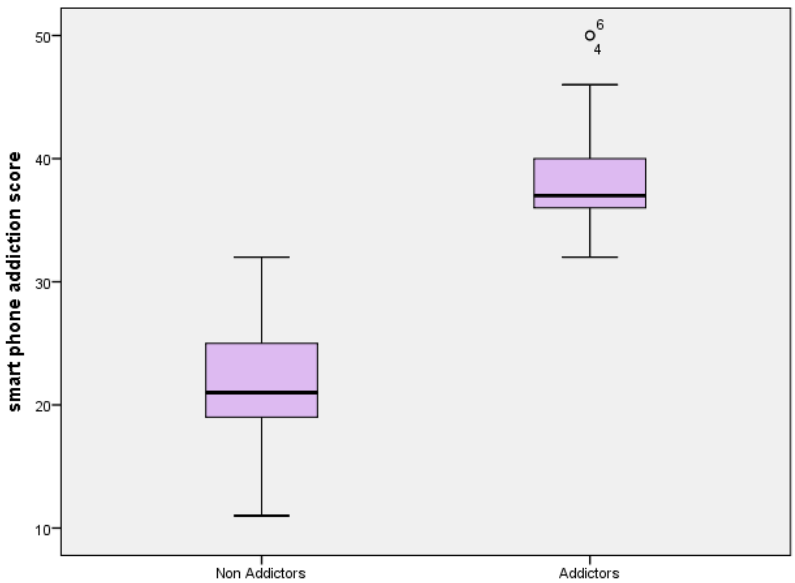
**Table-1: Comparison of efficiency index in smartphone addictors & nonaddictors in young adults**

| Variable | Nonaddictors | Addictors | t value | *P* value |
|---|---|---|---|---|
| Age (years) | 19.20+1.01 | 19.62+1.19 | 1.90 | 0.061 |
| Efficiency index | 78.90+17.04 | 53.70+18.06 | -7.17 | 0.001 |

There was no significant difference for age among smartphone addictors & nonaddictors. There was a significant reduction of efficiency index among the smartphone addictors as compared to nonaddictors (p<0.001)

Mann Whitney U test indicated that smartphone addiction score was significantly higher in adductors(median-37) than for nonaddictors(median-27) U=0.500, n1=n2=50, $P < 0.001$.

**Fig-1: Comparison of smartphone addiction score between Nonaddictors & Addictors**



## Discussion

In the current day of events, the younger generation are becoming vulnerable to lucrative information technology devices which makes them addicted. Hand held devices such as Smartphones have become increasingly popular and more advanced over the last decade. Its use compels the user to use both hands simultaneously to perform the tasks like texting,gaming,browsing internet etc ,inturn spending more time using both hands continuously. Thus the current study has focussed to assess functional evaluation of smartphone addiction on bimanual coordination in young adults.

Regular user is defined as those who use smartphone at least 6 or more times in 6 months[12]. In the present study the data was collected in the age group 18-25 years which is age matched who were using smartphone >6 months. Smartphone addiction score between addictors & nonaddictors was significantly higher ($p<0.001$).(Fig-1)Time spent on smartphone /day was significantly more in addictors i,e 81.5% & 71.4% were spending their time was between 4-6 hours & >6hrs. similar results was found in a study done by Inal etal,where the students were spending more than 3 hours on using smartphone for various purposes[13]. One more study showed a major component of daily smartphone usage time among students was 4-6 hours (40.1%) per day[14].

The present study also showed a significant relationship where smartphone addictors were spending >once /week for app installation ,but both the groups once the apps were installed spent less time on uninstalling. For emailing, facebook usage, games, texting messages ,web usage smartphone addictors spent almost daily compared to nonaddictors. Similar results are found where the facebook users considered their Facebook dependency, are known as salience, tolerance, and conflict. But an interesting fact is that most of them in both the groups spent > 3-4 times daily for education purpose which is statistically not significant. Another study showedThe primary purpose of smartphone use was to access social networking services (56.8%), such as Facebook, Twitter, WhatsApp, and Instagram[14]. In the present study both the groups most of them used Whatsapp daily,but showed no statistical significance.

Smartphone usage in day to daily activities requires bimanual coordination of hands. Bimanual coordination neurophysiology studies are very few. The present study showed most of them were using the smartphone for various activities almost daily which was statistically significant. The efficiency index assessed by bimanual coordination is significantly decreased in smartphone addictors compared to the non addictors ($p<0.001$),(Table-1)thus indicating delay & also increase in error committed for the completion of the task. Increase in smartphone usage in young adults in the present study has decreased the rhythmicity of movements and the ability to synchronize limbs. Due to this there is decreased interlimb coordination,which is occurring at a slower pace & the individual is not aware of the damage occurring by using the gadget for a longer time.

When using Hand held devices the user is compelled to engage both the hands simultaneously where on repeated use it decreases the efficiency index of bimanual coordination. Possible explanation for the decrease in efficiency index might be due to chronic usage of smartphone in the hands there occurs fatigue in the distal muscles & the smartphone addictors demonstrated errors while performing the task. As distal muscles of the hand are primarily under the control of contralateral primary motor cortex. The corpus callosum which allows reciprocal information exchange between homologus cortical areas in the 2 hemisphere has been a source of neural cross-talk. This suggests that the corpus callosum plays a crucial role in exchanging sensory information about both limb motions to accomplish goal-directed task integration,which might be delayed[15]. The synchronisation of motor output will be decreased when there is repetitive flexing & extending of tendons in hands & fingers for prolonged period without rest. Our results corroborate in a study done by Inal etal[13]. Another study showed that Smartphone overuse assessed by ultrasound examination was found to be linked with higher signs of inflammation of musculoskeletal structures of hands joints in both psoriasis and controls,indicating its overuse may be a factor which speed up the possible development of psoriatic arthritis[16].

## Conclusion

In the present study in smartphone addictors efficiency index of bimanual coordination has significantly decreased compared to nonaddictors. As time spent on smartphone usage was more in smartphone addictors for various purposes, thus the best approach in them will be to attain self control & achieve level of balance while using smartphone ,which might prevent

problems with interlimb coordination.

**Conflicts of Interest**---NIL

**Source of Funding** ----Self

**Ethical Clearance**---taken from Institute ethics committee (order No.DMC/KLR/IEC/08/2016-17 from SDUMC.

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# Effect of Acute Exercise on Cognitive Control

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## Abstract

**Aim:** To assess effect of acute exercise on attention and memory (Cognitive Control). **Introduction:** Studies have shown that exercise and cognition are positively correlated. Cognitive control encompasses core cognitive process like inhibition, working memory and cognitive flexibility. Key elements like selection, scheduling and coordinated programming process are needed for cognitive control is brought about by target oriented, self-regulatory operations of brain. This study was specifically designed to assess effect of acute exercise on attention and memory (Cognitive Control) in fifty healthy young male subjects in the age group of 17-25 years .**Material and Method:** Participant were instructed on methodology of Stroop colour Word Test, Ray Auditory Verbal Test and Complex figural test. Following instruction on methodology they were given five practice sessions. They were then divided in two group i.e. Group A had resting session on the second day and exercise session on the third day where as Group B had the session in exactly reverse order to that of group A. **Result:** After an acute session of exercise, the reaction time for Stroop colour condition, Stroop word condition and Strop colour word condition were decreased and this was found to statistically significant when compared to resting stage(before exercise) .In case of backward digit span test and RAVLT total score, delayed recall and average recall no significant change was observed. The immediate recall time changed significantly after exercise. **Conclusion:** A single bout of moderate intensity acute exercise has its effect on selective attention subset of cognitive control.

***Key words:*** *Cognitive control, Acute aerobic exercise, Memory, Attention*

## Introduction

Several aspects of the cognitive function such as Executive function, Attention, Memory and Visual-spatial skills etc. were found to be enhanced after regular aerobic exercise both in person suffering from psychiatric disorder as well as in healthy subjects [1,2,3,4,5,6,7].

Using investigational tool such as SPECT, PET and fMRI shows that aerobic exercise leads to change in the pattern of perfusion, glucose uptake and neurotransmitter release by areas of the brain tasked with cognitive control [8,9,10].

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Cognitive control encompasses core cognitive process like inhibition, working memory and cognitive flexibility. Key elements like selection, scheduling and coordinated programming process are needed for cognitive control that are brought about by target oriented, self-regulatory operations of brain [11].

Works of Angevaren et al [12]. shows that particularly in adult population the effect of exercise on tasks falling under the canopy of cognitive control is relatively more compared to the other subsets of populations. This is supported by evidence gathered by Colcombe et al. Differential increment in gray and white matter volume in the areas of the brain i.e. prefrontal, parietal and temporal cortex which are known to play role in cognitive control was observed after exercise by them [13, 14].

Most of the studies till date are directed towards elder population and have shown a positive correlation between physical activities and cognition. The recent

upsurge in the studies have somewhat ignored the age group of 17-25 Years. Research on this age group is particularly important in the sense that if this particular age group can be convinced of beneficial effect of exercise even for short duration on their cognitive functions then there are chances that they will imbibe the habit of regular exercise. This may as well act as a primordial prevention of dementia.

## Material and Method

The study was specifically designed to assess effect of acute exercise on selective attention and memory (Cognitive Control) in fifty healthy young male subjects in the age group of 17-25 years.

**Criteria for selection:**

Not suffering from any illness like diabetes mellitus, hypertension, CKD, Psychiatric disorder, Neurological disease or any other illness which is known to impair cognitive performance.

No History of drug abuse including alcoholism.

Not practicing Yoga, Meditation, Biofeed back technique or any other relaxation technique.

No family history of Psychiatric illness.

The study was explained to the subjects and their informed consent was taken according to the ethical principles of Indian Council of Medical Research, New Delhi.

**Procedure**

The study was modeled as within the subject design; where participant themselves acted as a control. Participant came to the Exercise physiology laboratory in the department of Physiology on three different days (7±6.5).They were instructed to come at the same time on all the three occasions and were also instructed not to indulge in any form physical exercise on the day of their scheduled visit.

Informed written consent was taken from the participant and resting heart rate was recorded after 15 minutes of seated rest using Cardivision Stress Test System, Medicaid India, on the first day of their visit. They were instructed on methodology of Stroop colour Word Test, Ray Auditory Verbal Test and Backward digit span. Following instruction on methodology they were given five practice sessions. Any query about the test was answered. Participants were then divided in two group i.e. Group A had resting session on the second day and exercise session on the third day where as Group B had the session in exactly reverse order to that of group A. This was done to remove any change in the result due to the order of the session.

**Exercise Protocol:**

The participant exercised for twenty minutes on treadmill (Cardivision Stress Test System, Medicaid India) at 60% of maximum heart rate estimated by the formula i.e. HRmax; 220-Age. Mean HR for this intensity was 120.4 ± 3.0 bpm which equaled to 59.7 ± 0.6 % of HRmax.

**Stroop Colour Word Test [15]:**

Vitoria version of Stroop Colour Word Test was used. It consists of three 21.5X14 cm cards, each containing six rows of four items (Helvetica, 28 point in rows which are placed one centimeter apart. In Part D (Dots), the subject is instructed to name as quickly as possible the colour of 24 dots printed in blue, green, red, or yellow ink. Each color is used six times, and the four colors are arranged in a pseudorandom order within the array, each color appearing once in each row. Part W (Words) is similar to Part D, except that the dots are replaced by common words, printed in lowercase letters. The subject is required to name the colors in which the stimuli are printed and to disregard their verbal content. Part C (Colors) is similar to Parts D and W, but here the colored stimuli are the color names "blue, green, red, and yellow" printed in lowercase so that the print color never corresponds to the color name. This latter task thus requires the individual to inhibit an automatic reading response and to produce a more effortful color naming response. The time difference between part C and Part W is known as interference effect or Stroop effect.

The Rey Auditory Verbal learning Test (RAVLT) [16]

RAVLT assessed verbal memory and learning. Participants were read a list of 15 common words five times. Immediately after each time, they were asked to recapitulate as many words as possible. After completion of the fifth trial, an interference list was presented following which subject had to spontaneously recall the original words. Finally, participants were required to spontaneously recall the original words after a 20 minute

delay. Scores were calculated as the total number of words recalled (1) across the five trials (total acquisition); (2) after the interference list (recall after interference); (3) on the fifth trial minus after the interference (loss after interference); and (4) after the delay (long delay free recall).

**Backwards Digit Span test [17]**

In a standard Backwards Digit Span test, the length of the number-string increases by 1 and continues until participants fail two consecutive attempts at reciting strings of a given length—generating a score in relation to the maximum string-length successfully recited . Participants attempted to recite nine number-strings which were 3–11 digits in length, increasing with order.

## Statistical Analysis

All data are expressed as mean ± standard deviation (SD).The analysis was performed using SPSS 17. Statistical significance was accepted at $P<0.05$. Comparisons among after exercise and before exercise were performed by two tailed paired t test.

## Result

After an acute session of exercise, the reaction time for Stroop colour condition, Stroop word condition and Strop colour word condition were decreased and this was found to be statistically significant when compared to resting stage(before exercise)

In case of backward digit span test and RAVLT total score, delayed recall and average recall no significant change was observed. The immediate recall time changed significantly after exercise.

**Table1: Comparison of before–exercise and after-exercise Neuropsychological tests score**

| Neuropsychological Test | Before-exercise Score(Mean±SD) | After-exercise Score(Mean±SD) | p-Value |
|---|---|---|---|
| RAVLT-Total Score | 44.93± 10.07 | 45.74 ± 10.28 | >0.05 |
| RAVLT-Average Score | 8.78 ± 2.02 | 8.15± 2.06 | >0.05 |
| RAVLT-Immediate Recall | 8.98± 2.86 | 7.95 ± 2.68 | <0.01 |
| RAVLT-Delayed Recall | 9.55± 3.27 | 9.83± 2.23 | >0.05 |
| Backward digit span test | 4.61(1.54) | 4.89(1.08) | >0.05 |
| Stroop color condition(time in second) | 18.87±6.9 | 13.82±2.2 | <0.001 |
| Stroop word condition(time in second) | 26.68±5.2 | 19.5.4±2.7 | <0.001 |
| Stroop color-word condition(time in second) | 38.56±8.3 | 29.80±3.6 | <0.001 |
| Stroop Interference(time in second) | 16.82±7.1 | 12.57±4.2 | <0.001 |

**All results are expressed as Mean ± standard deviation, p< 0.05 is considered significant**

## Discussion

Our finding suggests that a single acute session of moderate intensity aerobic exercise yielded a positive influence on the tasks requiring cognitive control.

In our study, the inhibitory control, a component of cognitive control, was assessed using Stroop's colour word test (SCWT). In SCWT, the colour condition and word condition are congruent task where as colour word condition is an incongruent task requiring sustained and selective attention to the task at hand and inattention to distracting task.

The reaction times were significantly decreased after an acute session of moderate intensity exercise in all the three condition i.e. Stroop colour, Stroop word and Stroop colour word condition when compared to the reaction time score before exercise condition.

Statistically significant change in interference (difference in reaction times for congruent and incongruent condition) .The mean value of interference changed from 16.82±7.1second at before exercise to 12.57±4.2 second in after exercise condition.

Acute moderate intensity continuous aerobic exercise can improve specific cognitive functions, such as short-term memory and selective attention. Before and after each experimental session, cognitive performance was assessed by the Victoria Version of the Stroop test (a selective attention test) by Alves CR et al. They were of opinion that following the exercise session, the time to complete the Stroop «Color word" test was significantly lower when compared with that of the control session. Our findings of change in reaction times in congruent and incongruent task conditions are similar to those of Alves CR et al [18].

Other studies also report similar finding on the Stroop colour word test but they were on either the preadolescent or elderly population [7, 8, 11, 19].

Backward Digit span test is primarily employed as a test for short term memory. Alves CR et al. assessed the effects of an acute high-intensity interval training (HIT) session on short-term memory tasks. The performances Digit Span test was not significantly different and thus their result being congruent with that of our observation, but in their case the mean age group was 53.7 years[18].

Vasques PE et al after their study on elderly depressed patients were of conclusion that the Digit Span Test did not change significantly on comparison between the control and the exercise sessions. The results of the Stroop Color-Word Test improved after physical exercise, indicating a positive effect of exercise on cognition. Their finding is also similar to ours but again there is the difference in the age group.

We observed that RAVLT score didn't change significantly after exercise session in terms of total recall, average recall and delayed recall. The change was significant when immediate recall was considered.

RAVLT as a test for short term memory was included in the study undertaken by Nagamatsu LS et al. They had a similar finding but in their case the study group consisted of elderly adult with mild cognitive impairment.

## Conclusion

A single bout of moderate intensity acute exercise has its positive effect on selective attention, a subset of cognitive control.

**Conflict of Interest:** None

**Ethical Clearance:** Taken

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# Relevance of 2D:4D Ratio as a Marker of Depression in Adolescents of a South Indian Medical College – A Cross Sectional Study

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## Abstract

**Context**: Digit ratio is a sexually dimorphic trait which is negatively correlated to prenatal testosterone exposure. 2D:4D ratio has been associated with numerous physiological, psychological and performance traits in adulthood. The alarming rise of depression in adolescents poses a huge worldwide threat. Men with lower 2D:4D ratios showed lower aggression scores while those with higher ratios had higher incidence of depression.

**Aim:** To compare the 2D:4D ratio of the adolescents between sexes and evaluate the association between digit ratio & depression.

**Settings & Design**: In the present cross sectional study, 269 adolescents of 18-19 years of age were included by stratified random sampling. A single trained examiner measured the 2D:4D ratios of the participants using digital vernier calipers. Depression scores were calculated using Beck's Depression Inventory.

**Statistical analysis:** Using SPSS version 17.0, comparison of digit ratios was done using unpaired Student t test.

**Results**: Mean 2D:4D ratio of the study population was 0.97±0.082. There was no significant difference in mean 2D:4D ratios (Males=Females) and mean depression scores between sexes (Males >Females). Mean 2D:4D ratios of the depressed individuals were lower than that of the non-depressed individuals. (p=0.05) There was no significant correlation between 2D:4D ratio and the depression scores.

**Conclusion**: The present study revealed borderline significance in difference in 2D:4D ratios between the depressed and non-depressed individuals among the study population. 2D:4D ratio could be used as a non-invasive tool to predictably forecast the proneness of child to depression in future.

***Keywords:*** *Digit ratio; 2D:4D ratio; depression; adolescence; prenatal testosterone*

## Introduction

2D:4D ratio or the ratio of the lengths of index finger (2D) and the ring finger (4D) is sexually dimorphic with males showing lower ratios when compared to females. Digit lengths and ratios have been hypothesized to be proxy markers for prenatal androgen exposure.[1] The fourth digit tends to be longer than the second in men. On the other hand, in women, the two digits tend to be identical in length or occasionally the ring finger is longer.[2,3] Masculine or lower 2D: 4D ratios indicate higher prenatal testosterone exposure and vice versa.[4] An earlier study reported the average digit ratios to be 0.947±0.029 and 0.965±0.026, respectively in males and females.[5] In an Indian population, the mean digit ratios

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were found to be 0.96 and 0.97 in males and females, respectively. [6,7] At the molecular level, studies have reported that prenatal sex steroids affect the expression of Hox A genes, which are also responsible for the growth of digits. [8]

Traits ranging from handedness, musical abilities, numerical and spatial skills and sporting capabilities have been reported to be associated with the digit ratios in different populations.[9] Lower or masculinised 2D:4D ratios showed a relationship with better arithmetic, visual and spatial skills.[10] Men with lower (masculine) 2D:4D ratios showed lower aggression scores while men with higher (feminine) ratios scored higher on a test for depression.[11]

Depression is forecasted to be a huge burden on all nations with projections expecting depression to reach the second place in the ranking of disability-adjusted life years.[12] A school based cross sectional study among urban adolescents in South India reported 60.8% of the study population to be depressed.[13,14] The findings of research conducted on the relationship between depression and digit ratios are highly variable. Further, the prevalence of depression amongst adolescents is also on alarming rise. Hence, we conducted the present study to understand the relevance of 2D:4D ratio as a marker of depression.

## Material and Method

**Study setting and population:**

After obtaining ethical clearance and informed consent, the present cross sectional study was conducted on 168 adolescents of 18 – 19 years of age pursuing Medicine at South Indian Medical College. Participants with any history of injury in the second and/or fourth digits were excluded from the study.

**Measurement of 2D:4D ratio:**

The lengths of the second and fourth digits were measured from the fingertip to the ventral proximal crease using digital vernier calipers. It has been consistently shown that digit ratio is more strongly differentiated on the right hand than left.[15] Further, personality and behavioural traits have also been found to correlate more strongly with right hand digit ratio than left.[7,15] Hence, we measured 2D:4D ratios of the right hand only. Two measurements were taken on the right hand by the same examiner. The examiner was well trained and the instrument was calibrated prior to the conduct of the experiment. The ratio was calculated by dividing the mean index finger length (mm) and mean ring finger length (mm) for the right hand.

**Administration of Beck's Depression Inventory:**

The BDI (Beck Depression Inventory) was used to measure depression. It is a self-reported questionnaire containing 21 questions with four possible responses to measure the intensity, severity & depth of depression.[16] Each response is assigned a score ranging from zero to three, indicating the severity of the depression. The subject required about 10 minutes for completing the questionnaire.

## Statistical Analysis

Statistical analysis was done using SPSS 16.0 and STATA 11.0. The correlation between 2D:4D ratio and mean scores for the depression questionnaire was tested using Spearman correlation coefficient. The mean 2D:4D ratios and scores of the Beck Depression Inventory were compared between the sexes and right & left hands using student t test and Mann Whitney U Test, respectively. Comparison between the mean 2D:4D ratios of the 5 groups based on depression scores was done using one way ANOVA.

## Findings

The sample size of the present study was 270 (Males = 100; Females = 170) according to the stratification applied while sampling. The mean age of the study participants was 18.32±0.988. The mean 2D:4D ratio of the population was 0.97 ± 0.082. The mean depression score of the study population was 11.84 ± 9.009. Males had 2D:4D ratios that were almost equal to that of females. Males were found to have higher depression scores when compared to females, though not statistically significant. (Table 1)

**Table 1: Comparison of 2D:4D ratio and depression scores of males and females**

| Variable | Sex | Mean | SEM | Mann whitney U/ T statistic | p value |
|---|---|---|---|---|---|
| Depression score | Male | 12.62 | 1.064 | 8342.5[1] | 0.254 |
| | Female | 11.39 | 0.605 | | |
| 2D:4Dratio | Male | 0.968 | 0.0082 | 0.459[2] | 0.647 |
| | Female | 0.964 | 0.0062 | | |

[1] Mann Whitney U, [2] t statistic

The study participants were broadly grouped into depressed and non-depressed individuals. Overall, 78 (28.9%) of the study participants were depressed. Thirty one (31%) males and 47(27.6%) females were found to be depressed. The mean 2D:4D ratios of the depressed individuals were lower than that of the non-depressed individuals. (Depressed: 0.950 ± 0.113; Non depressed: 0.971± 0.0604) The difference achieved borderline statistical significance. (t statistic =1.941; p value: 0.053). However, there was no significant correlation between 2D:4D ratio and the depression scores. (Spearman correlation = -0.016, p=0.798).

The study participants were further categorized based on their depression scores into 5 groups – Normal (Score: 0 -10), Mild mood disturbance (Score: 11 -14), Borderline Clinical depression (Score:15 -20), Moderate depression (Score:0 -10),Severe depression (Score:0 -10) and extreme depression (Score:0 - 10). Using ANOVA, the differences between the mean 2D:4D ratios of the 5 groups were found to be statistically significant, however with a borderline p value of 0.055. (Table 2)

**Table 2: Comparison of mean 2D:4D ratios across various categories of depression**

| Depression category | Mean | SD | 95% CI for Mean | | ANOVA F statistic | p value |
|---|---|---|---|---|---|---|
| | | | Lower Bound | Upper Bound | | |
| Normal | 0.975565 | 0.0727876 | 0.962885 | 0.988246 | 2.195 | 0.055** |
| Mild mood disturbance | 0.962984 | 0.0382766 | 0.953344 | 0.972624 | | |
| Borderline clinical depression | 0.976914 | 0.0340232 | 0.962547 | 0.991281 | | |
| Moderate depression | 0.922647 | 0.1864526 | 0.848889 | 0.996406 | | |
| Severe depression | 0.961823 | 0.0222793 | 0.948360 | 0.975286 | | |
| Extreme depression | 0.944882 | 0.0357652 | 0.923269 | 0.966495 | | |
| Total | 0.965281 | 0.0817864 | 0.955463 | 0.975098 | | |

## Discussion

Digit ratio is a sexually dimorphic trait. Analysis of amniocentesis samples showed that, digit ratio is negatively correlated to prenatal testosterone & positively to oestrogen levels. It has been reported that prenatal testosterone may modulate striatally based dopaminergic circuits and place boys at greater risk of disruptive behavioural disorders. Further, oestrogen at puberty may have certain effects on the serotoninergic pathways and place girls at greater risk for mood disorders. Also, higher digit ratios, more commonly observed in females have been reported to be associated with depression.[11]

The mean 2D:4D ratio of the study population was 0.97± 0.082. The mean 2D:4D ratios of males and females were almost equal without any statistically significant difference. The ratios tabulated in the participants of the present study were similar with those reported by Bailey et al. [11] Lack of gender difference in the present study was in concurrence with the observations of Bull et al. [17] Non significant differences between 2D:4D ratios between the sexes were observed in the adolescents by Austin et al.[18] Findings similar to the present study were also observed in a study Meera Jacob et al.[19] They reported almost equal digit ratio for the left hand and males had greater 2D:4D for right hand. In a study on association of digit ratios to ethnicity, the 2D:4D ratio was lower in males than in females and this was significant for the Uygur, Han and Jamaican samples.[7]

The mean depression score of the study population was 11.84 ± 9.009. In the present study, males were found to have higher depression scores when compared to females, though not statistically significant. This was in concurrence with Bailey et al.[11] One out of every four secondary school students in Trinidad was found to have significant depression.[20] In urban adolescents of Chennai and South India, the prevalence was estimated to be approximately 60%. [13,19]

The authors grouped the study population as two broad categories - depressed and non-depressed individuals. The cut off score of >16 was the criteria for depression. The mean 2D:4D ratios of the depressed individuals were lower than that of the non-depressed individuals. In the present study, there was no statistically significant correlation between 2D:4D ratios & depression. This finding in our study was contradictory to Bailey et al and Martin et al. [1,11] The former showed higher digit ratios to be associated with high scores of depression while low digit ratios showed correlation in the study conducted by the latter.

Austin et al. (2002) also failed to find a significant relationship between severity of depression and finger length ratio.[18] However, the mean 2D:4D ratio of the depressed individuals was lower than those without depression. Martin, Manning and Dowrick have attributed the increased risk of clinical depression to high organizational testosterone in men.[11] They have reported data demonstrating a non-significant trend towards higher depression in men with more masculine finger length ratios. This finding was similar to the present study. On the contrary, depression being more common in women globally, Bailey et al hypothesised and then reported higher prevalence of depression in men with feminine ratios and low prenatal testosterone exposure. [21]

At the start of the present study, the authors hypothesised that higher or more feminine digit ratios should correlate with higher scores for depression within each sex. This hypothesis was predominantly assumed based on the fact that the risk and prevalence of major depression is about twice as high for females compared to males.[22] The authors conducted a pilot study of measurement of 2D:4D ratios in 30 clinically diagnosed cases of Major Depressive Disorders and compared it with 30 healthy controls which reported that 84% of study population had higher digit ratios and the difference was statistically significant. (Submitted for publication elsewhere). The pilot study results were concurrent with those of Bailey P Hurd et al.[11,23] However, when the authors pursued the study on a larger scale in 270 adolescents, lower 2D:4D ratios were associated with higher depression scores. The results of the main study were concurrent with Martin et al and contradictory to Bailey P Hurd et al.[1,11]

Depression, being a sexually dimorphic trait is more likely to be influenced by prenatal testosterone. It was surprising to note borderline significance between the 2D:4D ratios of depressed and non-depressed groups, despite an adequate sample size of both males and females. One of the probable reasons could be that depression was rated using a different scale (Neo PI scale) by the other studies, while the authors of the current study used the Beck's Depression Inventory. It has been suggested that tests like Beck's Depression

Inventory and Zung Self rating depression scale might not be able to detect small differences in non-clinical populations.

Further, the study conducted by Bailey P Hurd et al used scanned copies of hands and digits and the lengths and ratios were calculated using the GNU Image Manipulation Program (GIMP) measure tool.[11] The present study used measurements taken by a single investigator using digital vernier calipers. Photocopies yielded lower digit ratio measurements when compared to digital callipers and hence the authors preferred the latter to pick significant differences, if any.[24,25] The authors might have been unable to detect a highly significant correlation between depression scores and 2D:4D ratios due to a limited amount of variation in 2D:4D in the study population as well as using a state depression assay on a non-clinical population. Further, the role of uncontrolled effects of menstrual cycles and/or hormonal medications have been implicated in concealing the variations in depression scores in females and these factors were not taken into account in the present study. [25]

## Conclusion

Digit ratio, being constant since birth, can be used as a marker in the early identification of children prone to depression. It is a non-invasive measure that can predictably forecast the proneness of a child to depression in the future. Based on the digit ratios, one can plan early life style interventions to avoid or delay the onset of the depression or at the least, facilitate its early diagnosis. The present study revealed borderline significance in difference in 2D:4D ratios between the depressed and non-depressed individuals among the study population. Significant variations could be appreciated if future studies can be planned and conducted on even larger samples and subjects with a clinical diagnosis of depression.

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# Correlation Between Body Mass Index (BMI), Body Appreciation Score and Emotional Intelligence in Undergraduate Medical Students

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## Abstract

**Introduction:** Body appreciation score (BAS) is used to assess the positive attitude towards body image. Individuals with positive image were found to have higher emotional intelligence (EI). Body perception is influenced by the body weight. In this study we proposed to correlate the relationship between BMI, BAS and EI.

**Materials and Method:** It is an observational study. The study population comprised of undergraduate medical students aged between 18 – 24 years. Subjects on chronic medication for medical illness were excluded. We recruited 100 subjects (male 44, female 56, age 18 – 21).

A stadiometer was used to measure the height. We measured weight using digital weighing machine. BMI was calculated using Quetelet formula. The BAS2 questionnaire and The Schutte Self Report Emotional Intelligence Test (SSEIT) were administered to the participants. They were asked to score each questions on the Likert scale from 1 to 5.

**Results:** The means of the various parameters between males and females were compared using Student's t-test. There were no statistically significant differences between male and female students in terms of age, BMI, BAS2 and EI. The BAS2 score of different BMI categories were not different. The SSEIQ scores were not statistically different between each BMI categories. Pearson correlation coefficients were calculated between BMI and BAS 2 score (r = - 0.002), BMI and SSEIQ (r = 0.051) and BAS 2 score and SSEIQ (r = 0.19). There was no correlation between the two variables in any of the above cases.

**Conclusion:** BAS2 score was similar in both males and females of varying BMI. The SSEIQ scores were less for underweight students when compared with students with normal weight. The SSEIQ scores are relatively more in females than males. The BMI, BAS score and EI were not related.

***Key words:*** *BMI, body appreciation, body image, emotional intelligence*

## Introduction

Body image is a complex, multidimensional construct which includes self-perception and attitude towards body. Body appreciation considers positive components of the body image[1,2]. Body appreciation is defined as accepting, holding favorable opinions toward and respecting the body, while also rejecting media promoted appearance ideals as the only form of beauty[3]. Positive body image is associated with favorable health outcome, wellbeing, and high self-esteem[1]. Earlier reports have suggested that higher BMI is negatively associated with well-being and quality of life [4–7].

Emotional intelligence (EI) is a type of intelligence which enables an individual to observe the emotions of self and of other's, to discriminate them and to use the

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information to modulate the thinking and action. EI is used as tool for the prediction of leadership abilities, which in turn governs the performance and attitude [8]. It is also found to be a predictor of academic and professional success[9,10]. Reports have shown that individual with positive body perception were found to have higher EI[11] and higher EI is associated with health and well-being[12].

In this study we proposed to study the correlation between BMI, body appreciation score 2 (BAS2) and Schutte Self Report Emotional Intelligence Test (SSEIT) score among the first year medical undergraduate students as the data for the same is not available for Indian setting.

We hypothesized that individuals with extremes of BMI will be associated with lesser BAS2 score in both gender and individuals with normal BMI will have higher BAS2 score. Individuals with higher BAS2 score will have higher EI. We also propose to study the relationship between BMI and EI.

## Materials and Method

It is an observational study, conducted in the Dept. of Physiology, ESIC Medical College, Gulbarga. The study was approved by the institutional ethical committee for human studies. The study population comprised of medical students aged between 18 – 24 years. Subjects on chronic medication for medical illness were excluded.

We recruited 100 subjects (male 44, female 56, age 18 – 21) with above inclusion and exclusion criteria. Written informed consent was obtained after detailed explanation of the study.

A wall mounted stadiometer, accurate to the nearest 0.1 cm is used to measure the height. We measured weight using digital weighing machine accurate to the nearest 0.1 kg. BMI was calculated by using Quetelet formula i.e. BMI = body weight (kg) ÷ Height ($m^2$). All the measurements were taken by the same investigator.

The BAS2 questionnaire was given to all the participants and were asked to score each of the questions on the Likert scale from 5 to 1 [13] ( Table 1).

The Schutte Self Report Emotional Intelligence Test (SSEIT) comprising of 33 questionnaire were administered to the participants [14] (Table 2). The questions were to be scored based on the Likert's scale from 1 to 5. The total score is given on a scale from 33 to 165. Score less than 111 will be considered to be low and scores above 137 will be considered to be high[15].

**Body Appreciation Scale-2**

Directions for participants: For each statement below, using the Likert scale please indicate the best response that represents how you feel about your body

1 = Never, 2 = Seldom, 3 = Sometimes, 4 = Often, 5 = Always

**Table 1: Body appreciation scale2**

| |
|---|
| I respect my body. |
| I feel good about my body. |
| I feel that my body has at least some good qualities. |
| I take a positive attitude towards my body. |
| I am attentive to my body's needs. |
| I feel love for my body. |
| I appreciate the different and unique characteristics of my body. |
| My behavior reveals my positive attitude toward my body; for example, I hold my head high and smile. |
| I am comfortable in my body. |
| I feel like I am beautiful even if I am different from media images of attractive people (e.g, models, actresses/actors) |

Instructions: For each question below, using the Likert scale please indicate how much you agree or disagree with it.

**Scale:** 1 = strongly disagree, 2 = disagree, 3 = neither disagree nor agree, 4 = agree, 5 = strongly agree

**Table 2: The Schutte Self Report Emotional Intelligence Test (SSEIT)**

| |
|---|
| I know when to speak about my personal problems to others |
| When I am faced with obstacles, I remember times I faced similar obstacles and overcame them |
| I expect that I will do well on most things I try |
| Other people find it easy to confide in me |
| I find it hard to understand the non-verbal messages of other people* |
| Some of the major events of my life have led me to re-evaluate what is important and not important |
| When my mood changes, I see new possibilities |
| Emotions are one of the things that make my life worth living |
| I am aware of my emotions as I experience them |
| I expect good things to happen |
| I like to share my emotions with others |
| When I experience a positive emotion, I know how to make it last |
| I arrange events others enjoy |
| I seek out activities that make me happy |
| I am aware of the non-verbal messages I send to others |
| I present myself in a way that makes a good impression on others |
| When I am in a positive mood, solving problems is easy for me |
| By looking at their facial expressions, I recognize the emotions people are experiencing |
| I know why my emotions change |
| When I am in a positive mood, I am able to come up with new ideas |
| I have control over my emotions |
| I easily recognize my emotions as I experience them |
| I motivate myself by imagining a good outcome to tasks I take on |
| I compliment others when they have done something well |
| I am aware of the non-verbal messages other people send |
| When another person tells me about an important event in his or her life, I almost feel as though I have experienced this event myself |
| When I feel a change in emotions, I tend to come up with new ideas |
| When I am faced with a challenge, I give up because I believe I will fail* |
| I know what other people are feeling just by looking at them |
| I help other people feel better when they are down |
| I use good moods to help myself keep trying in the face of obstacles |
| I can tell how people are feeling by listening to the tone of their voice |
| It is difficult for me to understand why people feel the way they do* |

## Results

The descriptive statistics of the various parameters are summarized in Table 3. The means of the various parameters between males and females were compared using Student's t-test. There were no statistically significant differences between male and female students in any of the parameters studied.

**Table 3: Descriptive statistics of Age, BMI, BAS2 & SSEIQ**

| Participants | Age (mean and SD) | BMI | BAS2 (mean and SD) | SSEIQ |
|---|---|---|---|---|
| Male = 44 | 19.045 ± 0.94 | 19.89 ± 2.71 | 43.5 ± 5.35 | 125.16 ± 16.40 |
| Female = 56 | 18.92 ± 0.91 | 19.44 ± 2.73 | 43.05 ± 4.47 | 129.39 ± 13.34 |
| p value | 0.53 | 0.41 | 0.65 | 0.15 |

The relative percentage of underweight, normal weight, overweight and obese individuals in males and females is shown in Table 4. Percentage of overweight and underweight was relatively more in females than in males. Male were found to have higher percentage of normal weight.

**Table 4: BMI Characteristics of study population**

| BMI | Male | Percentage | Female | Percentage |
|---|---|---|---|---|
| Underweight | 16 | 36 | 23 | 41 |
| Normal | 27 | 62 | 29 | 52 |
| Overweight | 1 | 2 | 4 | 7 |
| Obese | 0 | 0 | 0 | 0 |

The mean and SD of BAS2 scores of male and female students in the different BMI categories are summarized in Table 4. The BAS 2 scores for each BMI category in both males and females. There was no significant difference in BAS 2 scores in both gender for different BMI categories. The BAS 2 score was relatively less in overweight individuals than normal and underweight category in both gender although not statistically significant as shown in Table 5.

The mean BAS 2 scores of the different BMI categories of the male students and female students were compared amongst themselves using ANOVA. There were no statistically significant differences seen in both the cases ($p = 0.42$ in case of males and $p = 0.48$ in case of females).

**Table 5: Mean BAS 2 scores for each BMI category**

| BMI | Female | Male | p value |
|---|---|---|---|
| Underweight | 43.65 ± 3.71 | 42.75 ± 6.31 | 0.57 |
| Normal | 42.89 ± 4.59 | 44.18 ± 4.74 | 0.32 |
| Overweight | 40.75 ± 7.68 | 38 ± 0.0 | 0.77 |
| Obese | 0 | 0 | 0 |

The mean and SD of SSEIQ scores of male and female students belonging to the different BMI categories are summarized in Table 6. The mean SSEIQ scores for each category of BMI were compared between the female and the male students using the Student's t-test. There were no statistically significant differences in any of the categories. Also the means of the SSEIQ scores of the male and females in the different BMI categories were compared using ANOVA. There was no statistically significant difference in the both the comparisons ($p = 0.58$ in male students and $p = 0.85$ in female students). The SSEIQ score is found to be higher in females of all BMI category than males though not statistically significant.

**Table 6: Mean SSEIQ score for each BMI category**

| BMI | Female | Male | p value |
|---|---|---|---|
| Underweight | 130.61 ± 14.03 | 122.19 ± 23.79 | 0.17 |
| Normal | 128.59 ± 12.84 | 127.19 ± 10.33 | 0.65 |
| Overweight | 128.25 ± 16.21 | 118.00 ± 0.00 | 0.61 |
| Obese | 0 | 0 | 0 |

Pearson correlation coefficients were calculated to assess the relation between BMI and BAS 2 score (r = -0.002), BMI and SSEIQ (r = 0.051) and BAS 2 score and SSEIQ (r = 0.19). There was no correlation between the two variables in any of the above cases.

## Discussion

In our study population we found that over 36% of males and 41% of female students were underweight and 2% of males and 7% of females were overweight and none were obese based on BMI. The BAS2 is a positive measure of body image and is associated with appreciation evaluation, body-esteem, and mental well-being [13]. Our results have shown that there is no significant difference in BAS 2 scores between males and females. We observed that BAS2 score was comparatively less in both males and females who were overweight based on BMI. Individuals who are overweight have tendency to have lower body appreciation as evidenced by relatively low BAS2 scores compared to normal and underweight individuals. It is well established that individuals who have high body appreciation were found to have eating behavior in accordance with physiological hunger and satiety cues [16].

In our study we observed that there was no significant difference between SSEIT scores in both males and females of study population. There are many studies which emphasize the role of EI in health and well-being [12]. Higher EI is associated with higher empathy, which is considered to be an important trait in medical students [17]. Though it is said that there is a difference in emotional intelligence between males and females [18,19], we could not find any difference statistically in our study population.

The SSEIT scores were relatively higher in females of all BMI when compared with that of males of BMI category though not statistically significant. The role of empathy has been emphasized as a critical element for effective communication between doctors and the patient. [17,18,20–22] Females tend to be emotionally more emphatic than males and were found to have higher EQ than males. They also tend to express emotions more skillfully than males. The observed difference in EQ with respect to gender may be due to differential cortical processing in females.

## Conclusion

BAS2 score was similar in both males and females of varying BMI. In our study, we observed that there is NO relationship between BAS2 score, SSEIT score and the BMI. The BMI, BAS score and EI were not related.

### Limitations

The sample size in our study is 100. We have considered BMI as a measure to differentiate the groups.

**Conflicts of Interest:** None

**Funding:** Self

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# A Study of Introduction of Concept of Emotional Intelligence in Medical Students

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## Abstract

**Introduction:** Despite high clinical skills of Indian medical graduates, there is growing mistrust between doctors and patients. Currently there is no programme of developing emotional intelligence (EI) in medical curriculum. **Material and Method:** A cross-sectional study based on questionnaire was conducted on 35 medical students. Demographic data was collected by semi open ended questionnaire. EI data was collected by Schutte's Self-Report EI test questionnaire of on a 5 point Likert scale. After collecting the responses, the students were asked to attend a one hour lecture on emotional intelligence. Data was entered in MS-EXCEL and analyzed by SPSS version 19. Student's t-test was used to calculate p value. Data was considered significant for $p< 0.05$. **Results:** Out of total 35 subjects, 20 (57.14%) were male. 26 (74.28%) stayed in hostel. Mean EI score was 102.42.EI in hostel vs. family accommodation was 98.34 and 103.27 respectively. Mean EI score males and females was 98.41 and 104.25 respectively. **Conclusion:** IMG have low EI. Gender and type of accommodation have no significant effect on EI. Sensitization of IMG is required to develop EI.

***Keywords:*** *emotional intelligence, medical graduates, doctor patient mistrust.*

## Introduction

Emotional intelligence (EI) is defined as the ability to perceive one's own emotions, to understand others 'emotions and to utilize emotions in such a way that it helps in emotional as well as intellectual growth. [1]Studies have found that higher EI leads to better interpersonal relationship which reflects in better doctor-patient communication .[2,3] Indian Medical graduates (IMG) have high clinical skills as shown by their high demands not only in India but also in foreign countries including United States and United Kingdom.[4]. Despite their high academic and intellectual abilities there has been growing mistrust among patients, rising number of incidences of violence and medico-legal cases against doctors and hospitals across the country. [5].This signifies a breakdown of doctor –patient relationship which in turn can be a result of low EI among IMG.

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Since the current curriculum in medical colleges in India revolves only around development of intellectual abilities but not on development of EI, IMG find them at a loss when it comes to development of doctor-patient relationship. Since there is no programme related with the development of EI among IMG, a study was conducted if the introduction of concept of EI will be beneficial to them.

## Materials and Method

A cross sectional study based on questionnaire was conducted at American International Institute of Medical Sciences, Udaipur, India in October 2017. Permission from institutional ethics committee was taken. Informed written consent was obtained from 35 second year medical students who volunteered to be the subjects. Demographic Data of the subjects was collected by a semi- open- ended questionnaire .It comprised of subjects' name, age, sex, type of residence (hostel /family). EI data was collected by Schutte's Self-Report EI test questionnaire of on a 5 point Likert scale. The questionnaire comprised of 33 questions with five responses options to each. The 33 questions

were subdivided into 4 groups namely: perception of emotions, management of own emotions, management of others; emotions and utilization of emotions. The score assigned to the responses for each question ranged on a scale from 1 to 5 (range of score: 33-165). After collecting the responses, the subjects were asked to attend a one hour lecture on the concept and relevance of EI. Feedback of the students was collected by a semi open ended questionnaire on 5 point Likert scale. Data was entered in MS-EXCEL and analyzed by SPSS version 19. Student's t-test was used to calculate p value. Data was considered significant for $p< 0.05$.

## Results

Out of total 35 subjects, 20 (57.14&) were male. The age (years) of males ranged from 17-20 (mean 18.52) and of females from 17-19 (mean 18.13).

**Table-1: Distribution of subjects according to type of accommodation (n=35)**

| | **Accommodation** | | **Total** |
|---|---|---|---|
| | Hostel | Family | |
| **Male** | 14 ( 40%) | 6 (17.1%) | 20 (57.14%) |
| **Female** | 12 (34.28%) | 3 (8.57%) | 15 (42.85%) |
| **Total** | 26 (74.28%) | 9 (25.71%) | 35 |

**Table-2: Distribution of EI score (n=35)**

| | **Overall Score** | **Perception of emotions** | **Management of own emotions** | **Management of others' emotions** | **Utilization of emotions** |
|---|---|---|---|---|---|
| **Mean Score** | 102.42 | 28.77 | 28.94 | 23.00 | 19.71 |
| **Standard Deviation** | 11.91 | 4.26 | 5.23 | 4.97 | 3.25 |

**Table-3: Distribution of EI score according to type of stay**

| **Type of stay** | **n** | **EI score** | **SD** | **p value** |
|---|---|---|---|---|
| **Hostel** | 26 | 98.34 | 10.31 | 0.137 |
| **Family** | 9 | 103.27 | 11.52 | |

Difference of EI score between those staying at hostel and those staying with family was not statistically significant ($p>0.05$)

**Distribution of EI score among males and females (n=35)**

Overall mean EI score males was 98.41( SD : 10.13) and in females was 104.25 ( SD : 11.29). No statistically significant difference in EI score was observed among males and females ($p>0.05$).

## Discussion

EI encompasses a wide spectrum of intelligence which is related with the processing of emotions. [6] It includes not only the perception of own emotions but also the management and utilization of others' emotions. [7-9]

In our study we found that the overall score of EI of IMG was low .Since EI is directly related with the performance of interpersonal skills, a low EI score is bound to create weak interpersonal bonds and mistrust among doctors and patients. [10] It has been observed that emotionally intelligent individuals are better able to provide social support and develop interpersonal bonds. [11]

The need to develop interpersonal skills among medical graduates is exemplified by a report in which the patients experienced significantly less pain when painkillers were administered to them in a warm and reassuring environment .[12] This need is further strengthened by another report in which the patients recovered faster after tonsillectomy when the medical practitioners were friendly to them .[13]The need to develop interpersonal skills, which is also known as 21st century skill or soft skills , among medical graduates, has been acknowledged recently .[14-17]

Now interpersonal skills have been included in the definition of professional competence in medical practice. [18]

Although we made an attempt to find the factors responsible for the low EI among IMG, we did not find any statistically significant difference according to the difference in their gender or type of accommodation. The factors responsible for low EI among IMG remains obscure. In our study when the medical students were introduced to the concept of EI by the method of 1 hour lecture it was received favorably and agreed by all the students that they have been sensitized towards the concept of EI and its need to develop among them for better interpersonal skills.

The major limitation of this study is small size of the study group. Also only quantitative data was obtained in this study. Post sensitization EI score of the subjects is yet to be studied. So a prospective study comprising of bigger study group which includes qualitative data analysis is suggested.

## Conclusion

IMG have low EI. Gender and type of accommodation have no significant effect on EI. Sensitization of IMG is required to develop EI.

**Conflict of Interest** – NIL

**Financial support**- NIL

**Ethical Clearance**- From institutional ethics committee.

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# Effect of Treadmill Exercise on Blood Glucose Control in Type-2 Diabetes Mellitus Patients

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## Abstract

**Background:** Diabetes mellitus type 2 is because of resistance to insulin resulting in inability to utilize glucose. In addition to medicines and diet control, regular exercise helps in increase in utilization of glucose.

**Aims & Objectives:** To study efficacy of exercise especially treadmill walking on controlling blood glucose homeostasis in diabetes mellitus.

**Material and Method:** The study was conducted on 40 clinically confirmed cases of type-2 diabetes mellitus male patients who were divided in study group and control group with 20 patients in each group. Study was conducted for period of 8 weeks. Diet plan was formed by expert during this period and subjects were instructed to follow it strictly. Fasting blood glucose and postprandial blood glucose was measured before and after exercise programme.

**Findings:** There is significant decrease in fasting blood glucose and Postprandial blood glucose level in study group as compared to control group with inter-group difference was significant ($P<0.05$).

**Conclusion:** Treadmill exercise is very useful for blood glucose control in addition to diet control and medicines.

***Keywords:*** *Type-2 diabetes mellitus, Treadmill exercise, Fasting blood glucose, Postprandial blood glucose, Glycemic control.*

## Introduction

Diabetes mellitus (DM) refers to a group of common metabolic disorders that share the phenotype of hyperglycemia. The two broad categories of DM are designated type 1 and type 2. Both types of diabetes are preceded by a phase of abnormal glucose homeostasis as the pathogenic processes progress. Type 1 DM is the result of complete or near-total insulin deficiency. Type 2 DM is a heterogeneous group of disorders characterized by variable degrees of insulin resistance, impaired insulin secretion, and increased glucose production.[1]

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The prevalence of diabetes is going to double globally from 171 million in 2000 to 366 million in 2030 with maximum increase in India. By 2030, around 79.4 million people will be affected by diabetes according to prediction made by Wild et al.[2]

In addition to medication and diet control, exercise is also helpful in increasing insulin sensitivity. American diabetes association recommends moderate aerobic physical activity of 150 minutes/week.[3] Walking is considered to be the best exercise as it involves larger muscles of lower limb as well as muscular work of upper limb. Treadmill machine which is electronically driven or manual simulates all the features of natural walking.

## Material & Method

In our study we used treadmill (Phillips, Novafit turbo) machine, oscilloscope for measuring heart rate and respiratory rate, Sphygmomanometer for measuring

blood pressure, weighing scale. Permission from institutional ethical committee was taken.

From diabetes OPD 40 male patients of age group 45-55 years who were clinically and biochemically confirmed cases of diabetes included in study after obtaining informed consent. Patients with known case of cardiac, respiratory, renal and musculoskeletal disorders were excluded from programme. Those who were willing to do exercise were included in study group and who were not willing to do exercise were included in control group.

Whole programme was conducted for period of 8 weeks. At the beginning of study, fasting blood sugar (FBS) and postprandial blood sugar (PPBS) was measured for all subjects. Additionally weight, height and body mass index was measured. Subjects were examined for any muscular weakness in lower limb. Regular diet may vary in different subjects so diet plan was formed for whole day by advice of dietician and they were explained to follow it strictly during the whole exercise programme so as to avoid effects of diet on blood glucose level.

Treadmill machine (Phillips, Novafit turbo) used for the study can measure speed in form of RPM, total distance travelled in kilometers and calories used during exercise. All subjects in study group were first given demonstration of treadmill machine to make them familiarize. Programme was conducted for total 40 minutes which include 5 minutes of warm up, 30 minutes of treadmill walking followed by 5 minutes of rest. All subjects were instructed to report immediately if they feel breathlessness, headache, dizziness or any other symptoms which are indicative for stopping exercise. Blood pressure, heart rate and respiratory rate were taken in supine at the beginning of exercise.

First warm up was done in the form of active limb movements and muscle stretching. Then oscilloscope was attached for monitoring of heart rate, respiratory rate and blood pressure. Subjects were instructed to walk on treadmill for 30 minutes. Speed of treadmill machine was set to 3.5 km/hour with fixed inclination. All the subjects were constantly monitored for development of any symptoms and any noticeable change in parameters. At the end of thirty minutes, parameters were measured immediately and then they are instructed to take rest for five minutes. Vital parameters were also taken during recovery period of five minutes. This completed session was conducted for five days in a week for total 8 weeks. At the end of 8 weeks FBS and PPBS was taken again for both groups. Statistical analysis was done using student's t test with p value $< 0.05$ is considered as statistically significant.

## Findings

All the subjects in study group completed exercise programme without any event. Pre and post exercise blood glucose levels are compared in both study and control group.

In study group, FBS and PPBS level before exercise was in the range of 150-196 mg% and 180-212 mg% respectively. After exercise programme range of FBS and PPBS was 130-162 mg% and 156-170 mg% respectively.

In control group, FBS and PPBS level before exercise was in the range of 154-202 mg% and 184-210 mg% respectively. After 8 weeks of observation range of FBS and PPBS was 150-188 mg% and 168-200 mg% respectively.

Difference between FBS and PPBS before and after programme in both the group was compared (Table-1). Mean decrease in FBS in study group was 38.6 mg% while in control group it was 26.8 mg% with intergroup difference is statistically significant ($p<0.05$). In study group decrease in PPBS was 42.8mg% as compared to control group having difference of 30.4 mg%. So inter group difference in PPBS is statistically significant (p value $<0.05$). Also subjects in study group reported of feeling of well being with loss of average two kilograms weight.

**Table-1 Comparison between study and control group for change in FBS and PPBS after programme**

| Difference | Study group (mean±SD) Control group (mean±SD) n=10 |
|---|---|
| FBS1-FBS2 | 38 ± 8.275<br>26 ± 8.910* |
| PPBS1-PPBS2 | 42 ± 6.784<br>30 ± 8.623* |
| FBS1- Fasting blood glucose before exercise<br>FBS2- Fasting blood glucose after exercise<br>PPBS1- Postprandial blood glucose before exercise<br>PPBS2- Postprandial blood glucose after exercise<br>*p<0.05, student t-test | |

## Discussion

Diabetes Mellitus is a clinical syndrome comprising a heterogeneous group of metabolic diseases that are characterized by chronic hyperglycemia and disturbances in carbohydrate, fat and protein metabolism secondary to defects in insulin secretion, insulin action or both.[4] Comprehensive management of diabetes includes drugs, insulin, lifestyle changes comprising of diet control, exercise and education.[5] In this study, efficacy of treadmill exercise on control of blood glucose was studied in addition to diet control and medication. Exercise improves insulin sensitivity and therefore has a positive effect on blood glucose control. In addition it also has positive effects on lipid profile and blood pressure and it is important part of weight management programme. For inactive person it is better to start with at least 5 minutes daily and then gradually increase 5 minutes to up to at least 30 minutes of daily walking.[6] Only problem with diet and exercise is that it requires strong motivation and self confidence. So for the patient's perspective oral drugs for diabetes is the best management.

At the beginning of exercise, muscle utilizes stored glycogen as fuel consumption. But it is available only for short period only. If activity is continued, glycogenolysis becomes source of glucose and then after few minutes gluconeogenesis starts in liver. After depletion of glycogen store in liver, stored fat in adipose tissue converted into fatty acids which are used as fuel by muscle.[7]

Wahren et al. reported that working muscles are more sensitive to insulin as compared to resting muscle, which increase utilization of glucose. Also during exercise blood flow to working muscle increase which increase size of capillaries and number of insulin receptors which ultimately balance sensitivity of insulin.[8]

Shivananda nayak et al. reported that after six weeks of treadmill exercise, glucose utilization is increased in muscle which has positive effects on glucose homeostasis with significant fall in fasting and postprandial blood glucose level.[9]

Exercise programme is also affected by some factors like type of exercise, duration of exercise, intensity and frequency of exercise. According to American college of sports medicine, exercise with low intensity but long duration gives better result as compared to high intensity short duration exercise. Duration of exercise should be gradually increased over days. Exercise programme should be restricted to five days per week. Intensity can be controlled by counting target heart rate with formula of subtracting your age from 220. In this study it was found that endurance exercise helps in control of blood glucose level. It works by increasing insulin sensitivity in exercising muscle. As compared to resting condition, numbers of insulin receptors are more in working muscle which ultimately helps to utilize glucose despite low production by pancreas as in diabetes mellitus.

## Conclusion

Well planned exercise programme which is strictly followed can improve glycemic control and also helps to reduce weight. In addition to mental well being it reduces cardiovascular risk factors in patients of diabetes mellitus.

**Conflict of Interest:** None

**Source of Funding:** Institution

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# HRV During One Minute Controlled Deep Breathing for Evaluation of Sympatho Vagal Imbalance in Type 1 Diabetes Mellitus Patients

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## Abstract

**Introduction**: The Autonomic nervous system is the principle way by which the heart rate can be controlled effectively. The integrity of the autonomic control of the cardiovascular system in diabetic patients can be studied by observing the heart rate variability (HRV)

**Materials and Method:** 30 type 1 diabetic patients attending the Diabetology clinic of Stanley Medical College, Chennai and 30 age matched controls were enrolled. Heart rate variability analysis during one minute controlled deep breathing was performed on all the subjects and the results obtained were compared between the groups

**Results:** HRV analysis in type 1 diabetes mellitus patients show

Significant reduction in SDNN, RMSSD, NN50 and pNN50

Significant reduction of mean RR, HF and HF nu, compared to that of controls

**Conclusion:** HRV during one minute controlled deep breathing is a simple non invasive test to detect cardiac autonomic neuropathy. Hence HRV db should be recommended as a screening test for diabetes mellitus patients.

***Keywords:*** *Type 1 diabetes mellitus, Autonomic neuropathy, heart rate variability, HRV with deep breathing*

## Introduction

The heart and vascular system are innervated by both parasympathetic and sympathetic nerves. The predominant supply of vagus is to the pace maker and conducting system and the sympathetic supply is more for cardiac muscle and vascular system. So the changes in the heart rate are predominantly modulated by the vagus and the contractility of cardiac muscle is brought about by sympathetic pathway. Although some local factors, such as temperature, hormone changes and stretch of tissues can change the heart rate, the Autonomic nervous system is the principle way by which the heart rate can be controlled effectively. The integrity of the autonomic control of the cardiovascular system in diabetic patients can be studied by observing the heart rate variability (HRV)

The first report linking HRV to respiration has been credited to Karl Ludwig, who in 1847 noted that heart rate increased with inspiration and decreased with expiration [1,2]

Clinical interest in HRV was sparked by the 1973 report of Wheeler and Watkins, who first drew attention

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to cardiac vagal innervations as the mediator of HRV and its potential value as a clinical test of cardiovagal function [3]

These investigators studied HRV with deep breathing (HRVdb) in normal subjects and diabetic patients , some with and some without evidence of autonomic neuropathy. They noted that HRV db was reduced or abolished in diabetic subjects with autonomic neuropathy and concluded that HRV db was a clinically useful test for autonomic neuropathy in diabetic patients.

Analysis of HRV can be studied in the frequency domain by using Fourier transformation and converting heart rate to a power spectrum [4] The peak power at the highest frequencies (> 0.15Hz) reflects respiratory sinus arrhythmia, while the lower frequencies reflect both sympathetic and parasympathetic influences. Marked reduction in the power spectrum was noted in patients with diabetic autonomic neuropathy[5]

**Aim of the Study:** To study the Cardiovascular Autonomic function in Type 1 Diabetics by doing Heart Rate Variability (HRV) analysis during one minute controlled deep breathing

## Materials and Method

The study was conducted in the Research Lab of the Department of Physiology, Stanley Medical College, Chennai.

**Cases:**

**Inclusion Criteria**

Type 1 Diabetes mellitus patients (based on WHO criteria) attending Diabetology out-patient department

Age: 10 to 40 years, both gender

Type 1 diabetic patients on Insulin treatment and with fairly good glycemic control

Type 1 DM patients with duration of disease > 2 years

**Exclusion Criteria**

Smokers

Alcoholics

Hypertension, Coronary artery disease, Renal disorders, Thyroid disorders

Patients with history of autonomic dysfunction

Controls

30 age and gender matched healthy subjects attending the Master health check up programme, Stanley Medical College.

Study Design : Cross-sectional study.

The **study protocol was approved by the Ethical committee of Stanley Medical College.**

The detailed procedure and purpose of the study was explained in the regional language, and then an **informed and written consent** was obtained from the subjects if they were 16 years of age or over and from their parents if they were younger than 16 years.

**Equipment and Methodology Of HRV**

ECG was acquired using RMS Polyrite D hardware 2.2 (India), and instantaneous heart rate at RR intervals were plotted using RMS 2.5.2 software on a Microsoft window based PC. The RMS Polyrite 2.5.2 helps to save multiple records and provided with additional filter settings, calculation tools, automated analysis and auto report generation. Respiratory movements were recorded using respiratory belt.

The recordings were done between 10 a.m. and 12 noon to avoid circadian variations. Height and weight were taken. Blood Pressure was recorded using sphygmomanometer. The lab environment was quiet, the temperature was maintained between 25 to 28˚C and the lighting subdued. Subjects were asked to empty their bladder before the test. The test did not involve any intravascular instrumentation or administration of any drugs at any stage.

The subjects were made to sit in the lab for 10 minutes to get accustomed to the new environment. The subjects were clearly instructed not to take coffee, tea or cool drinks 1½ hours before test.

**1. Electrodes were fixed in the following position after cleaning with spirit to record the ECG**

| Electrode | Position |
|---|---|
| Exploring Electrode | Left shoulder/forearm |
| Exploring Electrode | Right shoulder/forearm |
| Reference Electrode | Right leg |

2. Respiratory belt was tied around the chest at the level of the nipple to record respiratory movement

3. The electrodes and the respiratory belt were connected to RMS Polyrite D equipment. Task force guidelines [6] were followed

**HRV during one minute controlled deep breathing**

The subject was asked to lie down comfortably in the supine position. He was then instructed to breathe slowly and deeply at the rate of 6 breaths per minute in such a way that he takes 5 seconds for inspiration and 5 seconds for expiration. The entire procedure was monitored on the screen. Deep breathing will produce maximum Respiratory Sinus Arrhythmia.

## Results

Statistical Package for Social Sciences (SPSS) software 11.5 version was used for statistical analysis.

The Student independent unpaired 't' test was used to compare cases and controls.

$p < 0.05$* is taken as significant ;

$p < 0.01$** is taken as highly significant

**Table 1: Anthropometric measurements of subjects**

(Age, Height, Weight & BMI expressed as Mean ± SD)

| | CASES | CONTROLS | 't'value | p value |
|---|---|---|---|---|
| n | 30 | 30 | - | - |
| Males:Females | 18:12 | 18:12 | - | - |
| Age in years | 23.06 ± 6.06 | 22.86 ± 5.92 | 0.12 | 0.89 |
| Height in cm. | 155.96 ± 9.25 | 156.80 ± 9.57 | -0.34 | 0.73 |
| Weight in kg. | 53.83 ± 7.86 | 54.23 ± 7.88 | -0.19 | 0.84 |
| B.M.I. kg/m2 | 22.07 ± 2.31 | 21.98 ± 2.17 | 0.15 | 0.87 |

**Table 2: Heart rate & blood pressure measurements**

| | GROUP (n=30) | MEAN | STANDARD DEVIATION | Student independent 't' test |
|---|---|---|---|---|
| Resting Heart rate In bpm | Cases | 87.3 | 8.4 | t = 4.05 **p < 0.01**** |
| | Controls | 76.4 | 12.01 | |
| Systolic B.P. (mm.Hg.) | Cases | 120.60 | 5.61 | t=1.597 p=0.116 |
| | Controls | 118.00 | 6.92 | |
| Diastolic B.P. (mm.Hg). | Cases | 79.40 | 4.64 | t=0.858 p=0.395 |
| | Controls | 78.33 | 4.98 | |

**Table 3: Comparison of blood sugar level**

| | GROUP (n=30) | MEAN | STANDARD DEVIATION | Student independent 't' test |
|---|---|---|---|---|
| Fasting mg% | Cases | 124.06 | 18.20 | t= 12.22 **p< 0.01**** |
| | Controls | 82.33 | 4.29 | |
| Post prandial mg% | Cases | 158.34 | 31.22 | t=8.77 **p<0.01**** |
| | Controls | 107.93 | 3.94 | |

**Table 4: Frequency Domain Measures During One Minute Deep Breathing**

| Frequency Domain Measures | Cases (n=30) | | Controls (n=30) | | Student independent 't' test |
|---|---|---|---|---|---|
| | Mean | SD | Mean | SD | |
| Mean RR in sec. | 0.72 | 0.07 | 0.83 | 0.11 | t= -4.091 **p<0.01**** |
| HF in ms² | 0.82 | 1.01 | 1.91 | 1.72 | t= - 3.008 **p<0.01**** |
| HF in n.u. | 18.89 | 9.10 | 28.40 | 11.89 | t= - 3.47 **p<0.01**** |

**Table 5: Time Domain Measures During One Minute Deep Breathing**

| Time Domain Measures | Cases (n=30) | | Controls (n=30) | | Student independent 't' test |
|---|---|---|---|---|---|
| | Mean | SD | Mean | SD | |
| SDNN ms | 50.33 | 19.17 | 88.76 | 20.56 | t= - 7.48 **p<0.01**** |
| RMSSD ms | 56.62 | 32.12 | 98.76 | 24.18 | t= - 5.74 **p<0.01**** |
| NN50 | 8.73 | 7.82 | 28.16 | 11.56 | t= - 7.62 **p<0.01**** |
| pNN50% | 14.25 | 14.43 | 38.72 | 15.76 | t= - 6.27 **p< 0.01**** |

## Discussion

HRV with deep breathing is the simplest and most widely performed measure of autonomic control of the heart. This test produces a sensitive, specific and reproducible indirect measure of vagal cardiac function.

Fareedabanu et al [7] found a statistically significant decrease in mean minimal heart rate and one minute HRV during deep breathing among type 2 diabetic patients on comparison with that of healthy controls

Respiratory sinus arrhythmia (RSA) is a change of heart rate generated by a combination of respiration-induced biochemical changes, changes in intrathoracic pressure, and central vagal stimulation.[8] Respiration has a significant effect on the Heart rate oscillations and parasympathetic activity is very closely related to respiratory sinus rhythm. Frequency of RSA component falls in High Frequency range of HRV (0.15-0.4 Hz) for more than 6 breaths/min. On one minute controlled deep breathing at 6 breaths/min, with inspiration and expiration each lasting for 5 secs. the mean RR was significantly reduced in diabetic patients( p<0.01**).

In the frequency domain measures the HF in absolute power and HF in normalized units was significantly reduced in diabetics ($p<0.01$**) which might have been due to vagal neuropathy [18,25]. HRV during timed deep breathing is a major index of HR variation in the time domain because it has been shown to be one of the most reliable and reproducible markers of parasympathetic modulation of cardiac function [(11).] All the time domain variables were significantly reduced in diabetics ($p< 0.01$**). Reduced HRV during deep breathing in type 1 diabetics clearly indicates that cardiac vagal effects are diminished in this condition. This may possibly be due to vagal neuropathy.

In diabetes mellitus associated neuropathy, a reduction in time domain parameters of HRV seems not only to carry a negative prognostic value but also to precede the clinical expression of autonomic neuropathy [(12,13)]

HRV db represents a very sensitive measure of cardiovagal or parasympathetic cardiac function and thus is an important component of the cardiovascular autonomic function tests used in clinical autonomic laboratories. In most autonomic disorders, parasympathetic function is affected before sympathetic function, so HRV db provides a sensitive screening measure for parasympathetic dysfunction in many autonomic disorders.[(14)]

## Conclusion

HRV analysis in type 1 diabetes mellitus patients show

Significant reduction in SDNN,RMSSD,NN50 and pNN50

Significant reduction of mean RR, HF and HF nu, compared to that of controls

HRV during one minute controlled deep breathing is a simple non invasive test to detect cardiac autonomic neuropathy. Hence HRV db should be recommended as a screening test for diabetes mellitus patients.

**Conflict of Interest**: Nil

**Sources of Funding**: Nil

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# Impact of Single Use of Energy Drink on Blood Pressure and Heart Rate in Healthy Medical Students

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## Abstract

**Background:** Globally, the popularity of energy drinks is steadily increasing. After being first introduced around 1960, they have been increasingly used all over the world for the promotion of mental concentration and vigilance. Although few of these claims have been partly demonstrated in a few athlete-targeted surveys, many more health concerns are increasingly unfolded about the excessive consumption of energy drinks. A number of investigations focused on the hemodynamic effects of the consumption of energy drinks on healthy individuals; some of which found a statistically significant effect on heart rate (HR) and blood pressure (BP)

**Objective:** To evaluate the acute effects of the consumption of energy drinks on blood pressure and heart rate in a group of healthy medical students.

**Materials and Method:** The study was conducted on 40 healthy MBBS students studying in Bangalore Medical College and Research Institute in the age group of 19 to 22 years. Blood pressure and pulse rate were recorded pre and 1 hour post consumption of energy drink in the subjects.

**Results :** Descriptive statistical analysis was carried out on the data obtained in the present study. The systolic and diastolic blood pressure increased 1 hour post consumption of energy drink but not statistically significant. Heart rate increased significantly 1 hour post consumption of energy drink.

**Conclusion:** A statistically significant increase in heart rate was observed in the subjects one hour after consumption of energy drink (pre=78.6±9.03, post=83.4±10.08, p value=0.05*). Though there was no statistically significant change in blood pressure, systolic BP increased by 3 mm of Hg (from 112.2±9.96 to 115.3±9.86) and diastolic BP increased by 2mm of Hg (from 71±7.32 to 72.2±6.75).

***Keywords****: energy drinks, blood pressure, heart rate, medical students*

## Introduction

Energy drinks (EDs) are gaining popularity every year with a broad consumer base including athletes, amateur competitors, and even those experiencing work-related fatigue. EDs represent a relatively new class of caffeinated beverages that are generally marketed to improve energy, athletic performance, concentration, endurance, weight loss and to provide a short-term energy boost but they do not constitute suitable sources of rehydration or restoration of electrolytes in association with athletic activity. The main contents in these EDs are caffeine, water, sucrose, glucose, acidity regulators, acidulant (citric acid), glucuronolactone, taurine and vitamins.

In recent years the marketing of these energy drinks has increased drastically due to their easy availability. Adolescents and young adults are the most vulnerable group who fall prey to these energy drinks especially those in a transitional stage of physical and psychological development. Dependence on energy drinks could be

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a potential risk of substance abuse later in life [1]. The body develops a tolerance to the positive effect of these energy drinks and not to the negative effects. A number of studies have shown the high consumption rate of these energy drinks among college students and also medical students [2-4]. This shows the lack of awareness among college students and adolescence about the importance of good nutrition and the high caloric and caffeine content of energy drinks.

Numerous studies have associated EDs and their ingredients with acute hypertension [5, 6]. This is consistent with known hemodynamic changes caused by caffeine consumption [7, 8]. Caffeine is a sympathomimetic. Acute caffeine consumption can increase plasma renin, catecholamines, and dopamine. These substances stimulate the central nervous system, thereby increasing blood pressure and heart rate [9, 10]. A study on impact of acute consumption of EDs found that the systolic and diastolic blood pressures increased on an average by 4.44 mm of Hg and 2.73 mm of Hg respectively and the heart rate increased by 0.80 beats per minute [11].

Medical students are exposed to various stressors [12] that may precipitate a variety of health risk behaviours, such as smoking [13, 14] and consumption of high levels of caffeinated beverages [15]. Comparatively medical students' stress level is higher than non-medical students. Similarly stress level increases as one moves from junior to senior level at his/her college or university. There are also little researches done on energy drink consumption patterns among medical students.

Hence the present study was undertaken to assess the acute influence of energy drinks on blood pressure and pulse rate in medical students.

## Materials and Method

**Source of data:**

The study was done on 40 healthy MBBS students studying in Bangalore Medical College and Research Institute in the age group of 19 to 22 years.

Method of collection of data (including sampling procedure):

Subjects were matched in for age & sex and selected based on inclusion and exclusion criteria after taking a written informed consent.

Study period: February 2017- April 2017

Study group: Healthy MBBS students studying in Bangalore Medical College and Research Institute

Sample size: 40 healthy medical students.

**Inclusion Criteria:**

1. 40 healthy medical students

2. Subjects who have given written informed consent.

**Exclusion Criteria:**

1. Those with a BMI greater than 30 kg m−2

2. Competition athletes

3. Individuals with a daily exercise workload exceeding 60 min per day.

4. Subjects having any diseases or taking any medication affecting cardiovascular or autonomic regulation.

5. Subjects whose caffeine intake in excess of 150 mg daily from food and beverages.

6. Subjects who reported to be on psychiatric treatment.

7. Subjects suffering from any chronic disorders.

8. Subjects with history of smoking or alcohol use.

## Methodology

All experiments were conducted in a quiet, temperature-controlled (20–22 °C) laboratory and started between 08.00 and 09.00 a.m. Every subject would attend the experimental sessions at the lifestyle laboratory, centenary building, Victoria Hospital, BMCRI. On arrival at the laboratory, subjects were asked to empty their bladders if necessary and to sit in a comfortable armchair. All the subjects were asked to relax for a period of 30 minutes following which a baseline recording of BP using mercury sphygmomanometer and pulse rate were made. Then the test subjects would ingest 355 mL of a degassed energy drink containing caffeine (114 mg), taurine (1,420 mg), glucuronolactone (84.2 mg), sucrose and glucose (39.1 g) at room temperature. Subjects were asked to ingest their drink in a convenient pace over 4 min. After 1 hour of post-drink, BP and pulse

rate recording was repeated. Throughout the procedures, subjects were permitted to watch neutral documentaries on a flat TV screen set at eye level.

## Results

The study was conducted on 40 healthy first and second year MBBS students.

## Statistical Analysis

Descriptive statistical analysis has been carried out on the data obtained in the present study. Results on continuous measurements are presented on Mean ± SD .Significance is assessed at 5 % level of significance. Student t test (two tailed, independent) has been used to find the significance of study parameters on continuous scale between two groups. Significance was reckoned as: $0.01<P\leq0.05$ significant (*); $P\leq0.01$ highly significant

Microsoft word and Excel have been used to generate tables.

**Table 1: Mean±SD of different parameters pre and 1 hour post consumption of energy drink**

| Parameters | BEFORE | AFTER | P Value |
|---|---|---|---|
| SBP | 112.2±9.96 | 115.3±9.86 | 0.23 |
| DBP | 71±7.32 | 72.2±6.75 | 0.52 |
| HR | 78.6±9.03 | 83.4±10.08 | 0.05* |

**Inference**: The systolic and diastolic blood pressure increased 1 hour post consumption of energy drink but not statistically significant. Heart rate increased significantly 1 hour post energy consumption drink.

**Table 2: Mean ±SD of different parameters in females pre and 1 hour post consumption of energy drink**

| Parameters | BEFORE | AFTER | P Value |
|---|---|---|---|
| SBP | 105.4±5.6 | 110.3±8.3 | 0.05* |
| DBP | 70±8.1 | 72.5±6.45 | 0.34 |
| HR | 79.6±9.96 | 86.4±9.7 | 0.07 |

**Inference**: systolic blood pressure significantly increased in the female participants post 1 hour consumption of energy drink. Diastolic blood pressure and heart rate has increased but not statistically significant.

**Table 3: Mean ±SD of different parameters in males pre and 1 hour post consumption of energy drink**

| Parameters | BEFORE | AFTER | P Value |
|---|---|---|---|
| SBP | 119.4±8.6 | 122.3±3.87 | 0.5 |
| DBP | 72±7.5 | 71.8±7.3 | 0.9 |
| HR | 77.4±8.2 | 86.4±9.7 | 0.07 |

**Inference**: Systolic blood pressure and heart rate increased in the male participants 1 hour post consumption of energy drink but not statistically significant. Diastolic blood pressure has decreased minimally but not statistically significant.

## Discussion

There are currently more than 500 energy drink products available on the market purported to boost physical and mental alertness.[16] In line with their increased popularity is a coinciding rise in energy drink–associated emergency department visits and deaths, which has led to questions about their true safety profile. [17, 18, 19]

In this present interventional study we administered an energy drink containing caffeine (114 mg), taurine (1,420 mg), glucuronolactone (84.2 mg), sucrose and glucose (39.1 g) in 40 healthy first and second year medical students. We evaluated blood pressure and heart rate pre and 1 hour post consumption of energy drink in them. The results were tabulated and statistically analyzed.

Table 1 shows that the systolic and diastolic blood pressure increased 1 hour post consumption of energy drink but not statistically significant. Heart rate increased significantly 1 hour post energy drink consumption. These results are similar to the results quoted in the studies conducted by Emily A. Fletcher et al and G. Geethavani et al. [20]

Caffeine increases systolic blood pressure to extent of 17%and mean arterial blood pressure by about 11%. Heart rate was also increased. The increase in systolic blood pressure was attributed more to the increased stiffness of the aorta and larger blood vessels rather than increased stroke volume. The increase of aortic stiffness is attributed to the increased production of angiotensin II and catecholamines potentially nor adrenaline. These changes are attributable to the inhibition of adenosine A2α receptors activity in the smooth muscles of blood vessels. The concomitant increase in the release of renin from the kidneys because of the direct stimulation by caffeine and similar activity on sympathetic ganglions releasing noradrenaline contributes to the increased activity of vascular smooth muscles

Adenosine is a potent vasodilator but caffeine, an adenosine analogue competitively inhibits the adenosine receptors and brings out vasoconstriction. The psychoactive effects of caffeine are due to the blockade of adenosine receptors of brain. It can increase the systolic blood pressure by enhancing angiotensin II and epinephrine. It can also increase the heart rate by increasing the levels of catecholamines. [21]

Jonson w. daniels et al [22] showed that angiotensin II levels were increased with caffeine. As we know that angiotensin II is a powerful vasoconstrictor, it causes increase in blood pressure. In the present study we noticed increase in values of blood pressure after caffeine intake which clearly substantiates the above statement.

Angiotensin II (ANG) potently enhances catecholamine release from the peripheral sympathetic system. [23] Catecholamines released by this mechanism contribute to the vasoconstricting and sodium-retaining properties of ANG6. In particular, the chronic effects of ANG at moderately elevated levels are promoted by adrenergic pathways that are significantly involved in the development of hypertension. [24, 25]

Caffeine with its multiple effects is (1) an adenosine receptor blocker. (2) Increases levels of angiotensin II (3) increases the levels of catecholamines.

Table 2 systolic blood pressure significantly increased in the female participants post 1 hour consumption of energy drink. Diastolic blood pressure and heart rate has increased but not statistically significant.

This could be due to the varying levels of sex steroids during different phases of the menstrual cycle. [26]

Energy drinks generally contain more than the recommended amount of potentially harmful chemicals. The Food and Drug Administration (FDA) regulates the amount of caffeine in sodas and other caffeinated drinks but not in energy drinks.

Students should be counseled regarding the consumption of energy drinks like Red Bull and Monster energy drinks which contain a high amount of caffeine and have poor nutritive value. This increased caffeine consumption serves as a gateway for drug abuse later in life.

One has to outweigh the benefits and hazards of consuming an energy drink before consuming it in high amounts which raises concerns about its safety. Energy drinks also contain taurine and glucuronolactone which do not directly affect reaction time but may alter it in combination. Therefore consuming these ingredients in excess also raises concern regarding their toxicity. An ideal energy drink should have the lowest amount of caffeine and sugar while still accomplishing the needed results without addiction. Further research needs to be done to evaluate the effects of the individual components of energy drinks like taurine and glucuronolactone. Well-designed randomized placebo controlled studies are needed to assess the benefits of an energy drink.

Implementation of educational awareness campaigns, especially in medical colleges, about healthy dietary habits, potential benefits, side effects and correction of wrong perceptions about energy drinks is urgently needed. Policies for energy drinks consumption and control programs are also recommended.

## Conclusion

An interventional study was taken up to see the acute effect of energy drink commonly available in the market on blood pressure and heart rate in medical students. The data was tabulated, analyzed statistically and discussed.

The following conclusions were obtained from the study:

In all the 40 participants

Systolic and diastolic blood pressure increased 1 hour post consumption of energy drink but not statistically

significant and Heart rate increased significantly 1 hour post energy consumption drink in all the 40 subjects.

Systolic blood pressure significantly increased in the female participants post 1 hour consumption of energy drink. Heart rate increased but not statistically significant

Systolic blood pressure and heart rate increased in the male participants 1 hour post consumption of energy drink but not statistically significant.

**Conflict of Interest –** Nil

**Source of Funding-** Self

**Ethical Clearance –** was obtained from the institutional ethical committee.

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# Effect of Short Term Pranayama on Perceived Stress, Sleep Quality, Heart Rate, and Blood Pressure

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## Abstract

**Background:** Pranayama (breathing exercises), involves manipulation of breath, consists of three phases: "Puraka" (inhalation), "kumbhaka" (retention) and "rechaka " (exhalation) that can be either fast or slow. Among all yogic practices pranayama is simplest to learn and to practice regularly in daily life. So a study was conducted to explore whether pranayama practiced alone over a short duration, has any tangible effect on stress, sleep, and cardiovascular parameters

**Objectives:** To evaluate the effect of short term practice of pranayama on Perceived Stress, Sleep Quality, Heart rate & Blood Pressure.

**Materials and method:** 40 healthy subjects in the age group of 19-61 years were recruited in pranayama centers, prior to enrollment in pranayama course. Their HR, BP were recorded and they answered Perceived Stress Scale & Pittsburg Sleep Quality Questionnaire on the 1st day of enrollment. Then they practiced pranayama under supervision for 20 days, at the end of which HR, BP were recorded and they answered the same questionnaires. Data was statistically analyzed using students 't' test, with P value <0.05 taken to be statistically significant.

**Results:** Practicing pranayama for 20 days significantly ($p<0.05$) decreased stress, systolic & diastolic blood pressure, improved sleep quality. Heart rate changes were insignificant ($p=0.9$).

**Conclusion:** Pranayama alone when practiced even over a short term, significantly reduces perceived stress, improves sleep quality, and decreases blood pressure.

***Keywords:*** *Pranayama, Heart Rate, Blood Pressure, Perceived Stress Scale, Pittsburgh Sleep Quality Index*

## Introduction

Stress can be considered as a state of mental or emotional strain or tension resulting from adverse or demanding circumstances.[1] Exposure to stressful stimuli is perceived as a threat to an organism's homeostasis and elicits a variety of physiological adaptation, encompassing endocrine, autonomic and behavioral aspects[2]. Studies have shown that perceived stress negatively affects cardiovascular function by raising blood pressure (BP) and diminishing cardiovascular reactivity in the subjects. Stress also adversely affects sleep quality

Increasing body of evidence points to the benefit of Yoga in reducing stress, and indirectly reversing several of its ill effects. Yoga is also being advocated as an adjunct to pharmacotherapy of disorders like hypertension and dyssomnias[1]

Yoga encompasses a wide range of practices, including physical exercises, breathing exercises, meditation, and relaxation exercises. Yoga provides various physical and mental health benefits including reduction of stress, anxiety, depression, somatic and mental hyper-arousal, improves sleep quality[3]

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Pranayama also called as breathing exercises, involves manipulation of breath that is a dynamic bridge between body and mind. "Pranayama" is a Sanskrit word constructed of two separate words, "Prana" and "Ayama". Prana can be translated as breath, respiration, life, vitality and energy. Ayama can be translated as restraint, control and regulation. Put together Pranayama means regulation of breath and/or energy. Pranayama consists of three phases: "Puraka" (inhalation), "kumbhaka" (retention) and "rechaka " (exhalation) that can be either fast or slow.[1]

Among all yogic practices pranayama is simplest to learn and to practice regularly in daily life. So present study was conducted to explore whether pranayama practiced alone (independently of other yogic practices) has tangible health benefits, particularly over stress, sleep, and cardiovascular parameters. If so, whether these effects are observable after short duration of practice.

## Objectives

To evaluate the effect of short term practice of pranayama on Perceived Stress, Sleep Quality, Heart rate, and Blood Pressure**.**

## Methodology

Clearance for the study was obtained from ethics committee of Bangalore Medical College & Research Institute.

This was an interventional study for which subjects were recruited from a particular organization in Bengaluru, which imparts training in yogic practices through multiple yoga centers across the city. One particular course offered by these centers was chosen which typically lasts for twenty days and comprises of training and practice of Pranayama only.

Subjects were chosen according to pre-set criteria, as listed below:

**Inclusion Criteria:**

1. Apparently healthy individuals
2. Subjects who had not practiced pranayama or other forms of Yoga yet in their lifetime.

**Exclusion Criteria:**

1. Subjects with sleep disorders.
2. Subjects with anxiety disorders.
3. Smokers, alcoholics or subjects with any substance abuse.
4. Subjects with endocrinal disorders.
5. Subjects with history of hypertension & cardiovascular disorders.
6. Subjects with respiratory disorders.
7. Subjects on continuous medication for any condition.

Written consent was obtained from willing participants. General and medical history was taken.

Physical examination was done. 40 subjects were finally enrolled in the study. The sample included both male and female subjects, ranging in age, from 19 to 61 years. First assessment of the subjects was done, at the time of joining the Pranayama course, before the actual training and practice started.

Subjects were asked to relax for 10 minutes following which HR & BP were recorded. Three readings each of HR & BP were recorded 10 minutes apart and average of two closest values was considered. BP was recorded using sphygmomanometer and stethoscope. Each subject was asked to answer "Perceived stress scale" and "Pittsburgh Sleep Quality Index" questionnaires.

**Perceived stress scale**

PSS is the most widely used psychological questionnaire for measuring the perception of stress. Questions asked are of general nature, relatively free of content specific to any sub-population 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 1 month. Total score ranges from 0 to 40. Score of 0-13 is considered low stress, 14-26 is moderate stress & 27-40 is severe stress.[4]

**The Pittsburgh Sleep Quality Index (PSQI)**

The Pittsburgh Sleep Quality Index (PSQI) is a self-rated questionnaire designed specifically to measure sleep quality and sleep disturbances in clinical

populations. The PSQI asks subjects to rate sleep quality and disturbances over the month preceding test administration. The PSQI questionnaire consists of 19 items eliciting information on usual sleep habits, nature of sleep disturbances, suspected causes for sleep disturbances, use of sleep medication, overall sleep quality, daytime sleepiness, and vitality. Global score of >5 is considered poor sleep & <5 is good sleep[5].

Subjects then began a course in which they practiced pranayama under supervision, 2 hours per day from 6PM to 8 PM, for the next 20 days. Pranayama was taught to the subjects by trained instructors and further practice was also done under their supervision. The sessions involved practice of various types of Pranayama like anuloma viloma, mudra pranayama, meru dhanda, dhavthi, kapala bhathi & each session was structured to incorporate these techniques for fixed durations of time over 7 cycles. So all the subjects practiced similar techniques for similar duration of time, ensuring uniformity.

At the end of this period, the subjects underwent repeat assessment. Their heart rate, BP were recorded using the same procedure as earlier, and they answered earlier mentioned questionnaires.

The Pre and post Pranayama data was converted to mean and standard deviation, which were statistically analyzed using students 't' test. P value <0.05 was considered statistically significant.

## Results

40 subjects with 15 females and 25 males were included in the study. Mean age of subjects was 37 ± 10 yrs

**Table 1: Comparison of Perceived stress, Sleep quality, heart rate, and BP in 40 subjects before & after the course of pranayama**

| Parameter | Before course of pranayama | After course of pranayama | P value |
|---|---|---|---|
| PSS score | 17.02 ± 5.73 | 7.2 ± 6.65 | 0.01 |
| PSQI score | 5.5 ± 3.27 | 3.9 ± 2.75 | 0.01 |
| Heart rate (bpm) | 78.87 ± 9.12 | 79 ± 8.05 | 0.93 |
| SBP (mmHg) | 128.15 ± 17.76 | 117.15 ± 10.36 | <0.001 |
| DBP (mmHg) | 80.05 ± 9.96 | 76.1 ± 5.54 | 0.01 |

SBP: Systolic Blood Pressure

DBP: Diastolic Blood Pressure

PSS: Perceived Stress Scale

PSQI: Pittsburgh Sleep Quality Index

Practicing pranayama for 20 days significantly ($p<0.05$) decreased stress, systolic & diastolic blood pressure, improved sleep quality. Heart rate changes were insignificant ($p=0.9$).

We also observed that before beginning the course, 11(27.5% ) participants perceived low stress, 27(67.5%) perceived moderate stress & 2(5%) perceived high stress. But after practicing pranayama for 20 days 32(80%) participants perceived low stress, 7(17.5%) perceived moderate stress & 1(2.5%) perceived high stress as seen by PSS scores.

16(40%) participants reported poor sleep & 24(60%) reported good sleep before practicing pranayama. After the course of pranayama 6(15%) participants reported poor sleep & 34(85%) reported good sleep as seen by PSQI scores.

## Discussion

Our study reveals that practicing pranayama even for a relatively short duration of 20 days significantly decreased stress, SBP, DBP & improved sleep quality. It did not have significant effect on heart rate.

The mechanisms by which Pranayama brings about these effects is not yet clear, as the pathophysiological basis of stress and its ill effects, is itself not yet fully understood. From available literature, the following may be construed.

Psychosocial stresses of our modern life precipitates various cardiovascular and other disorders by distorting basic neuro-endocrine mechanism. The psychosocial stresses activate limbic system & hypothalamus which controls the autonomic nervous system. When this system is stimulated, increase in output of both adrenaline & nor-adrenaline occur, both from sympathetic fibres as well as from adrenal medulla causing increase in heart rate, systolic and diastolic blood pressures. Chronic exposure to psychosocial stimuli will result in the development of increase in blood pressure, coronary thrombosis and heart failure. In addition to the activation of sympatho-adreno-medullary system, exposure to psychosocial stresses also activates the hypothalamus centre governing pituitary adrenal axis. An increased secretion of corticotrophin releasing hormone from hypothalamus which stimulates the release of adrenocorticotrophic hormone from anterior pituitary which in turn stimulates adrenal cortex. Hence psychosocial stressful situation activates hypothalamo-pituitary-adrenal gland axis, glucocorticoid and aldosterone levels increase in the plasma causing salt and fluid retention which increases blood volume and blood pressure imposing severe strain on the heart. The harmful effects of these stresses on bodily systems can be reduced effectively by enhancing the adaptive mechanisms of our body[6]

Bodhe et al, in their study, have explained that a significant decrease in systolic blood pressure (SBP) observed in their study to be due to following reasons: decrease in Sympathetic tone, increase in parasympathetic tone, decrease in stress (reduced baseline glucocorticoid level), increase in plasma melatonin level, and relaxation of mind.[7]

Satyanand et al, in their study proved that practice of anuloma-viloma and Bhramari pranayama gives good result to maintain normal blood pressure and also to reduce the stress level that we get in our day to day life[8]

Some studies have proved that regular practice of Pranayama for 5 minutes which causes mental relaxation and reduction of stress levels in daily life also induces parasympathetic dominance on cardiovascular system.

Resting HR is mainly determined by parasympathetic nervous system (PNS) and DBP is a function of peripheral vascular resistance (PVR) which is mainly determined by sympathetic nervous system (SNS). Decrease in DBP represents increase in parasympathetic and decrease in sympathetic activity following pranayama.

Sharma et al in their study have explained that, Pranayamic breathing interacts with the nervous system affecting metabolism and autonomic functions. During above-tidal inspiration, stretch of lung tissue produces inhibitory signals by action of slowly adapting stretch receptors and stretch of connective tissue (fibroblasts) localized around the lungs generates hyperpolarization currents, which are propagated through neural and non-neural tissues and both of them cause synchronization of neural elements in heart, lungs, limbic system and cortex. Inhibitory current synchronizes rhythmic cellular activity between cardiopulmonary center and central nervous system and also regulates excitability of nervous tissues indicative of state of relaxation.

Hyperpolarization of tissues manifests itself in parasympathetic like change. Synchronization within the hypothalamus and the brain stem is mainly responsible for the parasympathetic response. Modulation of the nervous system and decreased metabolic activity is indicative of the parasympathetic state.[1]

Pranayama can be either slow or fast. More beneficial effects are seen with slow pranayamic breathing which can be due to the reason that slow breathing has been found to increase baroreflex sensitivity , reduce sympathetic activity and chemo-reflex activation in healthy subjects.

Furthermore, strongest cardio-ventilatory coupling is seen when there is decreased breathing frequency like slow pranayamic breathing. Increase in parasympathetic activity decreases resting HR and decrease in sympathetic tone in skeletal muscle blood vessels decreases peripheral vascular resistance resulting in decrease in DBP, MAP, reduced work load on heart and improved tissue perfusion.[1]

Our study demonstrates that practicing pranayama decreased stress levels as perceived by the subjects, improved sleep quality, reduced both systolic and diastolic blood pressures. These changes were observable after practice of Pranayama alone, independent of other yogic practices, and after a relatively short duration of

twenty days. Implications of this finding are large.

Pranayama is easy to learn and practice. It does not require any material infrastructure. It is not physically demanding, so it can be practiced by persons of all age groups and even by those who may have physical limitations to engage in other types of exercise. These factors make pranayama easy to incorporate into daily routine. It can be used a tool to improve general wellbeing and may be very well used as an adjunct to treatment of a host of medical conditions.

## Conclusion

Pranayama alone when practiced even over a short term, significantly reduces perceived stress, improves sleep quality and decreases blood pressure.

**Limitations:** Though the good results were obtained with 40 subjects the study should be reproduced with larger sample size. Stress levels and Sleep quality were assessed only by self- reporting by subjects. Tools like polysomnography and serum markers of stress, may be used for a more objective measurement.

**Conflict of Interest:** Nil

**Source of Funding:** Self

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# Cardiovascular Risks Assessment of Tobacco Smokers (Cigarette & Bidi) using hs CRP & Lipid Profile in Muzaffarnagar City

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## Abstract

Cigarette and Bidi smoking are quite common in Uttar Pradesh.The present study was conducted in Muzaffarnagar city of Western Uttar Pradesh to assess the cardiovascular status of young male chronic smokers by estimating their hsCRP and lipid levels.A total of 100 subjects divided into two groups of control and smokers having a chronic history of smoking were taken for the study.Proper exclusion criteria were applied to the case selection.After applying the standard stastical tests we found that dyslipdemia and hsCRP level significantly increased ($p<.05$)* in smokers($2.72+2.02$)* as compared to normal population($1.13+1.07$). So we can confer these smokers with higher hs CRP levels and dyslipidemias are at higher risk of CADs in future.

***Keyword:*** *Smokers Cigarette Bidi hsCRP Lipid Profile Cardiovascular Status CAD*

## Introduction

Muzaffarnagar is a district located in Western UttarPradesh with a popupation of around 40 lakh (2011 census). Here tobacco smoking (cigarette & bidi) are quite common as rest of Uttar Pradesh. According to NFHS (National Family Health Survey ) conducted in UP in late 90 s revealed that 34% of adult males and 3.1% of adult females are current smokers.Rules and Regulation for tobacco use are almost absent in the state. As we all know WHO report 2002[1] tobacco is the most preventable cause of cardiovascular mortality world wide.Tobacco smoking has resulted in two fold increase in risk of Coronary Artery Disease (CAD).

In present study we tried to assess the levels of hsCRP ( High Sensitivity C Reactive Protein ) and lipid profiles in chronic tobacco smokers.Both hsCRP level [2]and dyslipdemia [3] are established risk factors for CAD. American Heart Association AHA has described level of hsCRP >3 mg /l as higher risk of CAD.

WHO predicts that 70% of death from smoking related illness will occur in developing cuntaries by 2020.

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## Aims & Objective of the study

To assess the levels of hsCRP and dylipidemias in tobacco smokers as a marker of CAD in Muzaffarnagar city.

## Material & Method

The present study was conducted in the Department of Physiology Muzaffarnagar Medical College over a perod of 1 year from June 2017 to June 2018 .More than 50 chronic male smokers with a history of smoking cigarette or bidi for more than 5 years in the age group 18-45 years ,which are otherwise healthy, were taken as cases.

50 subjects in the same age group who don't have any history of tobacco consumption in any form were

taken as controls.

The subjects having history of any cardiovascular event (Angina,Myocardial Infarction, Coronary syndrome, Stroke), known hypertensive, diabetics, renal disease, drug abuse, COPD were not taken in the study.

Proper informed consent was taken in written form signed by the subjects before conducting the study.

**Ehical Clearance** from society of human experimentation was taken before starting the study.

The subjects were divided into to 2 groups of 50 each

Group 1 - Controls (normal subjects)

Group 2 - Cases ( Tobacco Smokers – cigarette or bidi)

These groups were evaluated for following tests

1 . Serum hs CRP levels

2 . Serum Lipid Profiles

Serum hs CRP level was estimated using ELISA kit method.

Lipid Profile Estimation –Triglycerides (TG) was estimated using GPO PAP method,total cholesterol was estimated by Wybenga &Pollegi method,HDL by spectrophotometry ,VLDL & LDL by formulas.

## Stastical Analysis

It was done by sotware SPSS 17 & Microsoft excel. Result was expressed as mean+SD . Unpaired t –test was used for comparison between the groups. p value < .05 was taken as significant.

## Findings

**Table 1 Serum hsCRP levels of two groups**

| Parameter | Control | Smoker |
|---|---|---|
| hsCRP(mg/L) | 1.13±1.07 | 2.72±2.02* |

**hsCRP in tobacco smokers was statistically significant p<.05 as marked by ***

**Table 2 LIPID PROFILES OF TWO GROUPS(*All values in mg /dl)***

| Parameters | Control | Smoker |
|---|---|---|
| Total Cholesterol | 184.97±40.43 | 245.57±91.32* |
| Serum Triglycerides | 115.91±28.2 | 122.41±45.17 |
| HDL | 56.52±6.0 | 54.31±4.13* |
| LDL | 123.39±28.17 | 183.40±78.45* |
| VLDL | 23.73±5.88 | 24.4±5.76 |
| T Choles./HDL | 3.3±.80 | 4.5±1.55* |
| LDL/HDL | 1.80±.55 | 3.39±1.4* |
| NonHDL/HDL | 2.3±.8 | 3.3±1.1* |

**All the values marked by * are statistically significant values with p <.05 .**

## Discussions

hs CRP levels has been found to be significantly increased in smokers as compared to control with p coming out be less than .05.The mean values of hsCRP is coming out be 2.72+2.02 mg/l which is accordance with AHA recommendation where values 1-3 recommend moderate risk and values >3 indicate high risks of CAD.These values in smokers are just approaching very high risk category.Tonstad et al[4] , Yanbaeva et al [5], Wannamethee[6], LoweGDO et al[7] and Cushman et al [8] all have shown rise of hsCRP in smokers as compared to past or never smokers.Nicotine present in tobacco smoke is responsible for creation of chronic inflammatory state Celermajer et al[9] and Burke et al[10]. Tobacco smoke leads to activation of IL -6 and IL-β which are increased in response to lung inflammation and implicated in induction of hs CRP.These findings support the idea that induction or exacerbation of inflammation could be a mechanisn by which smiking promotes Atherosclerosis.

Total cholesterol , LDL , Atherogenic indexes-T.Chol/HDL , LDL/HDL & Non HDL/HDL are found to be increased in our study in smokers as compared to normal population.HDL is found to be significantly decresed in smokers in our study as compared to normal

population.These findings are in consistence with similar results in past studies conducted by Gupta et al[3],Yusuf et al [11], Khurana et al[12] & Venkatesan et al[13]. The basis of dyslipidemias in smokers is sympathomimetic effect of nicotine . Release of adrenaline leads to lipolysis by increasing activity of lipolytic lipase enzyme in adipose tissue.This leads to increase in serum concentration of free fatty acids , triglycerides , LDL and VLDL.

## Conclusion

The people who smoke tobacco (cigarette or bidi) with elevated hsCRP levels and dyslipidemias are at higher risks of CAD in future.

**Conflict of Interest** None

**Source of Fundings** Self

**Ethical Clearance** From medical society on human experimentation taken.

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# Study of Variations in Handgrip Strength in Asthmatic and Non Asthmatic People

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## Abstract

**Background:** Asthma is a major public health problem worldwide. It causes a deterioration of physical condition and cardiorespiratory capacity. However, little is known about muscular strength differences between patients with asthma and healthy subjects. So this study is focused on determining whether asthma has any effect on muscular strength or not.

**Aims and Objective:** In this study, we aimed to find the variations in handgrip strength in mild asthmatic and healthy subjects.

**Material & Method:** This cross sectional study was done to analyze the handgrip strengths in 40 people diagnosed with mild asthma of age 15-40 years, and compare the findings with that of age and sex matched 40 healthy subjects (for control) by using a hand-grip dynamometer (B.D.Instrumations).

**Results:** This study showed a significant (with $p<0.05$) increase in the body mass index of mild asthmatic subjects. The Maximum handgrip strength was lower in mild asthmatic subject approximately by 6.62%, although it was not significant.

**Conclusion:** There was a significant increase in BMI when comparing subjects with mild asthma and healthy individuals. The maximum handgrip strength (MHGS) was lower in mild asthmatic subjects, although it was not significant. The height of healthy subjects was positively correlated with the handgrip strength whereas the age was negatively correlated with MHGS.

***Keywords:*** *Asthma, handgrip strength, hand-held dynamometer.*

## Introduction

Asthma is a heterogeneous disease, usually characterized by chronic airway inflammation. It may be defined by the history of respiratory symptoms such as shortness of breath, chest tightness and cough that varies over the time and in intensity together with expiratory airflow limitation.[1] It has been reported that the airway distensibility in subjects with asthma is lower than normal.[2]

Even in asymptomatic patient airways can be edematous and infiltrated with eosinophils, neutrophils and lymphocytes, with or without increase in the collagen content of the epithelial basement membrane. They can contribute mediators and cytokines to initiate and amplify both acute inflammation and long-term pathological changes.[3]

Patient with asthma undergoes some activity limitation leading to reduced functional capacity. Muscle weakness can be due to reduced motor neuron activity,

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decreased percentage of type 1 fibers and increased percentage of type IIB fibers and reduced activity of enzymes involved in oxidative energy conversion.[4,5]

Drugs like corticosteroid frequently used in asthma have risk for steroid induced myopathy.[6,7]

It has been reported that muscular strength is significantly reduced in moderate to severe asthmatic subjects when compared to healthy subjects.[8,9]

But little is known about muscle strength difference between mild asthmatic subjects and healthy subjects. In this context, the handgrip strength test is a quick and easy-to-perform muscular fitness test that provides useful information about overall muscular strength, and it could potentially be used in the clinical setting. So this study was undertaken to find out the effect of mild asthma on maximum hand grip strength (MHGS).

## Aims & Objective

To determine the effect of mild asthma on maximum hand grip strength.

## Material & Method

This was a cross sectional study done on 40 male subjects diagnosed with mild asthma of age 15-40 years and 40 healthy age, height, weight and sex matched volunteers (for control). It was carried out in the pulmonary function test laboratory, the Department of Physiology, IGIMS Medical College, Patna.

The study as approved by the ethical committee of the Institute. The study subjects who provided informed written consent were interviewed and a detailed clinical history was taken. Their age, height, weight and sex were recorded.

### Inclusion criteria

Subjects were 15 - 40 years of age, diagnosed with mild asthma.

### Exclusion criteria

Subjects with any other cardiac or pulmonary disease.

Subjects with any musculoskeletal and neuromuscular disease.

Either current or ex-smokers.

Subjects with inflammatory diseases.

History of hand or wrist surgery in last 3 months

## Materials used for the study

The diagnosis of asthma and its assessment of severity were done according to the criteria of the Global Initiative for Asthma (GINA).[1] The following anthropometric Parameters were measured: height (cm), body mass (kg), and body mass index (BMI), which was calculated by_dividing body mass (in kilograms) by the square of the_height (in meters). A hand-grip dynamometer (B.D.Instrumations) was used to measure handgrip strength. For this, warm up was done. The warm up exercises included shaking both hands three times and bending and stretching all fingers three times. When adjusting the grip size, the hand was in line with the wrist and forearm. The grip size of the dynamometer was adjusted until the second joint of the index finger was at a 90 degree angle on the handle. The dynamometer was grasped between the fingers and the palm at the base of the thumb, held in line with the forearm at the thigh level so that it didn't touch the body or any other object during the test. The subject stood with the feet hip width apart with their toes pointing forward. After that, Subject took a breath in before starting the squeeze, then blew out the air during the squeeze.[10]

For the test, dominating hand was tested three times, with a 60- second rest between trials. Grip strength measurements are more accurate when using the mean of three grip trials as compared to either a single grip trial or the highest reading of three trials.[11]

## Statistical analysis

All data were expressed as mean ± standard deviation (SD). Statistical significance was accepted at $P<0.05$. Comparison between asthmatic and non asthmatic subjects for all parameters was performed by independent t-test. Spearman correlation coefficients were used to examine the relationships of maximum hand grip strength with age, height, weight and BMI within both groups.

## Results

**Table-1: Subject characteristics and studied variables**

| | Asthmatic n = 40 | Control n = 40 | Significance P |
|---|---|---|---|
| Age (years) | 25.75±6.41 | 31.03±8.3 | >0.05, NS |
| Height (m) | 1.64±0.07 | 1.63±0.07 | >0.05, NS |
| Weight (kg) | 63.08±11.9 | 56.88±8.69 | >0.05, NS |
| BMI (kg/m²) | 23.38±3.79 | 21.57±3.49 | <0.05, S |
| MHGS (kg) | 17.78±3.66 | 19.04±4.59 | >0.05, NS |

BMI, body mass index, MHGS, Maximum hand grip strength

All values are expressed as Mean ± SD
Analysis of all parameters done by Independent T- test
S- significant, NS-Not significant

No significant difference ($p<0.05$) was observed in the distribution of age, weight and height among the asthmatic and healthy subjects. The body mass index was significantly increased in asthmatic subjects. The Maximum handgrip strength was lower in asthmatic subject approximately by 6.62%, although it was not significant.

**Table-2: Pearson correlation between anthropometric variables and maximum hand grip strength in healthy male subjects (n=40)**

| Parameters | R(correlation coefficient) | Significance P |
|---|---|---|
| **Age (years)** | -0.508 | <0.01 (HS) |
| **Height (m)** | 0.501 | <0.01 (HS) |
| **Weight (kg)** | 0.248 | >0.05 (NS) |
| **BMI (kg/m²)** | -0.08 | >0.05 (NS) |

**Table-3: Pearson correlation between anthropometric variables and maximum hand grip strength in asthmatic male subjects (n=40)**

| Parameters | R(correlation coefficient) | Significance P |
|---|---|---|
| **Age (years)** | -0.305 | >0.05 (NS) |
| **Height (m)** | 0.195 | >0.05 (NS) |
| **Weight (kg)** | -0.107 | >0.05 (NS) |
| **BMI (kg/m²)** | -0.226 | >0.05 (NS) |

HS-Highly significant, S- significant, NS-Not significant

Maximum handgrip strength has significant positive correlations with height, whereas age has a significant negative correlation with maximum handgrip strength in healthy subjects.

## Discussion

In this study we have taken 40 case of diagnosed mild bronchial asthma patients and 40 healthy subjects, whose MHGS test was done and relevant observation was made. All subjects were male of age 15 to 40 years. It was seen that the parameters weight and body mass index are all increased in asthmatic subjects as compared to healthy subjects, whereas MHGS was decreased in asthmatic subjects. Weight (kg), BMI (kg/m²) and MHGS (kg) in the asthmatic subjects and healthy subjects were 63.08±11.9, 23.38±3.79, 17.78±3.66 and 56.88±8.69, 21.57±3.49, 19.04±4.59 respectively. The BMI was significantly increased in asthmatic subjects.

Peoples with asthma tend to have a sedentary lifestyle and they have a lower aerobic capacity than healthy persons.[12] The fear of breathlessness and of exercise-induced asthma inhibits the participation of many patients[13] in physical activity and sport, which causes a deterioration of their physical condition and cardiorespiratory capacity in relation with healthy people. Moreover, a sedentary lifestyle causes a higher prevalence of obesity among persons with asthma.

In our study, the height of healthy subjects is positively correlated (R=0.501) with the hand grip strength. It could be due to various factors such as with greater heights that would lead to longer arms, with greater lever arm force generation, resulting in an efficient amount of force.[14]

Moreover, the age is negatively correlated (R= -0.508) with MHGS in this group. It can be explained by the decline in musculoskeletal strength and mass associated with aging.[15] MHGS is not significantly correlated with weight and BMI. Koley S *et al.* also reported that weight and BMI is not associated with MHGS in Indian collegiate population.[16]

## Conclusion

In conclusion, there was significant increase in BMI when comparing subjects with mid asthma and healthy individuals. The Maximum handgrip strength was lower in mild asthmatic subjects, although it was not significant. The height of healthy subjects was positively correlated with the Maximum hand grip strength whereas the age was negatively correlated with MHGS.

**Ethical Clearance**- Taken

**Source of Funding**- Self

**Conflict of Interest** - Nil

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# Impact of Parental History of Hypertension on Heart Rate by Treadmill

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## Abstract

The heart rate response to exercise is another determinant of the healthy cardiovascular system. Increased heart rate has been shown to be predictive of mortality and morbidity. A total of 100 subjects with parental history of hypertension were divided into two groups during pre exercise and post exercise period by tread mill. There was a significant decrease in heart rate after training. Heart rate variation has been shown to be predictive of mortality and morbidity in subjects with parental history of hypertension.

***Keywords:*** *Heart rate Parental history Tread mill pre exercise post exercise*

## Introduction

Hypertension is commonly asymptomatic, readily detectable usually easily treatable and often leads to lethal complications if left untreated. Given the health costs and potential importance of early detection of hypertension, several studies have examined the heart rate response to exercise as a risk factor for the development of hypertension.[1,2]

Family history of hypertension is a contributory risk factor for cardiovascular abnormalities. Exercise tests bring about changes in the haemodynamics of the cardiovascular system.[3]

## Materials and Method

The study was carried out at Government Medical College Kurnool in the department of Physiology and cardiology of Government General Hospital Kurnool for the selection of subjects.

We have selected 100 male subjects in the age group of 18-30 years with normal BMI and divided each 50 subjects as control group with parental history of hypertension during pre exercise and case group with post exercise by excluding any acute illness, Diabetes Mellitus, Anti-hypertensive medication, History of chest pain, breathlessness, orthopnoea, Physical disability like arthritis of the knee, any recent illness during the past two weeks.

A brief history, general and systemic examination was performed. Subjects were interviewed on the previous day with a detailed description of the protocol of the study and written consent was taken from them.

Study was done in a quiet room during which subjects lay supine, awake and breathing normally. After instrumentation, subjects were given a 30 min mandatory rest period. At the end of 30 minutes rest period, the ECG (II lead) recordings were started along with Blood pressure recording every 5 minutes for the next 10 minutes. Least Basal Heart Rate and Blood pressure was determined.

The target Heart Rate was then calculated

Maximum Heart Rate = 220-Age

Heart Rate Reserve = Maximum Heart Rate – Basal Heart Rate

Target Heart Rate = 60% Heart Rate Reserve + Basal Heart rate

The subject was instructed to walk on treadmill for 3 minutes at a speed of 1.75 kmph and speed increased to 2.4.kmph for 3 minutes , speed increased to 5.4 kmph. The subject was told to walk till he reached the target heart rate and the stop watch was started. The ECG and the heart rate were recorded during this period. At the end of 6minutes of exercise he is instructed to stop.

Recovery period began from the cessation of exercise and lasted for 10 minutes. The heart rate was recorded during 1st min, 3rd min, 6thmin during the recovery period. The recording was stopped at the end of 10 minutes.

## Results

**Table 1. Comparision of heart rate changes in pre and post training of exercise in group with p/h of HTN**

| HEART RATE | WITH P/H OF HTN (n=50) | WITH P/H OF HTN AFTER TRAINING (n=50) |
|---|---|---|
| At 1st min | 147. 83 ± 7.25 | 139.69±3.56 |
| At 3rd min | 150.61 ± 7.63 | 145.69±5.28 |
| At 6th min | 153.33 ± 4.42 | 150.38±4.09 |

There is significant decrease in heart rate during 1st min 3rd min and 6th min in the group with parental history of hypertension after exercise training with $p < 0.0001$

## Discussion

Physical activity inhibits vagal nerve impulses to heart and increases sympathetic discharge. The concerted inhibition of parasympathetic areas and activation of sympathetic areas of the medulla on the heart results in an increase in heart rate and myocardial contractility. The tachycardia and enhanced contractility increases cardiac output. As a result there is an increase in heart rate and blood pressure[6].

Persons with high-normal resting blood pressure or unusually high blood pressure response to exercise are prone to develop hypertension[7] and elevated exercise systolic blood pressure response was also predictor of new-onset hypertension. Subjects with parental history of hypertension also show an exaggerated blood pressure response.

Individuals with dysfunctional autonomic heart rate responses may be more predisposed to lethal cardiac arrhythmias and thus increased mortality regardless of the presence or extent of coronary artery disease. An example of attenuated response is chronotropic incompetence. The increase in heart rate that accompanies exercise is due in part to a reduction in vagal tone. Attenuated heart rate response to exercise has been shown to be predictive of mortality and coronary heart disease risk[8].

Abnormal heart rate response to exercise is associated with a significantly increased risk of cardiovascular mortality after adjusting for age, exercise capacity, cardiovascular risk factors, and ST segment depression.

## Conclusion

Physical exercise is associated with parasympathetic withdrawal and increased sympathetic activity resulting in increases in heart rate. So, isotonic exercise in young age is beneficial to prevent many diseases. Heart rate rises linearly with increasing grades of exercise and comes back to basal value within 5 -10 minutes. Normotensive young adults with a family history of hypertension will show an exaggerated heart rare response to exercise.

**Conflict of Interest:** No

**Ethical Clearance:** Taken from Kurnool Medical College, Kurnool, Andhra Pradesh committee

**Source of Funding:** Self

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# Assessment of Neurocognitive Impairment in Obstructive Sleep Apnea

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## Abstract

Sleep apnea is usually reported in south Indian population. The indications of obstructive sleep apnea (OSA) comprise of breathing difficulties particularly owing to obstruction in the upper airway tract. The present study investigated the effect of the syndrome, the patients documented with OSA, by categorizing the patients into mild, moderate and severe OSA groups depending on apnea-hyponea index (AHI), derived from sleep study (polysomnographic findings). The comparative evaluation of various outcomes considered in this study included healthy individuals (control group, AHI < 5), mild OSA (AHI 5-15), moderate (OSA 15-30) and severe (AHI > 30). Investigations were conducted on the subjects which evaluated baseline characteristics, polysomnographic data and neuro-cognitive performances by Mini-Mental State Examination (MMSE). The results revealed significantly higher body mass index (BMI), snoring and decresed sleep efficiency in patients with sleep apnea syndrome when compared with control group. OSA patients further exhibited compromised neuro-cognitive. The intensity of the impairments and difficulties increased with upsurge in severity of the syndrome among all patients. The findings of this work strongly indicated that impaired executive functioning; neuro-cognitive abnormalities exit in a heightened state among OSA patients, than in the normal healthy individuals, the control group. These findings in aggregate would help clinicians in diagnosis and in understanding the disease prognosis.

***Keywords:*** *Obstructive Sleep Apnea, apnea-hyponea index (AHI), Mini-Mental State Examination (MMSE), Polysomnographic findings.*

## Introduction

Sleep is a vivacious part of good health and wellbeing. Pathologic disruption of sleep is related with a number of adverse health and safety outcomes[1-2]. Episodic cessation of breathing during sleep is referred as sleep apnea[3]. Sleep apnea is broadly classified into three principal types: obstructive, central and mixed. Obstructive sleep apnea, is caused by collapse of the soft tissues of upper airway during sleep whereas, Central apnea, which occurs when brain does not send proper signals to the muscles that controls breathing. Additionally some people have complex sleep apnea which is a combination of both The distinctive features of obstructive sleep apnea (OSA) includes repeated episodes of high-resistance breathing, reduced breathing (hypopnea events), and breathing pauses (apnea events) during a single night of sleep[4-5]. OSA is generally defined as five or more apneas and/or hypopnic events as per hour of sleep [(apnea-hypopnea index (AHI)>5)]. The severity of OSA is measured by the apnea-hypopnea index (AHI), obtained by counting the total number of apneas and hypopneas during sleep and dividing that by the hours of sleep. An AHI lower than 5 per hour is considered as normal; an AHI of 5 to 15 is mild OSA, 15 to 30 is moderate OSA, and greater than 30 events per hour is severe disease. The common symptoms of OSA is excessive daytime sleepiness, which may be mild or severe enough to interfere with employment or driving an automobile, day to day activities and could also leads

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to cognitive decline[6-7].

OSA is being progressively renowned as a cause of substantial medical, social and psychological morbidity as well as an increased mortality[8-9]. The concerns of OSA are diverse and in most of the cases are often serious; nevertheless the syndrome remains largely under-diagnosed. Early recognition and treatment are essential to alleviate the symptoms and consequence of sleep related disorders. The aim of this study was to determine the strength of association of OSA and its sequelae of events to morbidity in a representative sample and to assess the neurocognitive functioning in patients with OSA and its correlation with the severity of OSA.

## Material and Method

### Study protocol

100 OSA patients and 50 control subjects of both the genders were recruited for the study. Prior to the study, informed consent will be obtained from the patients and the ethical clearance was obtained from Institutional Ethics Committee of Deccan College of Medical Sciences and allied hospitals. Data on demographic characteristics, sleep pattern, medical history, medication use, and habits was obtained with the use of a standardized questionnaire administered by a trained technologist before the initiation of overnight polysomnography (PSG); the questionnaires was reviewed by a physician. Patients on continuous positive airway pressure (CPAP) therapy, oral appliances or any other treatment for OSA, Diabetics and any other disorders such as Parkinson's disease which are known to affect peripheral neuropathy, smokers, pregnant and lactating female were excluded from the study.

### Assessment of Sleep apnea

Based upon the symptoms the patient's undergone full-night polysomnographic study within the premises of a sleep lab. Continuous polygraphic recordings was acquired applying electroencephalographic, electrocardiographic, electro-oculographic and actigraphic leads. Total cessation of airflow for at least 10 seconds was classified as apnea and partial airway closure, resulting in a reduction of airflow by more than 30% for at least 10 seconds and associated with oxygen desaturation of 4% or more, was termed as hypopnea. Calculated polysomnographic variable was including the apnea–hypopnea index[15].

### Cognitive function test

The Mini-Mental State Examination (MMSE) is a well-validated screening tool and was used for appraisal of cognitive impairment. The test measures orientation to time and place, attention, immediate recall, short-term verbal memory, calculation, language, and the ability to follow simple verbal and written commands. The division of scores were according to the task allotted in each part of the test such as for orientation (10 points), registration (3 points), attention and calculation (5 points), recall (3 points) and 9 pints for language and praxis. The scores were summed and the interpreted. An aggregate score in the range of 24-30 showed no cognitive impairment, 18-23 mild cognitive impairment and 0-17 severe cognitive impairment

## Statistical Analysis

Student's t-test was used to compare mean values at baseline among OSA patients with those in the control group. The data will be analyzed by an analysis of variance (ANOVA), chi-square, t-tests, correlation and regression analysis and other necessary statistical analysis wherever necessary. The differences was considered significant if $p < 0.05$. All the analysis was processed by the software's; SPSS 18.0 and Origin 8.

## Observations and Results

The average time for administration of the OSA questionnaire and cognitive test was 30 minutes. A total of 123 patients were enrolled to the sleep center during the study period, of whom, 100 (M/F, 1/0.27) were considered eligible to participate in the sleep study and underwent polysomnography. Based on the past history, 23 patients were deemed ineligible as they were taking Continuous positive airway pressure (CPAP) treatment for OSA. A total of 100 of the 123 study participants (71%) were identified as having obstructive sleep apnea. Table 1 shows the demographic data of the study group and controls. Apnea-hypopnea index (AHI) was acquired by including the total number of apneas and hypopneas during sleep and dividing that by the hours of sleep. Among all the OSA patients 26% were having mild OSA, 16% moderate and 48% were having severe OSA (with respect to the AHI criteria discussed above) respectively.

**Table 1: Socio- demographic characteristics of participants.**

| Characteristics | OSA patients (n=100) | Controls (n=50) | Significance (P value) |
|---|---|---|---|
| Age (Yr) (Mean ± SD) | 51 ± 12 | 62 ± 3 | 0.836 |
| Male Sex (%) | 52 | 36 | 0.04 |
| Habitual Snoring (%) | 29 | 11 | <0.001 |
| Body Mass Index (Mean ± SD) | 36 ± 5 | 21 ±3 | <0.001 |
| Obesity (%) | 23 | 08 | <0.001 |
| Apnoea-Hypopnea Index (AHI) | 34.6±16.5 | 1.4±0.8 | <0.001 |
| Current Consumption of Alcohol (%) | 15 | 9 | 0.12 |

Table 2 shows the evaluation of MMSE for cognitive assessmentin both OSA patients and control. We observed a significant decrease in MMSE score in OSA patients when compared to control.Orientation 3.2±0.8 was low in OSA patients whereas it was found to be 3.9±1.1in controls. Memory (immediate and delayed recall), registration, attention and calculation skills, language and constructive praxis was observed to be 7.9± 1.3, 2.2±0.6, 3.7±1.2 and 2.2±0.6 respectively in OSA patients which was found to significantly low in contrast with controls.

**Table 2: Cognitive performance of OSA patients and controls .**

| Cognitive test | Patients with OSA (n=100) | Controls (n=50) | Significance (P value) |
|---|---|---|---|
| MMSE | 26.7 ±1.6 | 28.9 ± 0.9 | 0.01 |
| ***Orientation*** | 3.2±0.8 | 3.9±1.1 | 0.042 |
| ***Registration*** | 2.2±0.7 | 2.6±0.4 | 0.038 |
| ***Attention and Calculation*** | 3.7±1.2 | 4.2±0.7 | 0.046 |
| ***Recall*** | 7.9± 1.3 | 8.7± 1.0 | 0.02 |
| Language and Praxis | 2.2±0.6 | 2.7±0.3 | 0.041 |

## Discussion

OSA syndrome, estimated to occur in about 1 in 20 of all adults, is usually unrecognized, undiagnosed and results in behavioral, metabolic and cardiovascular morbidity. The patients with OSA have difficulty with attention, task learning and performing any task at work compared with the general population[16]. As such cognitive impairment can also disrupt a patient's ability to gain or maintain employment because their behaviour may be misunderstood as laziness or a lack of motivation[17]. The present study, included adults from Hyderabad, South India, attempted to examine the epidemiological and cognitive status of obstructive sleep apnea, particularly its relationship with AHI, obesity and cognitive parameters.

Executive and cognitive functioning are integral parts of daily life. The data suggested serious impairment by day time sleepiness, sleep fragmentation on cognitive abilities in OSA patients. The negative effects of these attributes have also been extensively discussed in research findings of other researchers as well, such as impaired cognitive function reduced attention, vigilance,

memory, executive dysfunction, with worsening effects with increase in severity; resulting in a global cognitive impairment..

Our results demonstrated that, sleep disordered breathing was strongly associated with the impaired cognitive functioning. The Mini-Mental State Examination (MMSE), a well-validated selection tool was used for evaluation of cognitive impairment. In our study while assessing attention, memory, language and executive functions, we found that the performance of OSA patients was impaired in comparison to healthy controls in. The impact of OSA on cognitive performance provided insight into important parameters in ascertaining the degree of damage in OSA subjects. Low attention, loss in memory and low executive function capabilities are useful indicators in understanding the symptoms of OSA. MMSE, being a global measure of cognitive functioning, showed significant categorical changes in various aspects of executive function, and the overall score indicated the implication of the score.

Hence, a variability of cognitive fields seems to be exaggerated in this condition and brief cognitive testing may detect such changes which are in consistent with the previous findings by Bawden CF et al 2011[10].

Our analysis suggests that OSA of reasonable severity may be associated with moderate to large impairments. While assessing the cognitive performance in patients with mild OSA, a noteworthy impairments may not be evident at low levels of sleep disordered breathing and symptomatology.

One of the probable reason could be either of nocturnal hypoxaemia or severe sleepiness in the impairment to cognitive performance both reported by [18,19] and measured patients with OSA[20,21]

As revealed previously, cognitive dysfunction may be an important denominator in the increased risk of occurrence of road accidents in patients with OSA. We believe that the assessment of cognitive impairment, even being of mild severity, is enough to persuade further studies targeting at explicating the etiology of these deficits.

## Conclusion

In conclusion, we found that OSA was responsible for inconsistencies in attention, memory and executive functioning. We observed cognitive impairment in patients with OSA, which is a significant factor in averting road accidents and may help the patient to improve or maintain employment. The early medical treatment may help to prevent such symptoms in patients with OSA and can improve the quality of life.

## Summary

In summary, the results of this study provide compelling evidence that OSA is related with cognitive decline. Although hypoxemic stress and sleep disruption are likely the key players in the pathogenetic mechanisms behind such derangements, the role of an underlying common denominator needs to be scrutinized. Further studies are needed to define the driving mechanisms through which sleep-disordered breathing promotes many of these consequences.

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**Ethical approval**: All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

**Informed consent:** Informed consent was obtained from all individual participants included in the study.

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# Glycated Haemoglobin and its Association with Lipid Profile in Type 2 Diabetes Mellitus

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## Abstract

Background: . Patients with type 2 diabetes have an increased prevalence of lipid abnormalities, contributing to their high risk of cardiovascular diseases (CVD)[1]. Glycated hemoglobin (HbA1c) is the indicator of glycemic status over long term. This study is an attempt to evaluate the diagnostic value of HbA1c in predicting diabetic dislipidemia. Method: Venous blood was collected from 100 type 2 diabetic patients age 35 – 75 years, 50 males and 50 females attending the Diabetic OPD, Civil hospital Gulbarga were enrolled in the study. Investigations like fasting and post prandial blood sugar, HbA1c and lipid profile (Cholesterol, Triglycerides, HDL, LDL & VLDL). Both males and females patients with worse glycemic control (HbA1c > 9%) had significantly high cholesterol and LDL levels. Result: HbA1c showed direct and significant correlation with cholesterol, triglicerides and LDL cholesterol, and reverse correlation with HDL cholesterol. .

***Keywords****: Glycemic control, HbA1c, Serum lipid profile, Type 2 diabetes*

## Introduction

Diabetes mellitus is a group of metabolic disease characterized by hyperglycaemia resulting from defects in insulin secretion, insulin action, or both. Diabetes causes about 5% of all deaths globally each year[4]. The chronic hyperglycaemia of diabetes is associated with long-term damage, dysfunction, and failure of various organs, especially the eyes, kidneys, nerves, heart, and blood vessels.50% of people with diabetes die of cardiovascular disease (primarily heart disease and stroke).The risk of chronic complications increases as a function of the duration of hyperglycemia; they usually become apparent in the second decade of hyperglycemia[2].

Glycated hemoglobin (HbA1c) is routinely used as a diagnostic tool for measuring long term glycemic control[3]. In accordance with its function as an indicator for the mean blood glucose level, HbA1c predicts the risk for the development of diabetic complication in diabetes patients.

Glycemic control with decreased level of HbA1c is likely to reduce the risk of complications.

Avogaro et all (Avogaro A et colab) have suggested that type 2 diabetic dislipidemia in females and hyperglycemia in males are important risk factors are amenable to more aggressive treatment[4].

## Material and Method

Study comprised a total of 100 type 2 diabetic patients who were examined at a private laboratory, in a national study of HbA1c in type 2 diabetic patients There were 50 males and 50 females. Informed consent was taken from the subjects.Ethical clearance was taken from ethical committee of M.R.medical college and research center.The age of patients ranges between 35 and 75 years. All the patients were categorized into four age groups : < 50; 50-60; 60- 70' > 75 years. Venous blood samples from all the subjects were collected in serum separator tubes. The sera were analyzed for glycated hemoglobin (HbA1c), fasting blood glucose (FBS), total cholesterol, triglycerides (TS) and high

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density lipoprotein cholesterol (HDL) using an auto analyzer Hitachy 17 The level of low density lipoprotein cholesterol (LDL) was determined using the formula: LDL = (Cholesterol – TG) / (2,2 HDL). The impact of glycemic control on various parameters was evaluated by categorizing all the patients into 3 categories on the basis of HbA1c levels : HbA1c < 6% (good glycemic control, HbA1c > 6-9% (poor glycemic control) and HbA1c > 9 % (worse glycemic control)[4] .

Hypercholesterolemia is defined as TC > 200 mg/dl, high LDL when value > 100 mg / dl, hypertriglyceridemia as TG > 150 mg/dl and low HDL when value < 40 mg/ dl. Dyslipidemia was defined by presence of one or more than one abnormal serum lipid concentration[3] .

Statistical analysis was done by using student's unpaired 't' test using Graph pad software11. Pearson's correlation coefficient was also calculated using online calculator to find the correlation between HbA1c and lipid parameters[3]. Value of HbA1c was given as percentage of total haemoglobin and values of all other parameters were given in mg/dl. All Values are expressed as mean ± SD. The results were considered non-significant when P > 0.05.

## Result

Among total 100 type 2 diabetic individuals included in this study, 50 were male and 50 were female. The mean age ± SD of male and female subjects were 51.14±6.40 and 50.46 ± 5.62 years respectively. The mean value of HbA1c and FBG were slightly higher in females in comparison to male patients but the differences were not significant. When lipid profiles were taken in to consideration, 61 patients (41.3%) had TG levels > 150 mg/dl; 28 patients (18%) had LDL > 100 mg/dl; 15patients (10.6%) had TC > 200 mg/dl & 1 (0.7%) patient had HDL < 40 mg/dl. There was no statistically significant difference in Total cholesterol, Serum Triglyceride, LDL or VLDL levels among both the genders though HDL levels in females were significantly more than males.(Table 1)

**Table 1: Male and female lipid parameters results of male and female type 2 Diabetes patients**

| Parameter | Males (n= 50) | Females (n=50) | Total ( n=100) |
|---|---|---|---|
| FBG(mg/dl) | 120.64±33.80 | 131.05±37.71 | 124.92±34.51 |
| HbA1c(%) | 7.27±1.40 | 7.67±1.44 | 7.49±1.42 |
| TC (mg/dl) | 146.36 ± 34.38 | 155.25 ± 30.42 | 152.91 ± 34.06 |
| TG(mg/dl) | 143.33± 50.31 | 160.42 ± 65.20 | 152.80 ± 58.59 |
| LDL(mg/dl) | 64.87 ± 34.60 | 72.81 ± 28.78 | 71.40 ± 32.00 |
| VLDL(mg/dl) | 27.80 ±09.87 | 32.08 ± 12.24 | 30.54 ± 10.92 |
| HDL(mg/dl) | 44.70 ± 4.10 | 53.32 ± 3.22 | 51.95 ± 7.20 |

**Table 2: Lipid parameters categorized by patient's glycaemic control ( HbA1c)**

| Parameter | HbA1c<7 ( Good glycaemic control) | HbA1c >7 ( Poor glycaemic control) | P value |
|---|---|---|---|
| FBG (mg/dl) | 106.19± 21.24 | 142.54± 37.65 | P <0.0001 |
| HbA1c(%) | 6.24± 0.46 | 8.54 ± 1.12 | P <0.0001 |
| TC ( mg/dl) | 140.95 ± 27.01 | 158.30 ± 28.54 | P=0.0010 |
| TG( mg/dl) | 136.60 ± 44.76 | 164.36 ± 67.42 | P=0.0052 |
| LDL( mg/dl) | 64.56± 20.84 | 72.86 ± 22.60 | P=0.0210 |
| VLDL( mg/dl) | 26.72 ± 9.12 | 32.08 ± 12.46 | P=0.0052 |
| HDL( mg/dl) | 52.62± 7.26 | 50.00 ± 7.3 | P=0.0320 |

Out of 100 patients, 50 patients had HbA1c values less than or equal to seven (Good Glycaemic control) while rest of 50 patients had HbA1c values more than seven (Poor Glycaemic Control). Strong positive correlation was observed between FBG and HbA1c as shown by pearson's correlation coeffecient. Similarly, values of TC, TG, LDL & VLDL in Good Glycaemic Control group were significantly lower than Poor Glycaemic Control group. Values of TG had Moderate positive correlation with HbA1c values while TC, LDL & VLDL values had only weak positive relationship. HDL levels were significantly high in Good Glycaemic Control group as compared to Poor Glycaemic Control group and demonstrated a weak negative correlation.

## Discussion

In this study, association of glycated haemoglobin and lipid profile among diabetic patients has been studied. There is no significant difference in glycemic parameters as well as lipid profile between males and females .The HDL values which are significantly higher in females. A good number of diabetic patients have hypercholesterolemia, hypertriglyceridemia, high LDL and low HDL levels and these are risk factors for cardiovascular diseases.

There is a positive corelation between glycated haemoglobin and lipid profile. . Khan et al., also reported that severity of dyslipidaemia increases in patients with higher HbA1c value16. Khaw et al has reported that reducing the HbA1c level by 0.2% could lower the mortality by 10%17. The glycemic control is important in prevention of cardiovascular diseases in type 2 diabetics.

## Conclusion

There is a greater association of HbA1c with lipid profile in type 2 diabetes mellitus and showed positive correlations with TC, TG, LDL & VLDL and negative correlations between HbA1c and HDL levels is found. HbA1c level can be used as good parameter for predicting the lipid profile of both male and female diabetic patients[9]. Timely intervention with lipid lowering drugs can be done in patient with elevated glycated haemoglobin screed for type 2 diabetes mellitus to reduce the risk of cardiovascular diseases[11].

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**Conflict of Interest**- None

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# High Sensitivity C Reactive Protein: A Surrogate Marker Appalling the Impact of Inflammation in Obese Young Adults

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## Abstract

**Introduction:** Obesity is primarily considered to be a disorder of energy balance, and it has recently been suggested that some forms of obesity are associated with chronic low-grade inflammation. Obesity is a chronic, multifactorial and complex disease which poses a major public health issue increasing the risk of non - communicable diseases like, Type -2-DM, Cardiovascular disease, Hypertension etc. **Aim:** The present study aims to emphasize the burden of obesity in inflammation by associating with elevated levels of hs CRP in adults. **Materials and Method:** The study was a Hospital based cross sectional study including 30 obese individuals in the age group of 17-30 years,(15 males and 15 females)with BMI > 30 were included. Other systemic diseases were excluded. Assessment was done by Weight, Height, BMI by Quetelet index and measurement of hs CRP by Immunoturbidometer. The results were tabulated and analysed. **Results:** Total of 30 obese subjects were included of which 15 were males and 15 were Females. In obese subjects hs-CRP was elevated significantly. The level of hs-CRP was proportionally elevated in relation to BMI in obese subjects. **Conclusion:** Elevated hs-CRP levels in obese individuals indicates a proinflammatory state. This further concludes a risk for metabolic and cardiovascular manifestations in obese individuals.

***Key words:*** *BMI, hs CRP.*

## Introduction

Obesity is defined as a state of being overweight with excess body fat resulting in a significant impairment of health of a person. The most widely used method to gauge obesity is BMI which is [weight kg / height ($m^2$) ]. So BMI of 30 is the most commonly used threshold for obesity in both men and women.[1] Approximately 55 % of adults in the united States are overweight, and nearly 22 % of adults are obese.[2]

Genes that predispose to obesity in humans and animals have already been identified - the faulty gene -FTO, indicating the importance of genetic factor in the development of this disorder[3] and currently regarded as a proinflammatory state. Recent research has shown that the number as well as the size of adipocytes in obese people is more than people with normal body weight. Weight loss in an obese adult can reduce the size but not the number of adipocytes.[4]

CRP a trace protein is synthesized by the liver[7] with a medium concentration of 1 mg/L[5] increasing 1000 fold in diseases. Hence, it is an acute phase protein which gets elevated during episodes of acute-inflammation or infection.[6] The physiologic role of CRP is to bind to phosphocholine expressed on the surface of dead or dying cell ( and some types of bacteria ) in order to activate the complement system via the C1Q complex as an immunologic defense mechanism[8] and considered as an novel biomarker, since it measures even low levels of CRP in human serum or plasma.[9]

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The adipokine imbalance characterizing obesity, including low levels of adiponectin, high levels of leptin, inflammatory mediators (IL-6 and TNF-α) and antifibrinolytic factors (PAI-1) may induce oxidative stress and endothelial dysfunction- initial steps of atherogenesis.[10]Many studies have suggested that higher BMI is associated with higher CRP concentrations indicating a state of low – grade inflammation. Elevated CRP levels were present in 27.6% women and 6.7 % men of US adult population in obese persons with BMI > 30.[11]Only a few studies have been done based on the impact of hs CRP ( High Sensitivity C – reactive protein ) prevalence in obesity.

Due to the paucity of information for correlation between BMI and hs CRP in Indian settings, the present study was undertaken. Elevated hs-CRP levels in young obese individuals is an indication of an existing pro-inflammatory state in them, which might lead to complications in future. Thus the present study aimed to correlate the concentration of hs-CRP in obese individuals and create awareness regarding risk factors.

**Aim: :** The present study aims to emphasize the burden of obesity in inflammation by associating with elevated levels of hs CRP in adults.

## Materials and Method

Study was conducted at Sri Manakula Vinayagar Medical College and Hospital, Madagadipet , Puducherry between the period October 2012 to August 2013 after getting approved from the Institutional Research Council and Ethical committee. The subjects included into the study were selected after obtaining informed consent on the basis of fulfillment of inclusion criteria whilst excluding exclusion criteria. The study was a cross sectional study. 30 obese individuals such as Staff, Students, Persons attending medicine OPD (15 males and 15 females) in the age group of 17-30 years with BMI > 30 constituted the study population. other systemic diseases like diabetes,hypertension,hyperlipidemia were excluded.

**Procedures:**

**Body Mass Index :**

For the assessment of obesity, height and weight measurements were taken on each subject, and using Quetelet index, the value of BMI was calculated for each subject.

**BMI=weight (kg) / height (m) $^2$**

Classification of BMI:

Underweight : 18.5

Normal weight: 18.5-24.9

Overweight : 25-29.9

Obesity :

Class 1 : 30-34

Class 2 :35-39.9

Class 3: ≥40

**Height and Weight was measured using standard apparatus.**

**High Sensitivity C-Reactive Protein:[12] Immunoturbidometer (Beacon ) : Version 3.81.[12]**

**Principle**:[12]

The analyzer is designed on the basis of Lambert-Beer Law. The hs- CRP Turbilatex test is a quantitative turbidimetric test for the measurement of low levels of CRP in human serum or plasma. Latex particles coated with specific anti-human CRP were agglutinated when mixed with samples containing CRP.

**reference values :**

Below 3 mg/ L is considered as normal.

**Procedure:**

2 ml of blood was taken in a test tube and left undisturbed for half an hour for complete clot formation. The sample was then centrifuged at 3000 rpm to separate the serum from the clot. After centrifugation, the serum was stored at 20° C in Ependorf tubes till the analysis for hs-CRP was conducted. Serum hs-CRP levels were measured by turbidimetry method, using commercial kit ( Beacon Diagnostics Pvt Ltd, India ). hsCRP kit : Code no -T05, Pack size - 32 ml. Statistical analysis: At 95 % CI, 80% Power, minimum sample needed is 30.[18]The values of mean ± SD for the obese subjects to evaluate hs CRP levels are 1.710 ± 0.3434 and 2.450 ± 0.5130 respectively. The data collected was entered in Microsoft Excel and analyzed using SPSS software package Version 19. Pearson correlation was used to analyse the hs CRP thresholds with BMI of obese individuals.

**Results:** Total of 30 obese individuals were selected for the study of which 15 were males and remaining 15 were females categorised by calculating their BMI. The results were tabulated and analysed.

**Table 1: Age and gender distribution in obese subjects.**

| Age ( years) | Females n (%) | Males n (%) | Total n (%) |
|---|---|---|---|
| 20-24 | 6 (40%) | 7 (47%) | 13 (43.3%) |
| 25-27 | 3 (20%) | 4 (27%) | 7 (23.3%) |
| 28-30 | 6 (40%) | 4 (27%) | 10 (33.3%) |

Among these individuals 43.3% were between the age 20-24 yrs, 23.3% were between 25-27 yrs of age and 33.3% were between the age 28-30 yrs.

**Table 2: BMI and gender distribution in study subjects.**

| BMI | Females n (%) | Males n (%) |
|---|---|---|
| 30-34.9 | 9 (60%) | 9 (60%) |
| 35-39 | 5 (33.3%) | 6 (40%) |
| ≥ 40 | 1 (7%) | 0 (0%) |

Among the 30 obese individuals ( 15 Females and 15 Males ) whose BMI was categorized as Class I 30 to 34.9 Kg/ $m^2$, Class II 35 to 39.9 Kg/ $m^2$, Class III ≥ 40 Kg/ $m^2$ respectively. Among them 60% of both males and females had BMI of Class I, 40% males and 33.3% females had BMI of Class II and 7% of females and none of the males had BMI of Class III which showed no significant association between BMI and gender distribution in obese individuals.

**Table 3: Association between hs CRP and gender in subjects.**

| Reported hs CRP (mg/L) | Females n(%) | Males n (%) |
|---|---|---|
| < 3 | 3 (20%) | 6 (40%) |
| ≤ 3 | 12 (80%) | 9 (60%) |
| Total | 15 (100%) | 15 (100%) |

On the basis of gender, all the individuals included in this study were divided in two groups and were screened for the hs CRP levels. Total of 15 females and 15 males were screened and found that 80% females showed elevated hs CRP, as compared to 60% of males. The gender specificity was assessed for their association with hsCRP levels and no statistical significant association was reported (chi square 1.67 with a p value of > 0.5 NS ).

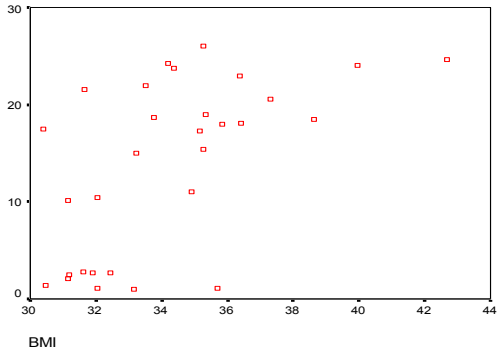


**Figure 1: Scatter plot to show relation between BMI and hs CRP in study subjects.**

A total of 30 individuals were screened for the strength of association of obesity with high sensitivity CRP. Based on the BMI calculation they were categorized as obese subjects which showed that, there was a significant relationship between BMI and levels of hsCRP, Pearson correlation coefficient r = 0.59, P = 0.01.Obesity was associated with high values of hsCRP.

All the individuals included in this study were also interviewed for the risk factors i.e. hypertension, hyperlipidemia, diabetes mellitus, drug intake, alcohol and smoking and found that these conditions did not illustrate any relation with obesity and levels of hs CRP.

## Discussion

Obesity is a long term disease having many serious consequences on the health of a person.[2] It is a state of excess adipose tissue mass and the most widely used method to calculate obesity is BMI.[1] Recently it has also been described as a pro inflammatory state which is involved in the pathophysiology of many diseases. The main aim of the present study was to explore the association between the body mass index and hsCRP level among the obese individuals.

Total of 30 obese individuals were selected for the study of which 15 were males and remaining 15 were

females categorised by calculating their BMI. Among these individuals 43.3% were between the age 20-24 yrs, 23.3% were between 25-27 yrs of age and 33.3% were between the age 28-30 yrs. Among the 30 obese (15 males and 15 females ) individuals who were subjected to relative BMI by using Quetelet index, no statistical significant difference in BMI was observed among males and females. The similar observation was made by other studies determined by Deepa M[14] and her colleagues and Desigamani Kanniyappan[15] and his colleagues.

The high sensitivity C- reactive protein is considered as the marker of inflammation inside the body. In this cross sectional study all obese individuals were analysed for the level of hsCRP and BMI and found that hsCRP was significantly elevated among the obese individuals,but there was no significant elevation in any specific gender in accordance with obesity. Our results, together with the evidence of previous studies by Visser M et al[16], Hussain S D[17], Preethi B L[18], Chieh Lin C et al[19], Shilpa B A et al[20], Rogowski O et al[21] indicates the overweightness and obesity as a risk factor for one's own health.

In recent reports obesity has linked with development of fatty liver diseases.[22] In obesity there is increased secretion of IL - 6 which activates the hepatic pathways to release the large amount of acute-phase proteins CRP in circulation.[23] The older experimental studies and cross-sectional studies have showed that CRP along with IL - 6 are contributing in the development of hyperglycemic, insulin resistance and Type 2 - DM.[24]CRP a liver derived pentraxin, recently has emerged as one of the most promising biomarker for future cardiovascular events and peripheral vascular diseases in the obese individuals.[25]

The link between obesity and inflammation is based on two basic theories. According to first theory, obesity - induced inflammation has been considered as a protective mechanism, which stops the body from losing activity or fitness by storing the fat in tissues and organs by anabolic process. Second theory suggest that inflammation as an catabolic process which break down the organs and tissue to control the body weight within the normal limits.[26]

## Conclusion

Higher the BMI, the levels of hs CRP increases, suggesting that obesity represents a major risk factor and constitutes a serious threat to the current and future health of all population on earth, in which inflammation acts as a major driver in the pathogenesis of obesity.

The present study advocated strongly to encourage people for healthy dietary patterns, regular assessment of BMI and biochemical parameters.

**Conflict of Interest:** Due to paucity of information regarding obesity,hence this study is aimed to create awareness among young obese adults to prevent individuals from metabolic syndrome and other high risk complications related to obesity.

**Source of Funding:** Self.

**Ethical Clearance:** Obtained from Pondycherry University, Pondy.

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# Should Problem based Learning be Included in Teaching Physiology along with Traditional Method of Learning? A Student's Perception

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## Abstract

**Aim:** To evaluate students' perceptions about the role of Problem Based Learning(PBL) in Hybrid curriculum. **Background:** Problem Based Learning is an approach which has more leaning towards student centered pedagogy. The general consensus is that PBL inculcate self directed learning which help them in learning core concept, improves communication skill, formulation of their own learning objectives and team work. Particularly in basic sciences the triggers which are used in PBl gives the students prior idea of the clinical relevance of the topic and this act as a great impetus for the student towards self directed learning. **Material and Method:** This questionnaire-based study was conducted in the Department of Physiology, IGIMS, Patna. 98 Medical students from first professional MBBS were inducted in the study. Questionnaire consisted of 15 items and used three point Likert scale as "disagree," "neutral," or "agree," to measure students' perception of Problem Based Learning effectiveness. Questionnaire judged the perception in the field of quality of learning, ability to inculcate team work, confidence, interpersonal communication skill with colleague as well as seniors and role of facilitators.

**Result:** Statement enquiring about the role of PBL in clarifications of doubt, learning from the peers, in overcoming the nervousness and anxiety while speaking in front of class, ability to communicate more effectively, better understanding of the applied aspect and in ability to develop acute clinical acumen ,we got a positive(agree) response which was well above ninety percent. For the rest of the statement the answer had a stronger leaning towards agree and the mean percentage for them was hovering around eighty five percent. **Conclusion:** The student's perception is strongly in favor of PBL. According to them PBL will help them to excel in all the aspect of Blooms taxonomy.

***Keyword:*** *Problem based Learning Self directed learning, Communication skill, team work*

## Introduction

Recent history has seen a quantum leap in the field of medical education. Newer methodology and techniques of imparting medical knowledge are abundant, and it's a herculean task to choose the best among them to teach our medical student a particular topic. Now the curriculum development is in fluid state and it needs serious research with due diligence to develop a curriculum which imparts in-depth knowledge to the student as well as to incline the students towards self-directed learning , critical analysis and application of the knowledge towards the treatment of the patient as a whole.[1,2,3,4,5]

Age old tradition of teaching by using didactic lecture has lost its relevance of late since it is teacher centric and autocratic in nature and doesn't promote active participation from the students. It blunts students own critical thinking, reasoning and analysis.

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In hybrid curriculum students gets exposed to two different type of teaching strategy i.e. PBL in small group and traditional didactic lecture and practical classes. In this set up students gets opportunities to utilize their earlier exposure to the topic instructed through didactic lecture and practical classes.[6, 7]

Problem Based Learning is an approach which has more leaning towards student centered pedagogy. The general consensus is that PBL inculcate self directed learning which help them in learning core concept, improves communication skill, formulation of their own learning objectives and team work. Particularly in basic sciences the triggers which are used in PBl gives the students prior idea of the clinical relevance of the topic and this act as a great impetus for the student towards self directed learning. [8, 9, 10, 11,12]

## Objectives

To evaluate students' perceptions about the role of Problem Based Learning in Hybrid curriculum.

## Methodology

This questionnaire-based study was conducted in the Department of Physiology, IGIMS, Patna. 98 Medical students from first professional MBBS were inducted in the study. Students were informed about the research methodology, objectives and formal written consent was obtained and permission was taken from the institute ethics committee.

98 students were further divided into were divided into small group of 8 to 10 students. A facilitator was assigned to each group. Among the group a chair and scribe was selected for each PBL scenario. The chair and the scribe rotated for each PBL scenario. The group stayed together for the entire duration study to allow positive group dynamics. Study group was instructed in cardiovascular physiology using didactic lectures and practical classes and Problem based learning method (PBL).

Creation of the scenario was done with utmost diligence since it should lead to compilation of learning objective by students matching to those of faculty. It was pertaining to the current stage of learning, and had future clinical relevance and capability to involve the entire group. The facilitators or tutors were trained in PBL methodology.

**PBL tutorial Step followed in our study: [13]**

1. Identification and clarification of unfamiliar term included in the problem scenario

2. Consensus of the students on the problem scenario to be included i.e. every student must be satisfied that their learning objective will be achieved by problem scenario and facilitator must himself be satisfied that learning objectives set by the students is relevant, compact and achievable.

3. Orchestrated in a way so that there is through brainstorming and everyone's individual knowledge should complement that of others. Group should share their result of private study. Restructuring can be done when ever needed.

Questionnaire consisted of 15 items and used three point Likert scale as "disagree," "neutral," or "agree," to measure students' perception of Problem Based Learning effectiveness. The questionnaire was prepared in such a manner that it judged the perception in the field of quality of learning, ability to inculcate team work, confidence, interpersonal communication skill with colleague as well as seniors and role of facilitators

## Results & Observations

98 students were part of the study. Among 98 participant 56 were male and 42were female and they fell in the in the age bracket of 17 to 23 years (Mean±SD= 18.76±0.53).For all the statement of the questionnaire we did not observe any change in pattern on the basis of gender.

For the statement enquiring about the role of PBL in clarifications of doubt, learning from the peers, in overcoming the nervousness and anxiety while speaking in front of class, ability to communicate more effectively, better understanding of the applied aspect and in ability to develop acute clinical acumen we got a positive(agree) response which was well above ninety percent.

For the rest of the statement the answer had a stronger leaning towards agree and the mean percentage for them was hovering around eighty five percent.

Few statements of the questionnaire were purposefully similar to obviate any misunderstanding the question.

**Table: 1 Perception of undergraduate medical Students towards PBL (n=98)**

| S.N. | Statements | Disagree | Neutral | Agree | Score(Mean±SD) |
|---|---|---|---|---|---|
| 1. | PBL will help me to acquire better clinical acumen. | 5 | 8 | 85 | 2.81±0.50 |
| 2. | Discussion during the PBL helps to clarify my doubts on the subject matter. | 3 | 2 | 93 | 2.91±0.37 |
| 3. | Healthy peer competition makes the learning more interesting and challenging. | 8 | 7 | 83 | 2.76±0.45 |
| 4. | PBL gives me chance to know about the methodology my peers adopt and imbibe into my learning process if I find it useful. | 4 | 3 | 91 | 2.88±0.42 |
| 5. | Allowed to overcome nervousness while speaking in front of class. | 3 | 2 | 93 | 2.91±0.00 |
| 6. | PBL boosted my confidence and my ability to express my thought and gathered information. | 4 | 5 | 89 | 2.86±0.17 |
| 7. | PBL improved my interpersonal communication skill, leadership quality and how to approach any problem as team. | 7 | 5 | 86 | 2.86±0.30 |
| 8. | Small group made the learning more challenging, interesting, motivating, engaging and fun. | 8 | 6 | 84 | 2.77±0.34 |
| 9. | Small group enhanced my ability to communicate more effectively | 3 | 5 | 90 | 2.88±0.32 |
| 10. | Knowledge and skill acquired in group will help me in clinical practice. | 2 | 3 | 93 | 2.92±0.00 |
| 11. | I have understood the applied aspect in a better way | 2 | 3 | 93 | 2.92±0.00 |
| 12. | In general, tutors stimulate students to make use of different sources of information and stimulated my learning activity. | 6 | 8 | 84 | 2.79±0.28 |
| 13. | PBL will help me to become doctor with better teaching ability | 6 | 5 | 87 | 2.82±0.22 |
| 14. | PBL will help me to understand the subjects of the other professionals easier and interesting | 3 | 2 | 93 | 2.89±0.01 |
| 15. | Facilitators have a positive influence | 7 | 9 | 82 | 2.74±0.40 |

## Discussion

This study was undertaken with the purpose of finding out student's point of view with respect to small group teaching particularly Problem Based Learning in addition to didactic lecture. PBL effectiveness was assessed for five major domains of learning i.e. self directed learning, ability for critical analysis and its application in clinical scenario, building up of self confidence and motivation, Communication and ability to work as a team.

In our study mean score of almost all the questions asked hovered mainly around three (on a three point Likert scale) which is in alignment with the studied opinion of Dochey et al. and that of Saha et al and others. In their view PBL enhances self directed learning, ability to critically analyze and brings about increment in the self confidence and critical analysis and has over all positive bend in the learning attitude of students [14, 15,16,17,18]

Students were strongly of opinion that PBL gave them the opportunities to acquire the art of team work and to imbibe the learning methods of others and got motivated from each other. Similar observation was made by Dolmans et al in their study.[19]

On the question of problem solving skill, self directed learning and the opportunities to clarify doubt students vehemently supported PBL. Studies undertaken by several researchers had showed similar observation.[14, 15, 16,17,18,20]

A number of studies have reported advantages for small group teaching method which include increasing opportunities to ask questions; increasing student faculty and peer to peer interaction; improving communication skills, and improving presentation skills of the students.[15]. In our study, students indicated that learning in small group settings have helped them communicating effectively.

On the issues of improving communication and presentation skill, doubt solving with the help of peers and facilitators we had a similar finding to that of studies done by Euliano TY et al. [15]

One of the statements of our questionnaire was enquiry about effectiveness of the PBL in overcoming the nervousness of speaking in front of class. Our study found out PBL is an effective tool in this regard which is in contradiction to the observation made by Rehman et al.[21]

Our study also draws a conclusion that facilitators or tutors had a positive influence on the students with respect to their process of learning. Similar observation was made by Chung et al. and others [16, 22]

The questionnaire used by Saha et al in their study had few open ended question regarding the role of facilitators. They observed that students were uncomforted by dominating role of the tutor. For overcoming the above mentioned difficulty they suggested proper training of the tutor by medical education unit for conducting a fruitful PBL session

## Limitations of the study

The current study was confined to Department of Physiology so we cannot extrapolate the observation to other subject of the same professional and to that of other professionals. The questionnaire prepared is influenced by the subject of physiology and therefore it cannot be used as an umbrella questionnaire.

## Conclusion

The student perception is strongly in favor of PBL. According to them PBL will help them to excel in all the aspect of Blooms taxonomy.

**Source of Funding:** Self

**Ethical Clearance:** Taken

**Conflict of Interest:** None

**Acknowledgement:** Nil

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# The ECG Change in QRS Complex- A Tool for Evaluation of Heart Disease in Asymptomatic Type II Diabetics

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## Abstract

**Background:** The chronic hyperglycemia of diabetes mellitus is associated with long term damage, dysfunction and failure of various organs especially the eyes, kidneys, nerves, heart, and blood vessels. Electrocardiographic (ECG) abnormalities are found to be predictors of silent ischemia in asymptomatic persons. **Aim and Objective of the study:** The purpose of this study is, to detect & compare the electrocardiographic changes (QRS complex) in asymptomatic type II diabetics & controls. **Materials and Method:** Fifty type II DM cases aged between 30-55 years and minimum of fifty age and sex matched controls for each group were selected from the general population satisfying the inclusion criteria. **Findings:** There was statistically highly significant increase in QRS duration among type II Diabetics when compared to controls ($p< 0.001$). There was no statistically significant difference in QRS axis between type II DM cases and controls ($P > 0.05$). There was no statistically significant difference in QRS amplitude among type II diabetics when compared to controls ($p > 0.05$). **Conclusion:** The prolonged QRS complex can be considered as the evidence that the heart of diabetic patients is damaged by cardiomyopathy. Hence the screening of diabetics for electrocardiographic abnormalities is strongly recommended at the time of diagnosis for proper interventions & to prevent complications at the earliest.

***Keywords;*** *QRS complex, ECG change in type II diabetics, heart disease asymptomatic type II diabetics.*

## Introduction

Diabetes mellitus (DM) is a group of metabolic disorders characterized by hyperglycemia. The chronic hyperglycemia of diabetes mellitus is associated with long term damage, dysfunction and failure of various organs especially the eyes, kidneys, nerves, heart, and blood vessels. Electrocardiographic (ECG) abnormalities are found to be predictors of silent ischemia in asymptomatic persons. An abnormal ECG response is associated with statistically significant high risk for cardiac mortality and morbidity.[1]

Normal Electrocardiographic Complexes

**P wave** is due to deflexion produced by atrial depolarization. It does not exceed 0.11 second in duration and 2.5 mm in height.

**QRS complex** is due to ventricular depolarization and measures normally 0.04 to 0.10 seconds.

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**PR interval** is the interval between the beginning of the p wave and the beginning of QRS complex and it represents interval between onset of atrial depolarization and onset of ventricular depolarization. The normal duration is 0.12 to 0.20 seconds in the adults.

**ST segment** represents greater part of ventricular repolarization. Normally it is isoelectric.

**T wave** represents ventricular repolarization, atleast 10% of R wave in the same lead. No upper limit.

The purpose of this study is, to detect & compare the electrocardiographic changes (QRS complex) in asymptomatic type II diabetics & controls.

## Materials and Method

Fifty type II DM cases aged between 30-55 years and minimum of fifty age and sex matched controls for each group were selected from the general population satisfying the inclusion criteria. Following an

explanation about the nature and purpose of the study, those subjects who were willing to participate in the study were included after obtaining written informed consent.A detailed assessment was done and a pretested structured proforma was used to record the relevant information from each individual case selected. Data acquisition was performed in the morning.The subjects who were selected, a detailed physical and systemic examination was done. Physical examination of all the subjects included measuring height in centimeters, weight in kilograms, recording of resting pulse rate by palpating the radial artery and blood pressure recording with a mercury sphygmomanometer using the appropriate sized cuff. Clinical examination of the cardiovascular system was done in detail.Following detailed assessment of the subjects, they were screened for the presence of inclusion and exclusion criteria and dropped if any exclusion criteria were present.

**Inclusion Criteria**

Subjects between 30-55 yrs of age with Type II DM.

Diagnosed Type II DM cases of more than five years duration.

Age and sex matched controls

**Exclusion Criteria**

Known diabetics of duration less than five years.

Subjects with history of cardiac diseases, hypertension, smoking and alcoholism. Subjects above 55 yrs of age.

**Electrocardiographic Recording**

The instrument used to record electrocardiogram is the twelve channel Electrocardiograph HEWLETT PACKARD page writer manufactured by Phylips electronic Ltd. The PageWriter 100 offers all the features, functions and portability that we need to record superior ECG. This high-quality cardiograph captures accurate 12-lead ECGs on full-size paper with no cutting or pasting. It records 3 or 6 channels at speeds ranging from 5 mm to 50 mm per second, so we can capture multiple levels of detail. We can activate an ECG at the press of a single button.

The instrument contains following components:

**On/Standby button:** To switch on the ECG machine.

**Stop button:** To switch off the ECG machine.

**Chart speed button:** 5, 10, 25 or 50 mm/Sec speed paper movement can be selected by operation of this button.

**ECG size button:** 5, 10, 20 mm/mv ECG graph size can be selected by this button.

**Filter A/C:** Muscle tremor interference in the recording of the ECG can be eliminated by using this switch. Operation of this switch will prevent any distortion of the ECG wave.

**Page advance button:** The paper starts moving if this switch is depressed.

**Auto button:** Pressing of auto button leads to automatic movement of ECG paper. A flashing auto light indicates that an ECG is being acquired. When the light stays on, the acquisition is complete.

**Manual:** A flashing manual lead group light indicates an electrode placement problem.

**Copy:** Pressing of this button gives extra copy of the previous recorded ECG.

**An isolated ECG input:** The machine is operated from AC mains supply. The instrument can also be operated on rechargeable batteries, which are available optionally along with the machine.

**Accessories:** Patient cable, Clipper electrodes, Chest electrodes, Cardijelly bottle, Recording paper.

**Recording paper;**

The paper used is thermo sensitive. The paper upon which the ECG is recorded is ruled in lines apart both horizontally and vertically. Each 5th line in both directions is heavier than the rest. The vertical axis represents voltage (amplitude). With normal standardization, each 1mm represents 0.1 mV. The horizontal axis represents time (duration). With normal speed 1 mm represents 0.04 sec .i.e. each 5mm represents 0.2 sec and in one minute the ECG paper moves by 300 thick lines or 1500 mm (25 mm per second).

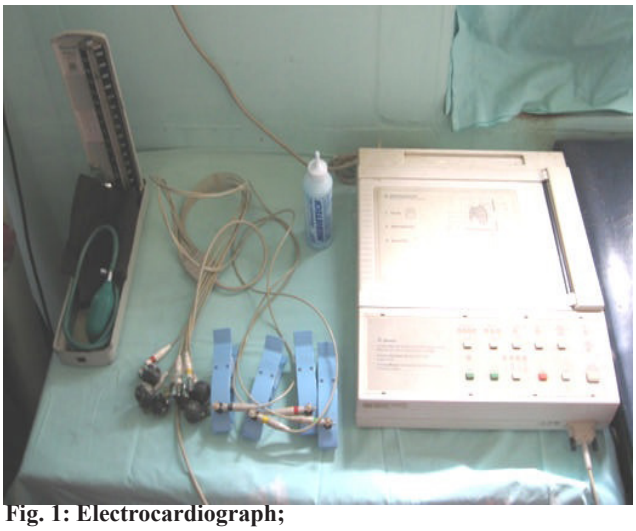

**Fig. 1: Electrocardiograph;**

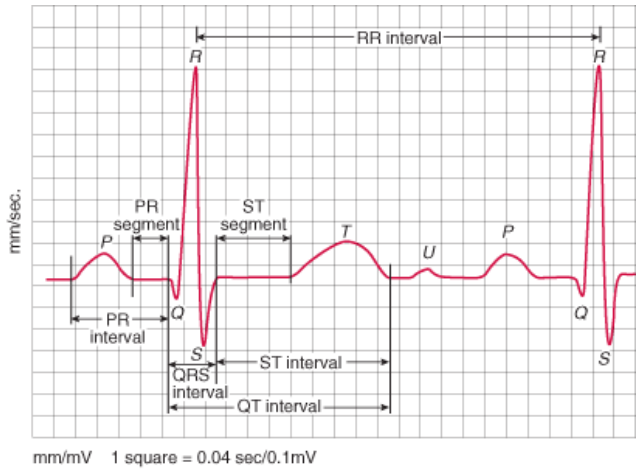


**Fig.No.2 –Waves of ECG**

## Statistical Analysis

SPSS version 16 software was used for all the analysis. Results were expressed as Mean ± SD for continuous data and number and percentages for discrete data. Unpaired t test was used for statistical analysis.

## Findings

### Subject Information

**Sex Distribution :** Out of 50 subjects 20 were male's and 30 were female in type II DM cases and controls of each group respectively (Table- 01) .

**Age;**The mean age (yrs) was 45.8 ± 4.9 and 45.9 ± 5.0 in type II DM cases and type II DM controls respectively (Table-01).

**Height;** The mean height (in cms) were 161.58 ± 8.3 and 160.98 ± 6.02 in type II DM cases and controls respectively (Table-02). There was no significant difference in height between type I DM cases and controls (p>0.05).

**Weight;** The mean weight (in kgs) were 64.44 ± 7.78 and 57.46 ± 5.65 in type II DM cases and controls respectively (Table-02). There was statistically highly significant increase in weight in type II diabetics when compared to controls (p< 0.001).

**Body Mass Index (BMI);** The BMI (in kg /$m^2$) were 24.55 ± 2.19 and 22.15 ± 1.37 in Type II DM cases and controls respectively (Table-02). There was highly significant increase in BMI among type II diabetics when compared to controls (p < 0.001).

**Pulse;** The mean pulse rates (bpm) were 75.18 ± 1.11 and 76.21 ± 10.2 in type II DM cases and controls respective (Table-02). There was no significant difference in pulse rate between type II diabetic cases and controls (p> 0.05).

**Systolic Blood Pressure;** The mean SBP (in mmHg) were 123.5 ± 1.11 and 120.42 ± 12 in Type II DM cases and controls respectively (Table-02). There was no significant difference in SBP among type II diabetics and controls (p>0.05).

**Diastolic blood Pressure;** The mean DBP(in mmHg) were 79.44 ± 3.23 and 79.16 ± 2.65 in Type II Diabetics and controls respectively (Table-02). There was no significant difference in DBP among type II DM cases and controls (p >0.05).

### Electrocardiographic Report

### QRS Complex

**Duration :** QRS duration (in sec) in type II DM cases and controls were 0.10 ± 0.02 and 0.08 ± 0.01 respectively (Table-03). There was statistically highly significant increase in QRS duration among type II Diabetics when compared to controls (p< 0.001).

**Axis:** The QRS axis (in degrees) among type II DM Cases and controls were 51.42 ±16.44 and 52.20 ± 14.83 respectively (Table-03). There was no statistically significant difference in QRS axis between type II DM cases and controls (P > 0.05).

**Amplitude:** The amplitude (in mm) were 17.74 ± 5.34 and 17.64 ± 3.90 in type II DM cases and controls respectively (Table-03). There was no statistically

significant difference in QRS amplitude among type II diabetics when compared to controls ($p > 0.05$).

**Table -01: Age and Sex Comparison of the Group's Studied**

| Variables | | DM- II | CONTROLS |
|---|---|---|---|
| Subjects | NO | 50 | 50 |
| Gender | Male | 20 | 20 |
| | Female | 30 | 30 |
| Age (yrs) | Mean ±SD | 45.8 ± 4.9 | 45.9± 5.0 |
| | Range | 35-54 Yrs | 35-54 Yrs |

**Table – 02: Comparison of variables Between Type - II DM cases and Controls**

| Type II DM | | | | |
|---|---|---|---|---|
| **Variable** | **Group** | **Mean** | **SD** | **p value** |
| HEIGHT(cms) | DM II | 161.58 | 8.34 | 0.68 |
| | Controls | 160.98 | 6.02 | |
| **WEIGHT(kg)** | DM II | 64.44 | 7.78 | 0.000 ** |
| | Controls | 57.46 | 5.65 | |
| **BMI(kg/m$^2$)** | DM II | 24.55 | 2.19 | 0.000 ** |
| | Controls | 22.15 | 1.37 | |
| PULSE(mmHg) | DM II | 75.18 | 1.11 | 0.47 |
| | Controls | 76.21 | 10.2 | |
| SBP(mmHg) | DM II | 123.5 | 1.11 | 0.08 |
| | Controls | 120.42 | 12.4 | |
| DBP(mmHg) | DM II | 79.44 | 3.23 | 0.64 |
| | Controls | 79.16 | 2.65 | |

Unpaired t test , *p <0.05 sig, **p< 0.001 HS

**Table – 03: Comparison of Electrocardiographic Changes in Between Type II DM Cases and Controls**

| Variables | | Group | Mean | SD | t value | p value |
|---|---|---|---|---|---|---|
| QRS COMPLEX | **DUR(sec)** | DM II | 0.10 | 0.02 | 5.76 | 0.000 ** |
| | | Controls | 0.08 | 0.01 | | |
| | AXIS(degrees) | DM II | 51.42 | 16.44 | 0.24 | 0.80 |
| | | Controls | 52.20 | 14.83 | | |
| | AMP(mm) | DM II | 17.74 | 5.34 | 0.11 | 0.915 |
| | | Controls | 17.64 | 3.90 | | |

Unpaired t test , *p <0.05 sig, **p< 0.001 HS , p > 0.05: not Sig.

## Discussion

In our study increased weight and BMI in diabetics could be due to increase in adiposity associated with insulin resistance attributed to more of sedentary life style and less physical activity[2,3].

Significant increase in QRS duration was noticed among type II diabetics . This could be due to diffuse damage of myocardium caused by increased accumulation of collagen in the interstitium of the cardiac muscle in diabetes mellitus [4,5,6].

## Conclusion

The prolonged QRS complex can be considered as the evidence that the heart of diabetic patients is damaged by cardiomyopathy. Hence the screening of diabetics for electrocardiographic abnormalities is strongly recommended at the time of diagnosis for proper interventions & to prevent complications at the earliest.

**Conflicts of Interest:** Nil

**Ethical Clearance**- Taken from JJMMC ethical committee Davangere.

**Source of Funding**- Self.

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# Gender Differences in Spatial Localization of Sound in the Azimuthal Plane in Normally Sighted Young Adults

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## Abstract

**Background:** Research studies have shown that there are differences in the neuroanatomy of males and females. The aim of our study was to find whether there are any gender differences in the spatial localization of sound.

**Method:** A total of eighteen blindfolded subjects, consisting of nine males and nine age-matched females with normal hearing, were subjected to the spatial bisection task where they had to localize the second sound, whose location varied from -20° to +20° in the azimuthal plane, while the first and third sound were fixed at -20° and +20° respectively. The Minimum audible angle task was administered, where the subjects had to say whether the 2 sounds presented were from same location or from two different speakers.

**Results and Conclusion:** There was no significant difference between the males and females with respect to their performance of spatial bisection task and minimum audible angle task.

***Keywords:*** *gender difference, spatial bisection task, Minimum audible angle task, spatial localization of sound*

## Background

Men and women are equal in intelligence but differ in their skills and capacities. There are papers that support the view that there are differences between the neuroanatomy of males and female. The size of the male brain is on an average 8-10% larger than the female brain[1]. The hemispheric asymmetry in the cerebral hemispheres is more in males than in females[2]. This is supported by the fact that in the male brain, the functions are lateralized to one hemisphere[3]. Ruytjens et al explained that there is gender difference in the regional cerebral blood flow in the left and right primary auditory cortex when responding to music or noise[4].

Localization of sound is defined as a listener's ability to identify the location or origin of the detected sound in direction and distance. The human auditory system uses several cues to localize sound. One such mechanism is the inter-aural time difference used in sound localization in the azimuthal plane. For sounds less than 2 kHz, the sound reaches the ear closer to the origin of sound first and then goes around the head and enters into the other ear. Using this cue, the human brain can identify the location of sound source[5].

An essential consideration is of the reference frame which is used to localize sounds. The frame of reference is defined as the means of representing the location of entities in space[6]. The dominant ones are egocentric and allocentric frames of reference. The egocentric frame uses the subject as the center of the environment whereas the allocentric frame is centered around external objects or the environment itself. The spatial bisection task assesses the spatial localization of sound in the allocentric frame while the minimum audible angle task is based on the egocentric frame[7].

The Objective of our study was to find out whether there was any gender difference in spatial localization of sound assessed by the spatial bisection task and minimum audible angle task in the azimuthal plane.

### Subjects, Materials and Method

**Subjects:**

Ethical approval was obtained from the Institutional ethical clearance committee as part of a larger ICMR

Short Term Studentship - 2017 project. Nine males and nine age matched females, who were in the age group between 20 and 29 years were recruited for the study from the staff and student population of Bangalore Medical College, based on the inclusion and exclusion criteria. Inclusion criteria: healthy young adults with normal hearing. Exclusion criteria: history of any past or present ear disease, any neurological illness, usage of ototoxic drugs and occupational exposure to loud sounds. Informed consent was obtained from each of the participants. The hearing threshold of all the subjects had to conform to the normal range and this was tested by the audiometry. Only those with 'Normal Hearing' were recruited.

## Materials

The Audiometer mobile application 'Hearing Test version 1.1.2' (by developer: hearingtest@e-audiologia.pl), calibrated according to the default headphones of the phone was used to assess hearing by pure tone audiometry.

The horizontal array of speakers was placed on a table 150 cm away from the height-adjustable chair where the subject was seated. An angular separation of 2° was maintained between adjacent speakers such that 21 speakers covered the total angular range of +20° to -20° with respect to the position of the subject. The speakers were Generic Passive 5Volt-Speaker modules, compatible with Arduino microcontroller board. Arduino is an open-source platform based on easy-to-use hardware and software that provides a programming tool. Arduino IDE (Integrated Development Environment) was used for writing code and uploading it to the Arduino board. The duration of sound production and intervals between successive sounds were programmed on the IDE software on the laptop to which the microcontroller was connected.

## Methodology

All experiments were conducted in an anechoic room in the department of physiology, Bangalore medical college and research institute. The subjects were informed of the procedure before the start of the experiment and all doubts adequately clarified. Informed consent was taken from each subject before the procedure. All subjects were blindfolded to rule out any visual distractions.

**Spatial Bisection Task:**

In this method, the blindfolded subject was made to sit on the height-adjustable chair whose height was adjusted such that the subject's ears were in the same horizontal plane as the speakers. Three sounds each of 1.5khz frequency, lasting 75 ms were successively presented at 500ms intervals, the first sound from -20°, third sound at +20°, and the middle sound from an arbitrary point in between the first and last sounds. The subject was required to verbally indicate whether the second sound source was closer in space to the first or the third sound. Thirty such trials were performed for each subject

**Minimum Audible Angle Task:**

For this task, the same setup was used as for the spatial bisection task. Two 75 ms sounds were presented successively with a 500 ms interval, first on the central speaker (0°), and the second sound from the point adjacent to the central speaker. After every trial the subject was required to indicate whether the two sounds seemed to arise from the same point or not. Trials were repeated with successive increase in angular distance of the second sound from the central speaker till the subject was able to distinguish the two sounds sources as from 2 different speakers. 5 sets of such trials were done on each side of the central speaker alternately for each subject[7]. The data collected for each subject consisted of the 10 values of Minimum Audible Angles (correct to 2°) and their means.

## Statistical Analysis

Descriptive statistics were done and data expressed as Mean ± Standard deviation (SD). Inferential statistics for the spatial bisection task was done and the two groups were compared using student's t-test. $P<0.05$ was considered to be significant. The proportion of the total number of correct responses to the number of wrong responses in each group was compared using Chi-square test. Similarly, the mean of the two groups were compared during the minimum audible angle task by student's t test when the second sound fell to the left and the right of the central speaker individually.

## Observations and Results

**Table 1: Baseline characteristics of the male and female group**

| | Males n = 9 (Mean ± SD) | Females n = 9 (Mean ± SD) | P - value |
|---|---|---|---|
| Age (years) | 23 ± 4 | 23 ± 4 | 0.631 |

**Table 2: Mean and Standard Deviation (SD) of the number of correct responses out of 30 trials per subject in the spatial bisection task**

| | Males (n=9) Mean ± SD | Females (n=9) Mean ± SD | P - value |
|---|---|---|---|
| Number of correct responses | 26 ± 2 | 27 ± 2 | 0.63 |

**Table 3: Comparison of proportion of right to wrong responses in the 3 groups for Spatial Bisection task:**

| | Males ( n = 9) | Females (n = 9) |
|---|---|---|
| Number of correct responses | 236 | 240 |
| Number of wrong responses | 34 | 30 |
| Total | 270 | 270 |

P = 0.6892 (by chi squared test); Chi square – 0.16

**Table 4: Angular separation of the 2 sounds to denote Minimum audible angle:**

| | Males ( n = 9 ) | Females ( n = 9 ) | P - value |
|---|---|---|---|
| Right of central speaker (°) (Mean ± SD) | 3 ± 2 | 3 ± 1 | 0.745 |
| Left of central speaker (°) (Mean ± SD) | 3 ± 1 | 3 ± 1 | 0.259 |
| Mean of both sides (°) (Mean ± SD) | 3 ± 1 | 3 ± 1 | 0.464 |

## Results

Table 1 shows that there was no difference between the means of the 2 groups with respect to the age of the subject.

Table 2 shows that the mean and standard deviation of the number of correct responses out of 30 trials done by each of the 9 participants in each group. While the males showed a mean and standard deviation of 26 and 2 respectively, the females showed a better response of 27(mean) and 2(standard deviation). However there was no significant difference between the means of the two groups.

Table 3 shows the proportion of correct to wrong responses compared between the two groups by Chi square test which showed a P value of 0.689. There was no significant difference between the two groups

Table 4 shows the mean and standard deviation in either group with respect to minimum audible angle when the second sound was to the left of median speaker or to the right of the median speaker. When the mean of both groups were compared, it yielded a P value which was not significant.

## Discussion

There was no significant difference between the mean ages of the two groups. This supports the fact that the two groups were age matched.

Of the 30 trials of spatial bisection task for each subject, the number of correct responses in each group was 26 and 27 in the male and female groups respectively. At this point, we can say that not all could score 30 out of 30 correct responses as blindfolding itself put them at a disadvantaged position. What the subjects had been doing with their eyes open all their life, they had to do after blindfolding. They had only a few minutes to adapt themselves to this situation. We blindfolded them to rule out any visual distractions during the task. Tabry et al compared the effect of blind folding of normal sighted subjects to the not blindfolded condition. They stated that blindfolding put them at a disadvantage compared to the not blindfolded controls[8].

Ruytjens et al described that there is a difference between males and females in brain activation in the primary auditory cortex in response to different types of acoustic stimuli. They concluded that there was a significant sexual dichotomy in auditory gating. Males

showed inhibition of acoustic stimuli by corticofugal networks. This put them in an evolutionarily advantageous position, where in their role as hunters, they could focus on relevant acoustic stimuli and they could ignore the irrelevant acoustic stimuli. However, in our study, we could not find any significant difference between males and females in spatial localization of sound during the spatial bisection task and minimum audible angle task.

Sound localization can be studied in 3 dimensions - Azimuthal plane or horizontal plane, elevation or vertical plane, distance of stationary sound or the velocity of moving sound. In our study, we have studied sound localization in the azimuthal plane.

The medial superior olivary nucleus, which is a component of superior olivary complex, helps in localizing sound in the azimuthal plane at the ear level. When the source of sound is in the azimuthal plane, it reaches the two ears at different times. The ear closer to the sound receives first. The sound then has to travel around the head (takes 700 microseconds) and reaches the other ear. This difference in time is used by the medial superior olivary nuclei to localize sound in the azimuthal plane[5]. Sexual dichotomy in localization of sound in the azimuthal plane has not been studied much. Our study where we found that there is no gender difference in spatial bisection task and minimal audible angle task in spatial localization of sound is one of the few studies conducted on this topic.

Strength and limitations: An important strength of the study was the age matching. There are some studies which explain how the ability to localize sounds varies with age[9]. Another important aspect was the use of Arduino micro controller board. These scientific advancements eliminated the noise that would have been produced had it been necessary to shift the speakers during each trial manually.

Limitations of the study: Inclusion of a wider age group including middle aged and the elderly would have provided a complete answer as to whether there is any gender difference in middle aged and elderly.

## Conclusion

This study showed that there was no significant difference in sound localization between males and females during spatial bisection task and minimum audible angle task.

Future directions should focus on gender dichotomy in spatial localization of sound in the vertical plane.

**Conflict of Interest:** Nil

**Source of Funding:** Nil

**Ethical Approval:** Obtained as part of the ICMR Short Term Studentship-2017 project from Institutional Ethical clearance committee

**Acknowledgement**: We acknowledge the Indian Council of Medical Research for selecting Ganesh Prasanna for the ICMR- Short Term Studentship-2017.

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# Critical Fusion Frequency and Audio-Visual Reaction Time as a Function of Age

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## Abstract

**Background & objective:** Aging is associated with physiological changes in functioning of different parts of the body. One of the changes commonly seen in elderly persons is slowness of the movements. Many studies concluded that audio-visual reaction time (RT) increases with age. Critical fusion frequency (CFF) is the frequency at which an intermittent light stimulus appears to be completely steady to the observer. It is been observed that CFF decreases with age. But whether this decrease is a progressive phenomenon is not clear. Hence, the present study was designed to investigate CFF in various age groups.

**Materials & method:** The study involved hundred subjects within the age group of 20-70 years. Subjects were divided into five age groups. Audio-visual reaction time and critical fusion frequency were measured. Data was statistically analyzed by using one way ANOVA for group wise changes in RT and CFF. Relationship between visual RT and CFF was found out by Pearson's coefficient of correlation.

**Results**: Visual RT and Audio RT were positively and significantly correlated with age whereas CFF was significantly and negatively correlated with age in male and females separately as well as when combined together. ($p<0.001$)

**Conclusion:** From our study we conclude that the RT increases and CFF decreases with age. These changes are similar in both male and female subjects.

***Keywords:*** *Audio-visual reaction time, Critical Fusion Frequency, Age.*

## Introduction

Aging in humans is a multidimensional process of physical, psychological, and social change. It is associated with physiological changes in functioning of different parts of the body. One of the changes commonly seen in elderly persons is slowness of the movements.[1] Adequate and timely response to the auditory and visual stimuli are necessary in day to day activities & these activities are executed by reflex mechanisms involving cerebral cortex. Many studies concluded that reaction time (RT) increases with age.[2] But relationship between the age and changes in RT is not clear.

Critical fusion frequency is the frequency at which an intermittent light stimulus appears to be completely steady to the observer. Stimuli presented at a higher rate than the CFF are perceived as continuous stimuli. Measurement of CFF is used as a test for fatigue of the central nervous system, cortical processing capacity and level of cortical activity or arousal in a person.[3] It has also been observed that CFF decreases with age.[4,5] But whether this decrease is a progressive phenomenon is not clear.[6-8]

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Hence, the present study was designed to investigate changes in audio-visual RT and CFF in various age groups. To find out age wise changes in auditory and visual reaction time in healthy subjects. To study changes in critical fusion frequency in healthy subjects of various age groups. To compare changes in critical fusion frequency in healthy subjects of both gender groups.

## Materials and Method

The study was conducted in a sample of hundred healthy individuals within the age group of 20-70 years in Kolar. They had been divided into five age groups as follows- Group I; 20-29 years, group II; 30- 39 years, group III; 40-49 years, group IV; 50-59 years and group V; 60-69 years. In each group, 20 subjects were included. Subjects were selected based on inclusion and exclusion criteria.

**Inclusion criteria** [study group]

Hundred healthy individuals of both the sex aged between 20 and 70years were included.

**Exclusion criteria**

History of Neuro endocrine disorders

History of Musculo-skeletal disorders

History of audio-visual pathology and or surgery

History of visual acuity more than ± 5D spherical or ± 2D cylindrical

History of Hypertension

History of Diabetes Mellitus

## Methodology

The subjects were selected by a detailed history & thorough physical examination. The experimental protocol was fully explained to the participants to allay apprehension. Informed consent was taken from all the subjects. The study was approved by Institutional Ethical Committee. For all the subjects, basic vital data i.e. name, age, sex, address was noted. History of tea, caffeine, alcohol intake was also noted.

Each subject was given 10 trial sessions to get familiarized with both the techniques i.e. audio-visual reaction time and critical fusion frequency measurement. Auditory and visual reaction time was measured by the audio-visual reaction time apparatus (PC1000, software based instrument designed by one of the authors. Software used is Audacity; freely available). Here, subject has to respond to the auditory and visual stimulus as quickly as possible by pressing the switch. Best of three measurements was considered as the subject's auditory and visual reaction time respectively.

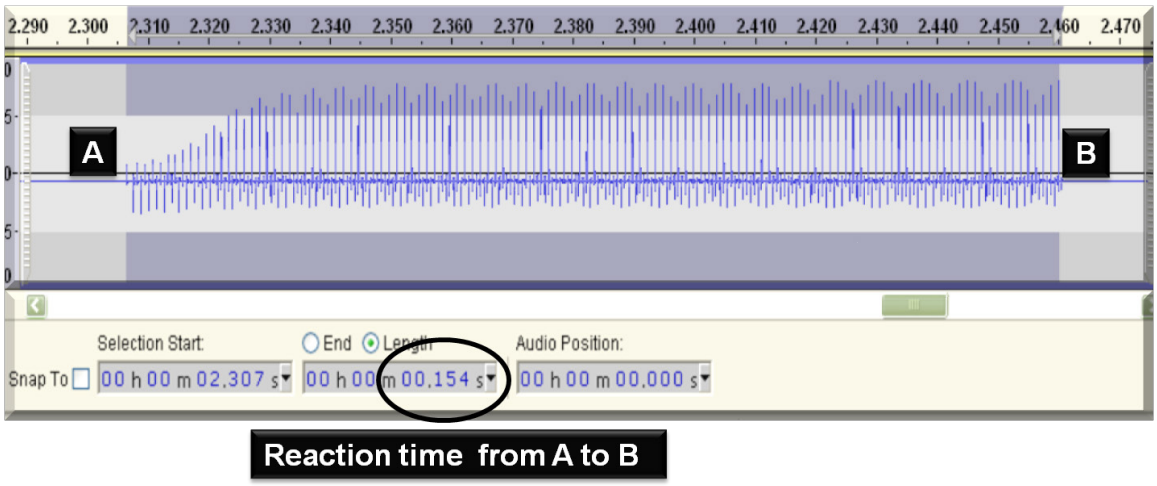


***Figure1:*** *Recording of visual reaction time. (A) Onset of stimulus; (B) End of Response by the subject. Distance between A and B is visual reaction time in msec as marked at the bottom of the screen.*

CFF apparatus was also a portable software-based apparatus designed by in house Bio-medical Engineer. Software used was SweepGen which was freely available on the net. Red LED of 5 mm diameter was used against the white background as a light source. It was kept at a distance of 30 cm from the subject's eye at the eye level. Flicker frequency was gradually increased by the rate of 1.5 Hz/sec. The frequency at which stimuli appear continuous was noted. Also by gradually decreasing the frequency of stimulation, the point at which flicker is felt was noted. Mean of such six frequencies was considered as CFF.

Data was statistically analyzed by using one way ANOVA for group wise changes in RT and CFF. Relationship between visual RT and CFF was found out by Pearson's coefficient of correlation.

## Results

As shown in table 1, both VRT and ART in male subjects showed progressive increase whereas CFF was decreased. Increase in VRT and ART was statistically significant from the age-group 40-49 years onwards when compared with the younger age groups. Decrease in CFF was statistically significant in all the age-groups when compared with 20-29 years age-group.

**Table 1: Comparison of VRT, ART & CFF in different age groups in males**

| Age group (years) | N | VRT (msec) | ART (msec) | CFF (Hz) |
|---|---|---|---|---|
| 20-29 | 20 | 179.87 ± 25.75 | 143.55 ± 20.09 | 38.80 ± 1.00 |
| 30-39 | 20 | 208.48 ±24.48 | 157.44 ± 19.34 | 37.17 ± 0.88* |
| 40-49 | 20 | 236.28 ± 34.39* | 183.83 ± 52.98* | 36.33 ± 1.02* |
| 50-59 | 20 | 270.05 ±30.47* | 214.65 ±33.56* | 35.64 ± 1.35* |
| 60-69 | 20 | 276.00 ± 44.35* | 229.58 ± 34.81* | 35.84 ± 1.47* |
| F Value | | 31.01 | 24.65 | 24.31 |
| P value | | 0.0000* | 0.0000* | 0.0000* |

In females, as shown in table 2, findings of CFF were similar to that of males. But VRT and ART were significantly higher at from the age group 50-59 years onwards when compared with the previous age-groups.

**Table 2: Comparison of VRT, ART & CFF in different age groups in females**

| Age group (years) | N | VRT (msec) | ART (msec) | CFF (Hz) |
|---|---|---|---|---|
| 20-29 | 20 | 213.32 ± 38.26 | 170.87 ± 30.45 | 38.17 ± 1.00 |
| 30-39 | 20 | 245.08 ± 43.10 | 174.62 ± 39.92 | 36.77 ± 0.83* |
| 40-49 | 20 | 243.04 ± 52.47 | 192.02 ± 29.12 | 36.19 ± 1.23* |
| 50-59 | 20 | 261.57 ±42.97* | 204.10 ± 31.41* | 35.95 ± 1.31* |
| 60-69 | 20 | 269.15 ± 44.70* | 220.22 ± 36.00* | 35.57 ± 0.47* |
| F Value | | 4.86 | 8.04 | 21.30 |
| P value | | 0.001278* | 0.000012* | 0.00000* |

Table 3 shows the result of unpaired t test. When compared the male and female of same age-groups, VRT and ART were significantly higher in females of age-group 20-29 and 30-39 years only. In higher age-groups the change was not significant. CFF results also do not show any significant change between the male and females of same age-groups.

**Table 3: Gender-wise comparison of VRT, ART & CFF in different age groups**

| Age group (yr) | N | VRT (msec) | | p value | ART (msec) | | p value | CFF (Hz) | | p value |
|---|---|---|---|---|---|---|---|---|---|---|
| Total | 200 | Male | female | | Male | female | | Male | female | |
| 20-29 | 20 | 179.87 ±25.75 | 213.32 ± 38.26 | 0.0027* | 143.55 ± 20.09 | 170.89 ± 30.45 | 0.002* | 38.80 ± 1.00 | 38.17 ± 0.1 | 0.056 |
| 30-39 | 20 | 208.48 ±24.92 | 245.08 ± 43.10 | 0.0026* | 157.44 ±19.34 | 174.62 ± 39.92 | 0.095* | 37.17 ±0.88 | 36.77 ± 0.83 | 0.139 |
| 40-49 | 20 | 236.28 ±34.39 | 243.04 ± 52.47 | 0.63 | 183.83 ±52.98 | 192.02 ± 29.12 | 0.55 | 36.33 ±1.02 | 36.19 ± 1.23 | 0.70 |
| 50-59 | 20 | 270.05 ±30.47 | 261.57 ±42.97 | 0.48 | 214.65 ±33.56 | 224.10 ± 31.41 | 0.31 | 35.64 ±1.35 | 35.95 ± 1.31 | 0.46 |
| 60-69 | 20 | 276.00 ±44.35 | 269.15 ± 44.70 | 0.6172 | 229.58 ±34.81 | 220.22 ± 36.00 | 0.39 | 35.84 ±1.47 | 35.57 ± 0.47 | 0.44 |

As depicted in table 4, VRT and ART were positively and significantly correlated with age whereas CFF was significantly and negatively correlated with age in male and females separately as well as when combined together.

**Table 4: Correlation of age with VRT, ART & CFF in males & females**

| | N | VRT (msec) | ART (msec) | CFF (Hz) | Std. alpha |
|---|---|---|---|---|---|
| Male | 100 | 0.75 | 0.71 | -0.64 | 0.38 |
| p value | | 0.000* | 0.000* | 0.000* | |
| Female | 100 | 0.43 | 0.52 | -0.63 | 0.2 |
| p value | | 0.000007* | 0.0000* | 0.0000* | |
| Both | 200 | 0.58 | 0.62 | -0.63 | 0.29 |
| p value | | 0.0000* | 0.0000* | 0.0000* | |

We have also found statistically significant but negative correlation of CFF with VRT and ART in both male and female group, separately as well as when combined together.

## Discussion

In our study we have found that there is a progressive increase in VRT and ART in both males and females with age. James L. Fozard *et al* also found slowing of simple RT in both male and female subjects across the decades. According to Waneen Wyrick Spirduso most of the slowing of responses in the aged is attributable to CNS processing.[8]

J. Richard Simon *et al* proposed that aging affects stimulus encoding but not response selection in elderly subjects when tested with choice RT. They have also shown that information processing is affected prior to the encoding stage but the encoding stage was the primary locus of the slowing which accompanied aging.[9]

In our study CFF showed a small but consistent decrease with age. Similar results were found by Brozek, J Keys. CFF is one of the measures of cortical processing capacity and central fatigue. This was evident by increase in CFF value with exercise induced arousal [10] as well as with the regular yogic practices including meditation.[11]

It has been shown by many researchers that with advancing age, there is degeneration of the optic nerve and cerebrum.[5]Aalso there is an accelerated increase of lens absorption and scatter or an accelerated loss of cellular elements of the retina, the afferent visual system,

or the combination of both.[12] According to Curcio the number of rods decreases linearly with increasing age, whereas cone density is not reduced significantly throughout adulthood. [13] Hence, decrease in CFF across the age groups can be attributed to decrease in neurons in visual pathway or in the visual cortex.

As shown in table 3, both VRT and ART were significantly higher for females in younger age groups when compared with males of same age groups but not after the age of 40 years. Also the difference in CFF values was not significant in any of the age groups. This suggests that aging related decrease in cortical processing may be responsible for these changes in both males and female subjects. VRT and ART were positively and significantly correlated with age whereas CFF was significantly but negatively correlated with age. Also the CFF is significantly and negatively correlated with VRT and ART. This suggests that changes in RT with age are partly associated with prolongation of central processing speed.

## Conclusion

In our study we conclude that the RT increases and CFF decreases with age. These changes are similar in both male and female subjects. As CFF is negatively correlated with RT, and also the age, it can be the reason for changes in RT as age advances.

**Source of Support:** Nil

**Conflict of Interest:** None declared.

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# Dyselectrolytaemia in Middle Aged Type II Diabetes Mellitus – A Harbinger of Cardiac Function Abnormalities

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## Abstract

**Background :** Diabetes mellitus(DM) is a chronic metabolic disorder. The management of blood glucose and other modifiable risk factor is a key element in the multifactorial approach to prevent complications of diabetes and decreasing the mortality and morbidity.

**Aim and Objective of the Study:** To determine the serum electrolyte (sodium & potassium) in asymptomatic type II diabetic cases and with controls. **Materials and Method:** Fifty type II DM cases aged between 30-55 years and fifty age and sex matched controls were selected from general population. Detailed physical and systemic examination was done. Ethical clearance and informed consent was taken. Estimation of Serum electrolytes (Sodium and Potassium) is done by Ion selective electrode method. Unpaired t-test was used to compare the parameters between type II DM cases & controls by using SPSS version 16. Level of significance was set at $p<0.05$. **Results:** There was statistically significant increase in Serum potassium level among type II diabetics when compared to controls ($p< 0.001$) **Conclusion:** There was significant increase in Serum potassium level among type II diabetics when compared to controls . Hence the screening tests such as estimation of serum electrolytes are strongly recommended at the time of diagnosis for proper interventions which could prevent the complications at an earlier date.

***Keywords:*** *Type II Diabetes mellitus, Serum electrolytes. Cardio vascular abnormalities, Serum Potassium, Serum Sodium.*

## Introduction

Diabetes mellitus (DM) is a chronic metabolic disorder[1]. The management of blood glucose and other modifiable risk factor is a key element in the multifactorial approach to prevent complications of diabetes and decreasing the mortality and morbidity.

## Materials and Method

Estimation Serum Sodium and Potassium[2]

**Method**: Ion selective electrode method (ISE) using undiluted specimens (ISE direct method)

**Principle;** Analyzer fitted with ISEs usually contain $Na^+$ electrodes with glass membrane and $K^+$ electrodes with liquid ion exchange membranes that incorporate valinomycin. Potentiometry is the determination of change in electromotive force (E potential) in a circuit between a measurement electrode, as the selected ion interacts with the membrane of the ISE. In instrument applications the measuring system is calibrated by introduction of calibrator solutions containing defined amounts of $Na^+$ and $K^+$.The potentials of the calibrators are determined, and the $\Delta E/\Delta \log$ concentration is stored in microprocessor memory as a factor for calculating unknown concentration when E of the unknown is measured.

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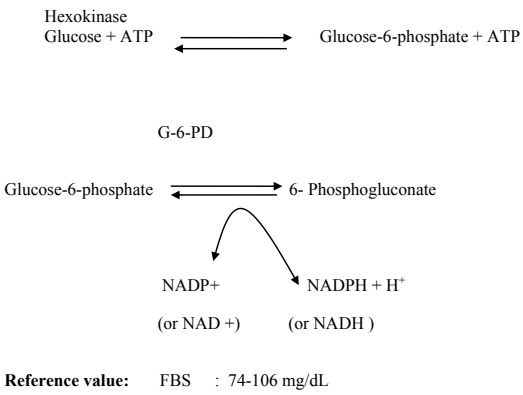
Normal Values S.Sodium : 135-148 mmol/L

S.Potassium : 3.7-5.3 mmol/L

Blood Sugar level

Estimated by Hexokinase method [3]

Glucose is phosphorylated by ATP in the presence of hexokinase and magnesium ($Mg^{2+}$). The glucose-6-phosphate formed is oxidized by glucose-6-phosphate dehydrogenase(G6PD) to 6- phosphogluconate in the presence of nicotinamide adenine dinucleotide phosphate(NADP+) . The amount of NADPH produced is directly proportional to the amount of glucose in the sample and is measured by absorbance at 340 nm. G6PD derived from yeast is used in the assay with NADP+ as the cofactor. The oxidized form of nicotinamide adenine dinucleotide (NAD+) is the cofactor if bacterial (Leuconostoc mesenteroides) G6PD is used , and the NADH produced is also measured at 340nm.




**Reference value:** FBS : 74-106 mg/dL

## Findings

### Subject Information

**Sex Distribution:** Out of 50 subjects 20 were male's and 30 were female in type II DM cases and controls of each group respectively (Table- 01).

**Age :** The mean age (yrs) was 45.8 ± 4.9 and 45.9 ± 5.0 in type II DM cases and type II DM controls respectively (Table-01).

**Height :** The mean height (in cms) were 161.58 ± 8.3 and 160.98 ± 6.02 in type II DM cases and controls respectively (Table-02). There was no significant difference in height between type II DM cases and controls (p>0.05).

**Weight :**The mean weight (in kgs) were 64.44 ± 7.78 and 57.46 ± 5.65 in type II DM cases and controls respectively (Table-02). There was statistically highly significant increase in weight in type II diabetics when compared to controls (p< 0.001).

**Body Mass Index (BMI) :**The BMI (in kg /$m^2$) were 24.55 ± 2.19 and 22.15 ± 1.37 in Type II DM cases and controls respectively (Table-02). There was highly significant increase in BMI among type II diabetics when compared to controls (p < 0.001).

**Pulse :**The mean pulse rates (bpm) were 75.18 ± 1.11 and 76.21 ± 10.2 in type II DM cases and controls respective (Table-02). There was no significant difference in pulse rate between type II diabetic cases and controls (p> 0.05).

**Systolic Blood Pressure:** The mean SBP (in mmHg) were 123.5 ± 1.11 and 120.42 ± 12 in Type II DM cases and controls respectively (Table-02). There was no significant difference in SBP among type II diabetics and controls (p>0.05).

**Diastolic blood Pressure:** The mean DBP (in mmHg) were 79.44 ± 3.23 and 79.16 ± 2.65 in Type II Diabetics and controls respectively (Table-02). There was no significant difference in DBP among type II DM cases and controls (p >0.05).

### Bio-Chemical Parameters

**Fasting blood Sugar:** The fasting blood sugar (in mg/dl) levels were 162.32 ± 57.09 and 86.98 ± 9.66 in type II DM cases and controls respectively (Table-03). There was statistically high significant increase in FBS level in Type II diabetics when compared to controls (p< 0.001).

**Serum Sodium:** The mean serum sodium (in mmol /L) levels were 141.12 ± 3.50 and 140.96 ±2.04 in type II DM cases and controls respectively (Table-03). There was no significant difference in serum sodium levels among type II diabetics when compared to controls (p> 0.05).

**Serum Potassium:** The mean serum potassium (in mmol/L) levels were 4.86 ± 0.49 and 4.40 ± 0.13 in type II DM cases and controls respectively (Table-03). There was statistically highly significant increase in Serum potassium level among type II diabetics when compared to controls (p< 0.001).

**Table -01: Age and Sex Comparison of the Group's Studied**

| Variables | | DM- II | CONTROLS |
|---|---|---|---|
| Subjects | NO | 50 | 50 |
| Gender | Male | 20 | 20 |
| | Female | 30 | 30 |
| Age (yrs) | Mean ±SD | 45.8 ± 4.9 | 45.9± 5.0 |
| | Range | 35-54 Yrs | 35-54 Yrs |

**Table-02: Comparison of variables Between Type - II DM cases and Controls**

| Type II DM | | | | | |
|---|---|---|---|---|---|
| **Variable** | **Group** | **Mean** | **SD** | **t value** | **p value** |
| HEIGHT(cms) | DM II | 161.58 | 8.34 | 0.41 | 0.68 |
| | Controls | 160.98 | 6.02 | | |
| WEIGHT(kg) | DM II | 64.44 | 7.78 | 5.13 | 0.000 ** |
| | Controls | 57.46 | 5.65 | | |
| BMI(kg/m$^2$) | DM II | 24.55 | 2.19 | 6.57 | 0.000 ** |
| | Controls | 22.15 | 1.37 | | |
| PULSE(mmHg) | DM II | 75.18 | 1.11 | 0.70 | 0.47 |
| | Controls | 76.21 | 10.2 | | |
| SBP(mmHg) | DM II | 123.5 | 1.11 | 1.74 | 0.08 |
| | Controls | 120.42 | 12.4 | | |
| DBP(mmHg) | DM II | 79.44 | 3.23 | 0.47 | 0.64 |
| | Controls | 79.16 | 2.65 | | |
| Unpaired t test | | | | | |
| ** p < 0.001, HS | | | | | |
| p > 0.05: not Sig. | | | | | |

**Table - 03: Comparison of FBS, Electrolytes and Lipid Profile Parameters between Type II DM Cases and Controls**

| Variable | Group | Mean | SD | t value | p value |
|---|---|---|---|---|---|
| FBS(mg/dl) | DM II | 162.32 | 57.09 | 9.20 | 0.000 ** |
| | Controls | 86.98 | 9.66 | | |
| SODIUM(mmol/L) | DM II | 141.12 | 3.50 | 0.29 | 0.775 |
| | Controls | 140.96 | 2.04 | | |
| POTASIUM(mmol/L) | DM II | 4.86 | 0.49 | 6.38 | 0.000 ** |
| | Controls | 4.40 | 0.13 | | |
| | Controls | 32.97 | 16.76 | | |
| | | | | | |
| Unpaired t test | | | | | |
| * p < 0.05, Sig | | | | | |
| ** p < 0.001, HS p > 0.05: not Sig. | | | | | |

## Discussion

India leads the world today with the largest number of diabetics in any given country. Diabetes is a major cause of mortality, but several studies indicate that diabetes is likely under reported as a cause of death. A recent estimate suggested that diabetes was the fifth leading cause of death worldwide.

### Weight and Body Mass Index

In this study increase in weight and BMI was seen in both type I and type II diabetics when compared to controls.

This increased weight and BMI in diabetics could be due to increase in adiposity associated with insulin resistance attributed to more of sedentary life style and less physical activity. Increase in body weight and BMI are important predictors of metabolic disturbances including dyslipidemia, hypertension and cardiovascular diseases .[4]

Similar findings were also seen in study done by Sani FB et al .[1]

### Fasting blood sugar

There was significant increase in blood sugar level in both type I and type II diabetics when compared to controls. This higher blood sugar values observed in diabetics were expected because, a person is said to be diabetic if fasting blood sugar is more. The increased FBS level in diabetics arises from the deficiency of insulin, the key hormone in the regulation of glucose metabolism.[5]

This increased blood sugar level can be taken as a simple biochemical marker in diabetic subjects to indicate their state of metabolic control and to intervene early in the treatment. The persistent hyperglycemia is an indicator of developing early complications in diabetics.

Similar findings were consistent with the study done by Onwuliri VA et al,[5] Banerjee S et al [6] and Gayoum AGAA et al.[7]

### Serum Sodium

In our study there was statistically significant increase in serum sodium levels in type I diabetics when compared to controls and no significant difference in type II diabetics and controls.

This increase in serum sodium level can be explained as that, the $Na^+ – K^+$ ATPase is a ubiquitous enzyme that ensures that the transmembrane gradient of sodium and potassium concentrations are maintained. Alterations of this transport enzyme are thought to be linked to several complications of diabetes mellitus. As the activity of $Na^+ – K^+$ ATPase enzyme is dependent on insulin and the dysfunction of this enzyme is probably connected with the relative insulinopenia of hyperglycemic type I diabetic patients promoting sodium retention and causing expansion of total body sodium levels. This increased serum sodium level could also be attributed by the transitionary sodium retention due to increased sodium reabsorption from proximal renal tubules.[8]

Similar findings were also reported in earlier studies done by Shahid SM et al,[8] Onwuliri VA et al[5] and Saito T et al.[9]

### Serum Potassium

In our study serum potassium level was significantly increased in type II diabetics whereas it was decreased in type I diabetics when compared to controls.

This altered distribution of serum potassium levels in diabetics could be due to hyperglycemia. The higher level of plasma glucose level results in greater reduction in circulating blood volume, as there was a significant negative correlation between plasma glucose and percent changes in blood volume. These changes might have increased the serum potassium levels. Also hyperosmolality would promote cellular dehydration, thus providing an increase in $K^+$ efflux from the cells leading to increased serum potassium levels in diabetics. The altered distribution of electrolytes is not merely dependent on hyperosmolality but also on insulin which affects the activity of $Na^+ – K^+$ ATPase enzyme. The dysfunction of $Na^+ – K^+$ ATPase is implicated in the altered distribution of electrolytes ($Na^+$& $K^+$) between intra and extracellular spaces.

Similar findings were also reported in earlier studies by Shahid SM et al,[8] Onwuliri VA et al,[5] and Saito T et al.[9]

## Conclusion

The following conclusion can be drawn from the results of our study.

There was significant increase in weight, BMI and fasting food sugar level in both type I and type II diabetics when compared to controls.

Pulse rate was significantly increased in type I diabetics than non diabetics.

Serum sodium levels were significantly increased in type I diabetics than controls.

Serum potassium level was significantly decreased among type I diabetics whereas it in increased in type II cases when compared to controls.

**Conflicts of Interest:** Nil

**Ethical Clearance**: Taken from JJMMC Davangere ethical committee

**Source of Funding**: Self

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# Spatial Localization of Sound in Early Blind During Spatial Bisection Task and Minimum Audible Angle Task

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## Abstract

**Background:** Research has shown that early blind have supra-normal localization abilities in the azimuthal plane while performing a minimum audible angle task which is based on egocentric paradigm. An opposing view has been proposed that the early blind have a deficit in spatial localization of sound in the horizontal plane during an allocentric based task such as spatial bisection of sound. The objective of our study was to assess spatial localization of sound in the early blind by means of minimum audible angle task and spatial bisection task.

**Methods:** A total of ten early blind and ten normal sighted blind folded controls were subjected to minimum audible angle task and spatial bisection task in the azimuthal plane.

**Results:** The early blind subjects performed significantly poorer than controls in the spatial bisection task which was based on the allocentric model. However, they performed as well as the controls in the Minimum audible angle task which was based on egocentric model.

**Conclusion:** The minimum audible angle task based on the egocentric paradigm does not require a metric representation of auditory space whereas allocentric paradigm based task would require the same. However the spatial bisection task which is based on the allocentric paradigm taxes the retinotopic maps. Hence the poor performance in this task

***Key words:*** *spatial bisection task, Minimum audible angle task, early blind, cross sensory calibration*

## Background

The consequence of blindness in the development of sound localizing abilities in the early blind has been a subject of research in the last decade. The research work in this area of neuroscience has yielded two different and opposing viewpoints. One set of research studies has proved that early blind are blessed with supra–normal abilities in the azimuthal plane [1]. An opposing view is that the early blind have a deficit in the spatial localization of sound in the horizontal plane [2]

At this point, we need to consider the reference frames that are used to localize sounds. The frames of reference are the means of representing the location of entities in space [3]. The two dominant ones include the egocentric frame of reference which uses the subject as the centre of environment [4] and the allocentric frame of reference, which is centred on external objects or the environment itself [5].

The objective of our research study was to study spatial localization of sound in the early blind during minimum audible angle task which is an egocentric task and during spatial bisection task which is an allocentric task.

## Subjects, Materials and Method

### Subjects:

Ethical approval was obtained from the institutional ethical clearance committee as part of an ICMR short term studentship 2017 project. Ten early blind subjects and ten age and gender matched controls were recruited for the study based on the inclusion and exclusion criteria. Early blind were defined as those who had complete

blindness by eleven years of age. Of the ten early blind subjects, eight were blind since birth and the remaining two had lost vision completely by the age of five years. Blindness was defined by World Health Organization criteria as visual acuity of less than 3/60 in both eyes. Inclusion criteria were: age more than nineteen years and normal hearing as screened by hearing test @audiologia 1.1.2. Exclusion criteria were: history of occupational exposure to loud sounds, history of consumption of ototoxic drugs, history of neurological impairment, ear diseases or any acute or chronic ailments other than blindness.

A total of twenty subjects included in the study were screened for deafness by 'Hearing Test version 1.1.2'. They were explained about the procedure of the test and each of them gave their informed consent. The blind gave their left thumb impression upon reading the informed consent in Braille.

**Instrument:**

The Audiometer mobile application 'Hearing Test version 1.1.2' (by developer: hearingtest@e-audiologia.pl), calibrated according to the default headphones of the phone was used which gives a result as (i) 'Normal hearing', or Hearing loss in increasing degrees as (ii)'Mild', (iii) 'Moderate' or (iv) 'Severe' hearing loss and (v) 'Deafness'.

The horizontal arrangement of Generic Passive 5-Volt Speaker modules, compatible with Arduino microcontroller board was placed on a table 150 cm away from the height-adjustable chair where the subjects took their seat. An angle of 2° was maintained between neighbouring speakers such that a total of 21 speakers covered the total angular distance from +20° to -20° with respect to the position of the subject. 'Arduino' is an open-source platform based on easy-to-use hardware and software that provides a programming tool, Arduino IDE (Integrated Development Environment), for writing code and uploading it to the Arduino board and was used in the study. The duration of sound production and the intervals between successive sounds were programmed on the IDE software on the laptop to which the microcontroller was connected.

## Method

The study was carried out in an anechoic room, in the Department of Physiology, Bangalore Medical College and Research Institute. Each subject sat on a height adjustable chair and the row of twenty one 5-Volt speakers was placed such that the subject's ears and speakers were at the same horizontal level. The central speaker was placed in front of subject 150 cms away.

**Minimum audible angle task:**

Two sounds each of 1.5 kHz frequency and of 75ms duration which were separated by a gap of 500msec duration were produced: The first from central speaker and the second sound from the speakers to the left of central speaker for 5 trials and from the speaker to the right of central speaker for 5 trials. During each trial, the subject had to say whether the two sounds were from same speaker or two different speakers. The angular separation between the 2 sounds was noted in each trial. The data was noted as the minimum angular separation between the 2 speakers.

**Spatial bisection task:**

The subject was seated as for the minimum audible angle task. The same instrument was used for this test. Three sounds of 75ms duration and 1.5 kHz frequency were presented from the speakers to each subject. The first sound was produced from -20° speaker, the third sound from + 20° speaker and the second sound from any other speaker except the central speaker. The subject had to say whether the second sound was closer to the first or third sound. The number of correct responses was noted. A total of 30 trials were done for each subject and their responses were noted. The angular distance of the second sound from the central speaker was noted from the computer programme.

## Statistical Analysis

Descriptive statistics were performed and data were expressed as mean and standard deviation. Inferential statistics were done to compare the means between early blind and age and gender matched controls. P-value less than 0.05 was considered to be significant. Graph was plotted using Microsoft excel.

## Observations and Results

**Table 1: Descriptive Statistics for age and gender matching of the subjects**

| | Early blind n = 10 | Sighted controls n = 10 | P - value |
|---|---|---|---|
| Age (in years) | 22 ± 4 | 20 ± 1 | 0.2 |
| Gender (M : F) | 7 : 3 | 7 : 3 | 0.6242 |

**Table 2: Minimum audible angle expressed as mean and Standard deviation from minimum audible angle task in the early blind and blindfolded sighted controls**

| | Early blind n = 10 | Sighted Controls n = 10 | P-Value |
|---|---|---|---|
| Minimum audible angle (°) (left of the central speaker) (Mean ± SD) | 3 ± 1 | 3 ± 1 | P = 0.06 |
| Minimum audible angle (°) (right of the central speaker) (Mean ± SD) | 3 ± 1 | 3 ± 2 | P = 0.134 |
| Minimum audible angle (°) (mean of both sides) (Mean ± SD) | 3 ± 1 | 3 ± 1 | P = 0.672 |

**Table 3: Mean and Standard Deviation (SD) of the number of correct responses out of 30 trials per subject in the spatial bisection task**

| | Early blind n = 10 | Sighted controls n = 10 | P - Value |
|---|---|---|---|
| Number of correct responses (Mean ± SD) | 25 ± 4 | 26 ± 2 | 0.0095* |
| Percentage of correct responses | 82% | 87% | |

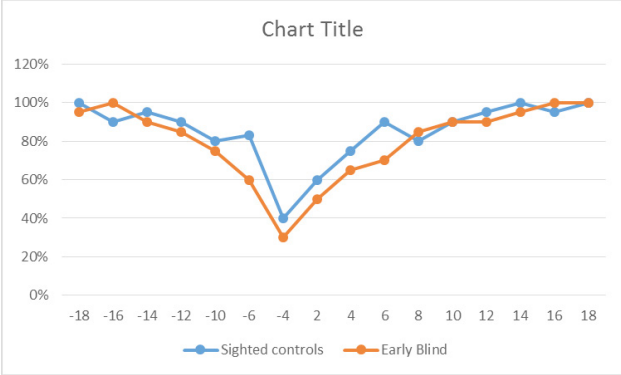
*** P<0.01: hence highly significant**

Graph 1: Angular position of the 2nd sound in spatial bisection task in X-axis and the percentages of correct answers in the Y-axis

Table 1 shows the descriptive statistics of the subjects in each group expressed as mean and standard deviation. There was no significant difference in means of age in years between the two groups. The two groups were gender matched and male to female ratio was 7:3

Table 2 shows that there was no significant difference between the 2 groups with respect to their performance in the minimum audible angle task. This means that the early blind performed this task as good as the blindfolded sighted controls.

Table 3 shows that the comparison of mean of correct responses during spatial bisection task between two groups was significant. The early blind performed the task significantly poorly compared to the controls.




**Graph 1 shows the angular position of the second sound during spatial bisection task in X-axis and the percentages of correct answers in the Y-axis.**

## Discussion

In this study, table 1 shows that there is no significant difference between the two groups with respect to age and gender. This emphasizes that the two groups were age and gender matched.

Table 2 shows minimum audible angle task performance of both groups. There was no significant difference between the two groups. This means that the early blind were as good as controls. Gori et al had conducted a study on minimum audible angle in congenital blind and found similar results in the minimum audible angle task [2] This task is based on the egocentric frame of reference. In this task the subject localizes the sound with respect to himself and hence

does not require a metric representation of auditory space which an allocentric paradigm requires.

Table 3 shows the performance of the subjects on spatial bisection task. The P-value of 0.0095 shows that early blind performed significantly worse than the controls. This task is based on allocentric frame of reference. To perform this task successfully, the subject needs to have had intact vision in his childhood. To visualize space, a person needs to have intact vision in childhood when utilizing the retinotopic mapping to calibrate their sound localization skills. In the retinotopic blind, this development would not have taken place as the visually impaired lacked visual calibration of the ability to localize sound in space[5].

There is sufficient evidence that the visual system plays a major role in calibrating auditory localization. Owls reared with distorting prisms show persistent and systematic biases in auditory localization. A study has shown that visually deprived ferrets show impaired development of auditory spatial map in the superior colliculus. The above cited examples indicate that vision is very important for the formation of auditory spatial maps[2,7] . Gori et al described that cross sensory calibration is a general property of the sensory system especially during the early years when the sensory apparatus is still developing [2]. They explained that while the sensory systems are still developing and have not yet reached complete maturity, the more accurate and robust sensory system calibrates the other sensory system. In these ten early blind subjects, lack of visual calibration of the developing spatial localization of sound in their childhood resulted in their poor localization abilities.

**Strengths and limitations of the study:**

The strength of this study was its adequate sample size and thorough age and gender matching of the subjects of the two groups. Another feature in this study was utilization of the Arduino microcontroller board to control the speakers. This removed bias by enabling the sound stimuli to be completely identical for each subject.

In our study, the tasks were performed only in the horizontal plane and not in vertical plane. This was chosen as it is the more commonly used plane during way finding in the blind. For a more thorough understanding of spatial localization of sound, the vertical plane should also be studied. Also, further insight can be gained by examining localization in different directions other than the front as was done in this study.

Future directions look at studying spatial bisection and minimum audible angle in the vertical plane in early blind and late onset blind and at finding out whether sensory motor feedback training will improve spatial localization of sound in early blind [5].

## Conclusion

The early blind group performed poorer than the normal sighted blindfolded controls in the spatial bisection task. . However their performance in minimum audible angle task was as good as the controls. This means that they did well on the egocentric task which does not require a metric representation of auditory space which an allocentric paradigm-based spatial bisection task would require. In the early blind, the absence of vision when the sensory systems were developing results in lack of visual calibration of auditory spatial localization skills. Hence this supports the cross sensory calibration hypothesis.

**Conflict of Interest:** Nil

**Source of Funding:** Nil

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# Relation of Anthropometric and Lifestyle Related Factors with Primary Dysmenorrhea

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## Abstract

Menstrual cycle is a cycle of natural changes that occurs in the uterus and ovaries as an essential part of making sexual reproduction possible. The biological activity of the menstrual cycle is created by coordination among hypothalamic, hypophyseal and ovarian hormones. Many females suffer from dysmenorrhea, painful cramping sensation in the lower abdomen during menstruation. It is one of the most frequently encountered gynaecological disorders, often accompanied by other biologic symptoms, including fatigue, dizziness, sweating, headaches, back ache, nausea, vomiting, and diarrhoea, all occurring just before or during menses

Our aim was to assess the anthropometric measurements during the different phases of menstrual cycle in premenopausal girls and women. The present study was targeted at further unveiling the effect of menstrual cycle on weight changed during its different phases. Body mass index was calculated and the interconnection of the same with the prevalence and the severity of dysmenorrhea was sought.. The major findings of the present study are high prevalence of dysmenorrhea (68%) among healthy female volunteers. Among them 36% suffered from severe pain during their menstruation when they had to cut down on their activities and take medications to ameliorate their pain. There is **no** significant relation existed between dysmenorrhea and age at menarche, nature of diet, and BMI. On the other hand, weight changes were of equal significance in women afflicted and not afflicted with dysmenorrhea. Hence they are not related to occurrence of painful periods.

***Key words:*** *Menstrual cycle Dysmenorrhea Anthropometry*

## Introduction

One of the most important attributes of female body that makes it the seat of procreation is menstrual cycle. Menstrual cycle is a cycle of natural changes that occurs in the uterus and ovaries as an essential part of making sexual reproduction possible.[1,2] The first cycle usually begins between twelve and fifteen years of age, a point in time known as menarche.[3] The biological activity of the menstrual cycle is created by coordination among hypothalamic, hypophyseal and ovarian hormones.[4]

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Menstrual cycle has been divided into two major phases, one before ovulation known as follicular phase and one after ovulation known as luteal phase**.** . During follicular phase of each menstrual cycle, a cohort of follicles begins to grow in the ovary.[5] As the dominant follicle grows, there is a concomitant rise in estrogen levels.[5] In the same phase, increasing levels of estrogen are responsible for the growth of fresh uterine endometrium post menstruation.[5]As the estrogen levels peak, the resulting LH surge occurs 10-12 hrs before ovulation.[5]Once ovulation occurs, a cascade of changes transform the remnant follicle into corpus luteum.[6] Nine to eleven days after ovulation corpus luteum regresses rapidly, a process known as luteolysis.[5]This is followed by a massive dip in circulating levels of estradiol and progesterone, a phenomenon heralding

phase of menstruation. Menstruation in many females is associated with painful cramping sensation in the lower abdomen. It is known as dysmenorrhea.

Dysmenorrhea is one of the most frequently encountered gynecologic disorders.[7] More than 50% of postpubescent menstruating women are affected by dysmenorrhea, with 10% to 12% of them having severe dysmenorrhea with incapacitation for 1 to 3 days each month.[8,9,10] Dysmenorrhea is most common in women between the ages of 20 and 24 years, with most of the severe episodes occurring before 25 years of age.[11] Primary dysmenorrhea is painful menstruation seen only in ovulatory cycles usually developing within 6 to 12 months of menarche with no pathology or organic basis.[7,12,13] Primary dysmenorrhea usually begins a few hours before or just after the onset of menstruation. The main causes of primary dysmenorrhoea are prostaglandins, leukotrienes and genetic factors. The cramps are most severe on the first or second day of menstruation. Secondary dysmenorrhea is usually due to pelvic pathology and it is not common in adolescent girls. The causes of secondary dysmenorrhea include endometriosis, presence of the intrauterine device, pelvic inflammatory disease and infection, adenomyosis, uterine myomas, polyps and adhesions, congenital malformation of the müllerian system, cervical stricture or stenosis, ovarian cyst, pelvic congestion syndrome, and Allen-Masters syndrome. The appearance of painful menstrual cramps years after the menarche may be a sign of secondary dysmenorrhea, frequently caused by endometriosis. In women with anovulatory cycles, the menstrual pain is likely to be secondary dysmenorrhea.[14]

In some studies, it has been demonstrated that women suffering from primary dysmenorrhea had higher BMI.[15] Also U-shaped association between dysmenorrhea and BMI has been shown, revealing a higher risk of dysmenorrhea for both underweight and obese women. Hence maintaining a healthy weight over time may be important for women to have pain-free periods.[16]

The present study was targeted at further unveiling the effect of menstrual cycle on weight as it changed during its different phases. Body mass index was calculated and the interconnection of the same with the prevalence and the severity of dysmenorrhea were sought.

## Materials and Method

This cross sectional study was carried out on healthy female volunteers in the age group of 15 to 45 years. A total of 50subjects were included in the study using a predesigned proforma and by measuring physiological parameters of weight, height and BMI during the two major phases of menstrual cycle, follicular and luteal phases. . Participants were asked to report their menstruation characteristics based on their experience over the last twelve months. The first day of bleeding was to be considered as the first day of cycle. Duration of bleeding was to be defined by the first day of the appearance of any spots until the complete spotlessness. Physical activity was measured using a semantic scale in which participants were asked to rate their physical activity from 'inactive' to 'very active.' The severity of dysmenorrhea was assessed by a scoring system reported by Anderch and Milsom [1982].[17] The height was measured using a non-elastic measuring tape fastened to a vertical wall in an erect standing position. Weight was recorded twice during the menstrual cycle. Once in follicular phase (on average 9$^{th}$ day of cycle) and once in luteal phase (on average 25$^{th}$ day of cycle).Weight was recorded using standard bathroom weighing scale. BMI [Body Mass Index] was calculated using internationally accepted formula:

BMI = Weight (Kg)/ Height (m)2 i.e., Kg/m2[18]

## Observations and Results

Out of 50 subjects included in the study, majority [28] were in the age groups 15-20 and 20-25 [13] years, with mean age being 26.18 years. Their mean weight was 60.43 kg and the mean height was 5.32 feet. Their mean BMI was in healthy range 23.04.

The mean age at menarche was 13.08 years. 19 out of 50 subjects had their menarche at the age of 12 and 17 out of 50 at the age of 14.

32 % subjects were without Dysmenorrhea, majority 68% were with Dysmenorrhea of which 12% suffered mild pain, 20% suffered from moderate pain and 36% severe pain..

Mean ± SD of BMI in subjects with dysmenorrhea was 22.97±4.18 and in subjects without dysmenorrhea was more at 23.19±3.91. Subjects who are thinner seem to suffer more but the difference is not statistically significant at $p<0.858$.

**Table 1:- Association between Dysmenorrhea and diet**

| | Number of subjects | No. of sub. Consuming veg. diet | No. of sub. Consuming mixed diet | P value |
|---|---|---|---|---|
| Dysmenorrhea | 34 | 15 | 19 | 0.193 |
| No Dysmenorrhea | 16 | 4 | 12 | |

**Table 2:- Interconnection between Dysmenorrhea and Family History**

| | Number of subjects | Number of subjects with positive family history | Number of subjects with negative Family history | P value |
|---|---|---|---|---|
| Dysmenorrhea | 34 | 29 | 05 | 0.008 |
| No Dysmenorrhea | 16 | 08 | 08 | |

**Table 3:- Relationship Between age and severity of dysmenorrhea**

| Age group [years] | Number of subjects | No. of sub. With no pain | No. of sub. With mild pain | No. of sub. With moderate pain | No. of subjects with severe pain |
|---|---|---|---|---|---|
| 15-20 | 15 | 2 | 0 | 3 | 10 |
| 20-25 | 13 | 2 | 4 | 2 | 5 |
| 25-30 | 6 | 3 | 0 | 3 | 0 |
| 30-35 | 5 | 2 | 2 | 0 | 1 |
| 35-40 | 5 | 3 | 0 | 1 | 1 |
| 40-45 | 6 | 4 | 0 | 1 | 1 |

**Table 4:- Effect of follicular and luteal phases of menstrual cycle on different physiological parameters**

| Physiological parameters | Follicular phase | Luteal Phase | t-value | p-value |
|---|---|---|---|---|
| Weight | 59.78±9.36 | 61.08±9.43 | 12.876 | 0.000 |
| BMI | 22.79±4.02 | 23.29±4.09 | 12.34 | 0.000 |

**Table 5:- Association of weight gain during follicular and luteal phases with severity of Dysmenorrhea**

| History of painful periods | Number of subjects | Weight [Follicular Phase] | Weight [Luteal Phase] | T value | P value |
|---|---|---|---|---|---|
| No pain | 16 | 60.91±8.76 | 62.16±8.55 | 8.257 | 0.000 |
| Mild pain | 6 | 54.58±3.77 | 55.58±3.87 | 7.74 | 0.001 |
| Moderate pain | 10 | 56.80±6.16 | 58.10±6.77 | 4.80 | 0.001 |
| Severe pain | 18 | 62.17±11.76 | 63.62±11.79 | 7.49 | 0.000 |

**Table 6:- Inter relationship between dysmenorrhea and weight gain**

| History of painful periods | Number of subjects | Weight [Follicular phase] | Weight [Luteal phase] | t value | P value |
|---|---|---|---|---|---|
| No pain | 16 | 60.91±8.76 | 62.17±8.55 | 8.25 | 0.000 |
| Pain | 34 | 59.25±9.70 | 60.58±9.90 | 10.06 | 0.000 |

## Discussion

The current study shows that 68% of healthy subjects (34 out of 50) included in the study suffered from dysmenorrhea. Out of these 50 subjects, 12%, 20% and 36% suffered from mild, moderate, and severe dysmenorrhea respectively (categorized on the basis of Andersch and Milsom scoring scale).[17]Similar findings were reported by Mckay and Diem (67%)[19],Sundel et al (67%)[20],Harlow and Park (71.6%)[21] and Ibrahim NK et al (60.9%).[22]Two more studies reported prevalence of 72.4% in Sweden [12] and 72% in Nigeria.[23,24]An Indian study reported relatively lower prevalence of 33.84% .[25]A Turkish study also showed a slightly lower prevalence of dysmenorrhea (55.5%).[26]Higher prevalence was reported by an Egyptian study.[27] The results of this study showed that the prevalence of dysmenorrhea was 76.1% (n = 643); of these, 26.6% described their menstrual pain as mild, 32.0% as moderate and 41.4% as severe.[27] The causes of discrepancies may be attributed to the use of different scales for grading pain.[28]Pain is an extremely subjective symptom which is very difficult to quantify. Researchers have, therefore, reported different ways to measure pain by various scoring systems. Some studies used VAS whereas others used Andersch & Milsom scale. Further, the variations may be due to differences between the target populations, lifestyle, or due to absence of a standardized universally accepted method for defining dysmenorrhea.[29,30] Present study showed an insignificant association between BMI and dysmenorrhea ($p > 0.05$). The results are in coherence with studies conducted in Sweden and New Zealand, that demonstratedseverity and prevalence of dysmenorrhea were unaffected by women's weight.[17,20,31]However, it has been shown in studies in US and Poland that being overweight was an important risk factor for experiencing menstrual pain.[21,32]The findings could be attributed to possibility of obese women tending to have higher estrogen levels.[33]It has also been shown that people with higher BMI have higher levels of prostaglandin.[34] Both high estrogen and high prostaglandins are probable mechanisms of dysmenorrhea. On the other hand, a study done in Taiwan found that nurses with dysmenorrhea had both lower body weight and Body Mass Index.[35] The results of the present study showed that the mean weight of subjects increased significantly by 1.3 kg during luteal phase compared to follicular phase of the menstrual cycle ($p < 0.05$). Almost similar results were shown by a study conducted by Oian P et al,reporting a significant, average weight gain of 0.7 kg in the subjects during the luteal phase.[36]The same study reported that the plasma and interstitial colloid osmotic pressures were reduced with no significant change in the serum albumin levels during the luteal phase and concluded it could be due to

water retention. [37]In another study, Robinson and Watson noted daily fluctuations in weight, of 0.59 to 2.07 kg, in women throughout the menstrual cycle with an increase in weight prior to menstruation and a decrease in weight eight days after the onset of menses. A slight increase in weight was also noted two days after ovulation.[38] The study by Rosenfeld et al also revealed exaggerated increases in Plasma renin angiotensin (PRA) and plasma aldosterone levels during the late luteal phases of women suffering from PMS. Furthermore, plasma levels of both fluid regulatory hormones positively and significantly correlated with plasma levels of progesterone. Summing it all up, the study pointed towards a relation between fluid retention and increased levels of plasma aldosterone and PRA which in turn seemed to be due to imbalance in levels of estrogen and progesterone during the late luteal phase. Present study also shows that the weight gain that occurred during the luteal phase of the menstrual cycle was statistically significant in both groups ($p < 0.05$), subjects who suffered from dysmenorrhea and those who didn't. As the p values are similar for both the groups, weight gain during the luteal phase has no significance in relation to dysmenorrhea.

## Conclusion and Summary

Menstrual cycle is a cycle of natural changes that occurs in the uterus and ovaries as an essential part of making sexual reproduction possible. The biological activity of the menstrual cycle is created by coordination among hypothalamic, hypophyseal and ovarian hormones. Many females suffer from dysmenorrhea, painful cramping sensation in the lower abdomen during menstruation[39]. It is one of the most frequently encountered gynaecological disorders, often accompanied by other biologic symptoms, including fatigue, dizziness, sweating, headaches, back ache, nausea, vomiting, and diarrhoea, all occurring just before or during menses. The major findings of the present study are high prevalence of dysmenorrhea (68%) among healthy female volunteers. Among them 36% suffered from severe pain during their menstruation when they had to cut down on their activities and take medications to ameliorate their pain. There is no significant relation existed between dysmenorrhea and age at menarche, nature of diet, and BMI. On the other hand, weight changes were of equal significance in women afflicted and not afflicted with dysmenorrhea. Hence they are not related to occurrence of painful periods.

**Ethical Clearance**- Taken from Institute Ethical committee, Santosh Medical College

**Source of Funding**- Self

**Conflict of Interest** - Nil

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# The Relationship between Performance of Students in Internal Assessment and Final Summative Assessment in the Subject of Physiology in a North Indian Medical College

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## Abstract

**Background.** Assessments, if suitably conducted, can serve several goals and provide many advantages to all stakeholders - the medical students, the teaching faculty, the universities and the society as a whole. Assessment in medical education is mostly of two forms either formative or summative. Although it is generally assumed that the performance of a student in formative assessment will act as a predictor for performance in the summative examination not many studies are available support it.

**Objectives.** To explore whether performance in the continuous internal assessment, correlates with the final summative assessment in first year medical students in the subject of Physiology for the last three years.

**Materials and Method.** This study was conducted over a period of six months at SKIMS medical college, Srinagar. It was a observational record-based study on 280 students who took a thorough internal assessment and final examination in the subject of physiology in the batches 2014-15, 2015-16 and 2016-17.

**Results.** The internal assessment marks showed a positive correlation with marks obtained in final assessment or final university exams in all three batches, which is statistically highly significant ($p<0.01$). It was also observed that the percentage of final university marks was higher as compared to internal assessment marks in all batches.

**Conclusion.** The present study revealed a positive correlation between internal assessment and final university marks supporting the general assumption that the performance of a student in formative assessment will act as a predictor for performance in the final summative examination.

***Keywords:*** *Assessments, Medical students, Internal assessment, Summative assessment, Physiology.*

## Introduction

A precisely framed system of assessment and evaluation is a powerful educational tool.[1]Assessments, if suitably conducted, can serve several goals and provide many advantages to all stakeholders - the medical students, the teaching faculty, the universities and the society as a whole.[2] Student learning is steered by assessment and these assessments are essential to the student's experience.[3] It is universally believed that the role of assessment is not merely to assess a student on predesigned criteria but also to facilitate learning through a continuous process of feedback , at the same time providing him/her with the opportunity to improve.[4]The evaluation of the competence of undergraduate medical students is a very crucial task, as in future, these 'to be physicians' have to cater with human lives.[5]

Assessment in medical education is mostly of two forms either formative or summative. The formative or internal assessment has multiple benefits. Its continuous nature throughout the training period has the potential

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to drive the students' learning in the right direction over the time. There is a chance to provide well timed remedial feedback that can be used both by the instructor to improve teaching and by the students to improve learning. Internal assessment can evaluate a wide range of capabilities, such as, skill in performing routine clinical procedures, professionalism, ethics, communication, and interpersonal skills, which can be hardly assessed in the summative examinations. On the other hand summative assessment is a test which is usually given at the end of a course to summarize the students' learning and effectiveness of the instructional program. [6-8]

Assessment of competency of medical students without subjective and methodological biasness is a troublesome task faced by many medical institutions of India. [9]As per MCI regulations, internal assessment should be based on continuous day-to-day assessment. The draft of the 2012 revised Regulations on Graduate Medical Education (GME) that was released by the Medical Council of India (MCI) makes it compulsory for the undergraduate students to have passed in their internal assessment to be eligible for appearing in the final university examinations. It means student have to secure at least 35% marks of the total marks fixed for internal assessment in a particular subject in order to be eligible for appearing in the final university examination. Weight age for the internal assessment is 20% of the total marks in each subject. The mean percentage in each subject in university examination is 50%. [10]

Although it is generally assumed that the performance of a student in formative assessment will act as a predictor for performance in the final summative examination not many studies are available support it. The objective of this study is to explore whether performance in the continuous internal assessment, correlates with the final summative assessment in first year medical students in the subject of Physiology for the last three years.

## Materials and Method

This observational record based study was conducted in the department of physiology, SKIMS medical college, Srinagar from July 2017 to December 2017. The study included the marks of 280 students who took a thorough internal assessment and appeared in final university exam in the subject of physiology in the batches 2014-15, 2015-16 and 2016-17. The subject physiology has a total of 200 marks. According to MCI guidelines 160 marks are awarded in external assessment and 40 marks are for internal assessment.

First the internal assessment marks of students were collected from the score sheets that are maintained by the department. Similarly, the total marks in this subject were also collected from the record section. Then internal assessment marks were subtracted from the total marks to obtain the marks scored by a student in the final university examination alone. Confidentiality and anonymity were maintained.

In our institution we follow a comprehensive system of formative or internal assessment, which takes into consideration the following:

1. Class tests after completion of each topic which includes essay type questions, short answer questions (SAQ) and multiple choice questions (MCQ).

2. Practical tests after completion of each practical portion (hematology, human, clinical and amphibian) which focus on the actual performance of the practical.

3. One terminal and one pre-university exams based on the pattern of university exams having a theory, a practical and a grand viva component.

4. Seminar preparations and presentations

5. Regular quizzes and vivas

6. Punctuality in submission of assignments and journals.

All teachers of the subject are involved in assessment process. No teacher contributes to more than 20% of the marks. This reduces the examiners bias and also prevents any favoritism or misuse of power. No single component of internal assessment contributes to more than 25 % of marks. Results of each component are shown to students. Regular feedback is provided to help them improve their performance. Counseling is given to poor performers and remedial measures are suggested.

Statistical analysis was performed using statistical software SPSS version 20. Standard tests for descriptive statistics were applied, which commonly included the use of correlation. Pearson's correlation coefficient was calculated to determine whether performance in internal assessment correlated with the performance in the final summative examination. P-value of less than 0.05 was

considered to be statistically significant.

## Results

Marks of 280 students (89 students in batch 2014-15, 95 students in batch 2015-16 and 96 students in batch 2016-17) were taken into consideration for the study. The batch wise marks distribution of the students is given in table 1.Table 1. Batch wise distribution of marks.

| Batch | No. of students | Mean marks obtained in internal assessment (%) | Mean marks obtained in final university exams (%) |
|---|---|---|---|
| 2014-15 | 84 | 17.58(44.48) | 92.12(58.47) |
| 2015-16 | 95 | 17.92(44.56) | 93.23(59.23) |
| 2016-17 | 96 | 18.36(45.62) | 90.47(57.43) |

A comparison of percentages of marks obtained by students in internal assessment and final university exam ( total marks – internal assessment marks) shows that the mean percentage in finals is higher for all three batches.

The internal assessment marks show a positive correlation with marks obtained in final assessment or final university exams in all three batches, which is statistically highly significant ($p<0.001$).

**Table 2. Correlation between internal assessment and final assessment.**

| Batches | Form of assessment | Marks obtained (%) | R | P value |
|---|---|---|---|---|
| 2014-15 | Internal assessment | 17.58(44.48) | 0.501** | <0.001 |
| | Final assessment | 92.12(58.47) | | |
| 2015-16 | Internal assessment | 17.92(44.56) | 0.555** | <0.001 |
| | Final assessment | 93.23(59.23) | | |
| 2016-17 | Internal assessment | 18.36(45.62) | 0.602** | <0.001 |
| | Final assessment | 90.47(57.43) | | |

** Correlation is significant at the 0.01 level.

## Disscussion

In our study we observed that there is a positive significant relationship between performance of students in internal assessment and final assessment indicating that better marks in internal assessment are related to better marks in final university exams. Which means that the performance of a student in the internal assessment can be presumed to be a predictor of his/her performance in final university examination.

Very few studies have been performed on this subject in north India. Our study is in accordance with a study conducted in a north Indian medical college which found a positive linear relationship between internal assessment and university marks in one selected subject each from all the four professionals. [11]Another study conducted in a medical college in Kolkata observed a partial direct correlation in their study which means the association between internal assessment and final examination performance is not completely linear, thereby indicating presence of other possible variables that may influence the final result.[12]

The comparison of internal assessment and final university marks shows that the university marks are higher than internal assessment, in all the batches. This is in contrast with previous reports that internal assessment marks tend to be inflated.[13,14] Our well designed step by step assessment system that provides timely feedback

to students could have contributed to better performance in finals.

An important limitation of this study is that the other possible variables like socio demographic characteristics and preferred learning styles which can have an impact of performance were not taken into consideration.

## Conclusion

The present study revealed a positive correlation between performance of students in internal assessment and final university exams supporting the general assumption that the performance of a student in formative assessment will act as a predictor for performance in the final summative examination.

**Ethical Clearance**- Not Required

**Source of Funding**- Self

**Conflict of Interest**- Nil

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# Comparison of Electrolyte Changes in Term Neonates before and after Phototherapy

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## Abstract

**Background:** Jaundice or hyperbilirubinemia is one of the most common problems occurring in the neonatal period. Phototherapy plays a major role in its treatment. However, this treatment modality may itself result in complications which even contribute to the development of convulsions. Hence in this study changes in serum electrolytes are evaluated in term neonates receiving phototherapy for unconjugated hyperbilirubinemia. **Aim and objective:** To estimate and compare the serum electrolytes levels in term neonates with unconjugated hyperbilirubinemia before and after phototherapy. **Method:** After getting Ethical Committee approval informed, written consent,medical history were obtained from the neonate's mother, general examination, systemic examination was carried out for 30 full-term jaundiced neonates receiving phototherapy. Laboratory tests including total serum bilirubin by Diazo method, serum calcium level by Arsenazo III method and serum electrolytes by Ion selective electrodes analyser were performed before and after 48 hours of phototherapy. Blood samples taken from the newborn babies before the commencement of phototherapy was regarded as control group. Blood samples taken 48 hours following establishment of phototherapy was regarded as study group. **Results:** Statistical analysis was done using Paired t test**.** There was a significant decrease in serum bilirubin after 48 hours of phototherapy. This was accompanied by a significant decrease in serum calcium levels with a p value of 0.014 in eighteen neonates (60%). None of the neonates were clinically symptomatic. There was no alteration in the values of serum bicarbonate, chloride, sodium and potassium. **Conclusion:** This study shows a decrease in serum calcium levels in term infants exposed to phototherapy. Hence serum calcium, sodium, potassium, chloride, bicarbonate along with routine measurement of serum bilirubin should be monitored regularly for neonates receiving phototherapy to prevent the development of complications.

***Keywords:*** *Jaundice, phototherapy, serum bilirubin, serum calcium, serum electrolytes, term neonates, unconjugated hyperbilirubinemia,.*

## Introduction

Neonatal hyperbilirubinemia has been the most common physical finding during the first week of life. It affects nearly 80% preterm and 60% term neonates**.** Hyperbilirubinemia in neonate is due to liver's immature excretory pathway for bilirubin.

Jaundice looks as if to proceed in a course starting from head and ending in foot, as bilirubin levels rises. When the level increases to 15 mg/dL (258 μmol/L) it becomes apparent upto the level of umbilicus and when the level increases to 20 mg/dL (340 μmol/L) it becomes apparent upto the feet. In the first week of living slightly additional than 50% of all neonates become apparently jaundiced.

Based on its reason and the degree of increase hyperbilirubinemia may be safe or dangerous . No matter what may be the bilirubin level few reasons of jaundice are very hazardous . Once the level is elevated enough hyperbilirubinemia of any cause is a concern. Depending on age level of prematurity and health position the threshold for concern changes.

Unconjugated hyperbilirubinemia is a normal physiological occurrence in most of the infants. High

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values of unconjugated bilirubin could proceed towards bilirubin encephalopathy and later kernicterus through overwhelming permanant neurological development problems[8]. Hence managing neonatal hyperbilirubinemia appropriately is of utmost importance.

Neonatal hyperbilirubinemia can be managed in three means which includes:

a. Mechanical removal of bilirubin by exchange transfusion b. Convertion of bilirubin into substances which can bypass the liver's system of conjugation and their excretion either through the bile or through the urine devoid of metabolism by phototherapy[3] c. Hastening the usual metabolic pathways for clearance of bilirubin or inhibition of enterohepatic circulation for bilirubin by meddling with heme degradation and synthesis of bilirubin through the action of pharmacologic substances. Subsequent to publications **of Dr. Cremer's** in the Lancet during **1958** paediatricians in the United Kingdom started to employ phototherapy[3] .

Phototherapy plays a major role .in prevention and management of hyperbilirubinemia. Phototherapy was suggested by the American Academy of Paediatrics[1]. A practical consideration which deals through the treatment in the healthy newborn, born at term with hyperbilirubinemia was formed during 1994 October by **the Subcommittee on Hyperbilirubinemia and Provisional Committee for Quality Improvement of the American Academy of Pediatrics (AAP)**.

During month of July in **2004, the American Academy of Peadiatrics** published protocols which would decrease beginning of avoidable circumstances[2]. Ultimate value of phototherapy relies on the kind of light source used (i.e. dosage, spectral release curve, deepness of infiltration), the space amidst the light and the infant, the surface area to be treated, the etiology of the jaundice and also value of total serum bilirubin at phototherapy's onset**.**

Phototherapy transforms bilirubin into water soluble isomers which can be excreted without conjugation in the liver. The goals of phototherapy are to prevent the already elevated total serum bilirubin level from rising, to prevent the occurrence of encephalopathy or kernicterus and to prevent the total serum bilirubin from rising to a level that requires exchange transfusion**.** The foremost exhibited phototherapy's value has been diminishing the need for exchange transfusion. When the total serum bilirubin reduces less than the level at which phototherapy was started phototherapy can be safely terminated in infants who were treated[9].

As any treatment has its side effects, phototherapy also has its adverse effects like hyperthermia, feeding intolerance, loose stools, skin rashes, bronze baby syndrome, retinal changes, dehydration, hypocalcemia, redistribution of blood flow and genotoxicity **.**

Numerous investigations have been carried out to establish the safety of phototherapy in the management of neonatal hyperbilirubinemia. Hypocalcemia is one of the known adverse effects. Hypocalcemia is defined as total serum calcium level less than 8mg/dl in term and less than 7mg/dl in preterm babies.

90% of preterm and 75% of fullterm neonates develop hypocalcemia after being subjected to phototherapy. Hypocalcemia can cause serious complication like irritability, jitteriness, convulsion and apnea. Therefore this study is aimed to evaluate and compare phototherapy induced changes in serum electrolyte levels in term neonates with unconjugated hyperbilirubinemia.

## Aim

To estimate and compare the serum electrolytes in term neonates before and after phototherapy.

## Material and Methodology

Prospective study was conducted in the Department of Paediatrics, Government Theni Medical College Hospital, in association with the Physiology Department, Government Theni Medical College, Theni. Approval was obtained from the ethical committee of Government Theni Medical College, Theni. This study was performed on 30 full-term jaundiced neonates (15 males and 15 females) receiving phototherapy. A detailed antenatal, perinatal history and examination of the neonates was done.

**Control group** :

It consists of blood samples of the neonates in which serum bilirubin and calcium, potassium, chloride, bicarbonate, sodium were measured before the onset of phototherapy.

**Study group :**

It consists of blood samples of the neonates in which serum bilirubin and calcium, potassium, chloride, bicarbonate, sodium were measured after 48 hrs of phototherapy.

- **Inclusion criteria** :

1. Cephalohematoma
2. External bruising
3. Breast feeding jaundice
4. Breast milk jaundice
5. Physiological jaundice

- **Exclusion criteria** :

1. Neonatal asphyxia.
2. Preterm infants.
3. Infants of diabetic mothers.
4. Infants undergoing exchange transfusion.
5. Hemolytic anaemia / Rh /ABO incompatability
6. Conjugated hyperbilirubinemia.
7. Sepsis.
8. Congenital malformations.
9. Respiratory distress.

**Blood investigations:**

The investigations include indirect bilirubin measured by Diazo method, Serum calcium measured by Arsenazo III method, serum electrolytes measured by Ion selective electrodes analyser .

## Results and Observation

The serum electrolyte changes in term neonates receiving phototherapy for jaundice was analysed before and after phototherapy using **Paired t test**. By means of **SPSS (Statistical Package for Social Sciences) software version 16,** analysis of statistics was performed**.**

The **statistical significance** was drawn at **'p' value < 0.05.**

**Table – I : Analytical statistics of total serum bilirubin and serum calcium before and after Phototherapy**

| S No | Parameters | Before phototherapy (Mean ± Standard deviation) | After phototherapy (Mean ± Standard deviation) | p value |
|---|---|---|---|---|
| 1. | Serum bilirubin (mg/dl) | 14.04 ± 0.71 | 8.13 ± 0.40 | 0.001 Significant |
| 2. | Serum calcium (mg/dl) | 9.51 ± 0.29 | 8.38 ± 0.31 | 0.014 Significant |

In the table above we compare the total serum bilirubin before and after phototherapy. It was found that the mean ± SD of total serum bilirubin before phototherapy was 14.04 ± 0.71 mg / dl and after phototherapy was 8.13 ± 0.40 mg / dl. The total serum bilirubin decreased significantly after phototherapy with a p value of 0.001.

The mean ± SD of serum calcium before phototherapy was 9.51 ± 0.29 mg / dl and after phototherapy it was 8.38 ± 0.31 mg / dl. Levels of serum calcium decreased significantly after phototherapy when compared to values before phototherapy with p value 0.014.

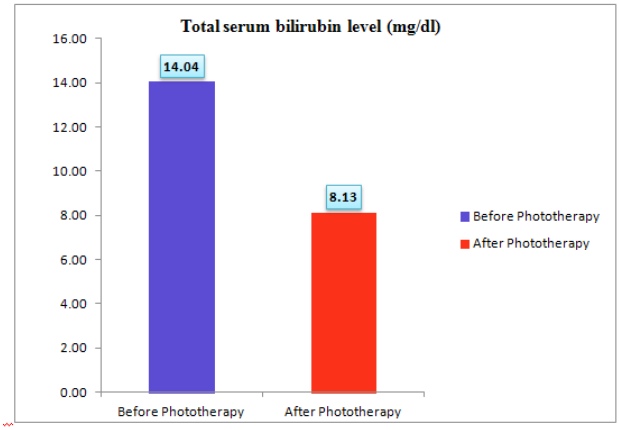


**Figure-1 : The diagram above shows the decrease in total serum bilirubin after phototherapy**

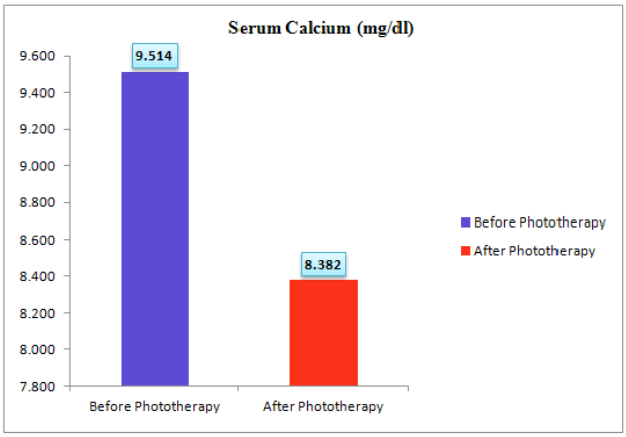


**Figure – 2 : The diagram above shows the decrease in serum calcium after phototherapy**

## Discussion

The general atypical physical finding in the initial week of life is neonatal hyperbilirubinemia . Phototherapy has emerged as the most widely used form of treatment**.** In order to diminish the rigorousness of neonatal unconjugated hyperbilirubinemia this is the recent therapy of preference.

As any treatment has, phototherapy also has its side effects. Unlike other side effects a very few studies are currently available that depicts the adverse effects of phototherapy on serum electrolytes. A few studies in the recent past have stressed on the incidence of hypocalcemia following phototherapy. The differential effect of other electrolytes with phototherapy has not been studied by other workers except that for **Curtis MD et al (1989)**.

The plan of this study was intended to establish the serum electrolyte changes in neonates receiving phototherapy for neonatal jaundice. In this present study we have estimated the serum electrolytes in 30 jaundiced term neonates before and after phototherapy. We compared the occurrence of phototherapy induced electrolyte changes in them. We excluded neonates having risk factors from this study**.**

**Romagnoli et al** in1979 noticed the the relationship in preterm newborns of phototherapy and hypocalcemia[10]. Likewise **Bergstrom and Hakanson in** 1981 experimented in newborn rat the same findings. **Odell and Gutcher in** 1983 suggested considerable reduction in levels of serum calcium in rats which were newborn subsequent to keeping them in fluorescent daylight.

**Eghbalian et al** (2008) in his study found that serum calcium levels declined considerably after neonates with hyperbilirubinemia treated with phototherapy. **Sethi et al** in 1990 proposed that after phototherapy 75% of term neonates begin to build up hypocalcaemia. In the same way **Medhat** in 2006 belonging to Cairo University suggested development of hypocalcaemia in 75% of term neonates after phototherapy.

**Sourabh dutta** (2001) in his study concluded that 75% of fullterm neonates with unconjugated hyperbilirubinemia developed hypocalcemia after phototherapy. A significant drop in level of calcium was observed after phototherapy among 66.6% of the term neonates which was noted by **Yadav RK and Rajesh KY** in 2011.

**Taheri PA et al** (2013) in his study found decrease in serum calcium level in 56% babies after 48 hours of phototherapy. **Arora S et al** (2014) in her study found hypocalcemia in 56% of term neonates after 48 hours of phototherapy.

In our study 60% of term neonates developed decrease in serum calcium levels 48 hours after phototherapy. Findings in the present study are in concurrence with the studies mentioned above.

In 1998 **Jain et al** in his study suggested among fullterm neonates with hyperbilirubinemia 30% developed hypocalcemia after 48 hours of phototherapy[6]. **Karamifar et al** (2002) in his study found that prevalance of hypocalcemia was 8.7% in fullterm neonates after 48 hours of phototherapy for hyperbilirubinemia

This study was conducted on 30 term neonates with jaundice managed with phototherapy. Serum bilirubin, potassium, chloride, bicarbonate, sodium and calcium were measured and compared before and after phototherapy. After 48 hours of phototherapy there was a **significant decrease** in serum calcium levels with **p value 0.014** in eighteen neonates (60%). None of the neonates were clinically symptomatic. There was no alteration in the values of serum bicarbonate, sodium, chloride and potassium .

Normal level of serum calcium is 9-11 mg per 100 ml. Calcium is an essential structural component of the skeleton and plays a key role in muscle contraction, blood coagulation, enzyme activity, neural excitability, secondary messengers, hormone release and membrane permeability.

**In Hypocalcaemia** cellular permeability to sodium ions increases and thereby increasing cell membrane excitability leading to the development of seizures, apnea, jitteriness, increased extensor tone, clonus, hyperreflexia and stridors .

## Conclusion

The mechanism of hypocalcaemic effect of phototherapy was hypothesised by **Hunter and Hakinson in 2004 .** There is inhibition of pineal gland secretion via transcranial illumination, resulting in decline of melatonin secretion. This blocks the effect of cortisol on bone calcium. Cortisol has a direct hypocalcemic effect and increases bone uptake of calcium and induces hypocalcaemia[5].

**Kim** (2001) in his study suggested that hypocalcemia was caused due to a reduction in parathormone secretion in jaundiced neonates who were treated with phototherapy[7].

In **Hooman's** study (2005) the significantly higher level of urinary calcium excretion was proposed to be the cause of hypocalcemia in phototherapy treated jaundiced neonates[4] .

Substantial reduction in the level serum calcium was seen in newborns with icterus which was induced by phototherapy were the observations of current study. There was no signs and symptoms suggestive of hypocalcemia which may present like convulsions, cyanosis and apnea due to diminished calcium in the neonates who received phototherapy.

Proper monitoring of electrolytes after phototherapy in the neonates can prevent dyselectrolytemia and its associated complications. In the newborns who were treated with phototherapy level of calcium need to be measured and should be treated accordingly. Significant decrease in calcium level was well evident in our study. Although the signs were not remarkable this decline may continue down to the threshold of hypocalcemia development.

Hence we suggest assessment of serum calcium, sodium, potassium, chloride, bicarbonate along with routine measurement of serum bilirubin in neonates before and after phototherapy. Thus by regular monitoring and maintaining normal serum electrolyte levels we can avoid the development of neurological complications in icteric neonates receiving phototherapy.

**Ethical Clearance**- Taken from ethical committee of Government Theni Medical College, Theni.

**Source of Funding**- Self

**Conflict of Interest** - Nil

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# A Comparative Study of Pain Thresholds between Diabetic Neuropathy Patients & Non Diabetic Subjects

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## Abstract

**Background & Objective:** Disturbance of sensory function can be a major feature of neurological illness. Objective measurement of the nature and degree of sensory disturbance is needed to understand and characterize the disorder. Among the many sensory modalities pain is the one which attracts the patient to the physician. Pain is a complex sensory experience. Decrease in pain thresholds, increase in magnitude of sensation is useful for the clinician and researcher. Diabetes Mellitus leads to several recognizable clinic-pathological neuropathic syndromes. Diabetic peripheral neuropathy (DPN) likely affects up to one third of adults with diabetes. The current study is designed to evaluate pain thresholds in DPN patients & to compare with non-diabetic healthy subjects.

**Materials & Method:** Thirty diabetic neuropathy patients & thirty non diabetic subjects in the age group of 35- 60 years were included for the study. Informed consent & IEC was obtained. The pain a threshold was measured by digital algometer. Subjects were instructed to indicate when the pressure sensation begins to hurt, and they first feel pain, which was noted as the pain threshold.

**Results:** The pain thresholds were significantly higher in DPN (11.74 ± 4.12) kg/cm$^2$ than in non diabetics (3.02 ± 0.31) kg/cm$^2$ ($p<0.05$).

**Conclusion:** Pain threshold is a useful parameter for assessing response to the treatment, but not useful in diagnosis or even as a screening method in diabetic neuropathy patients.

***Keywords:*** *Pain threshold, Algometer, Diabetes Mellitus.*

## Introduction

Pain is a complex sensory experience. Disturbance of sensory function is a major feature of neurological illness. Objective measurement of the nature and degree of sensory disturbance is needed to understand and characterize the disorder. Quantification of sensory function can be used to detect disruption of sensory pathways and modify the course and treatment at all levels of the nervous system. Among the many sensory modalities pain is the one which attracts the patient to the physician. Decrease in pain thresholds, increase in magnitude of sensation is useful for the clinician and researcher in evaluation of neurological diseases.

Instrument used to quantify pain sensation is Algometer, used by Head and Holmes to measure pressure pain[1]. Green and Swets described three methods for threshold detection[2]. These methods are now recognized as valuable in testing sensory function and examining the integrity of the small nerve fibers which are not examined by nerve conduction studies. Thus, the recent decade has provided a flurry of reports

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on the clinical use of quantitative sensory testing (QST) in diagnosis, follow-up and evaluation of therapy for many clinical entities. The main clinical applications seem to be the neuropathies and pain-centered disorders.

For clinical purposes, threshold is the function that can most easily and conveniently be measured in non-painful modalities. The rate of diabetes has substantially increased over the past five decades. The most common complication of diabetes is diabetic peripheral neuropathy (DPN). Diabetes Mellitus leads to several recognizable clinic-pathological neuropathic syndromes. DPN likely affects up to one third of adults with diabetes. Hence the current study is designed to measure pain thresholds in DPN patients & to compare with non-diabetic healthy subjects.

## Materials & Method

The study was conducted in a sample of forty healthy male subjects and forty healthy female subjects in the age group of 35- 60 years included for the study. Informed consent was taken from all the participants who volunteered for the study.The study was approved by Institutional Ethical Committee.

**Inclusion criteria [control Group]:**

1. Forty healthy subjects of both sex between 35-60 years.

**Exclusion criteria [control Group]:**

1. History of consumption of alcohol/smoking.
2. History of depressive disorders in the past.
3. History of sleep disorders
4. History of neurological disorders
5. Hypertension
6. Diabetes mellitus
7. History of consumption of drugs acting on CNS
8. Inclusion criteria [Study Group]:
9. Forty DPN patients of both sex between 35- 60 years.

**Exclusion criteria [Study Group]:**

1. History of consumption of alcohol/smoking.
2. History of depressive disorders in the past.
3. History of sleep disorders
4. Hypertension
5. History of consumption of drugs acting on CNS

**Experimental design:** The subjects were selected by a detailed history & thorough physical examination.

***Pain threshold was measured by digital algometer.*** Pain thresholds were measured by delivering gradually increasing pressure stimuli. The pressure at which subject perceives it as pain stimuli will be noted by the change in expression & instructed the subject to raise the hand when he perceives pain. Pain thresholds were measured at different areas. Mean of such six were points was considered as Pain threshold.

## Statistical Analysis

The results were expressed as mean ± standard deviation (SD). A p value of $<0.05$ was considered statistically significant. Statistical analysis was performed using the statistical package for social & sciences. Students unpaired 't' test was applied to compare between the parameters.

## Results

Pain thresholds were estimated in thirty healthy non diabetics in the age group of 35- 60 (36.85 ± 4.99) years and thirty DPN patients in the age group of 35- 60 (37.29 ± 4.76) years. Pain thresholds in DPN patients (11.74 ± 4.12) kg/cm$^2$ were significantly higher at 95% confidence interval than non-diabetics (3.02 ± 0.31) kg/cm$^2$, $p < 0.001$. The results are shown in the table 1.

**Table:1 Comparison of pain thresholds between diabetic neuropathy and non diabetics**

| | Non-Diabetics | Diabetics | p |
|---|---|---|---|
| Pain Threshold Kg/cm$^2$ (Mean ± SD) | 3.02 ± 0.31 | 11.74 ± 4.12 | < 0.001 |

## Discussion

Pressure algometers are advantageous for quantifying the pressure pain thresholds. Algometer is used for the evaluation of pain, the determination of therapeutic effects, and follow-up surveys of treatment in many neurological & musculoskeletal diseases. Pressure pain thresholds measured by pressure algometry may produce different results depending on many factors as sex, investigator, and apparatus.

Diabetes Mellitus is a major cause of peripheral neuropathy. Sensory symptoms like sensory loss & numbness predominate usually. However some patients also suffer painful or "positive" symptoms, which can be extremely distressing and difficult to treat[3,4] Microangiopathy is the leading cause of diabetic neuropathy associated with metabolic, vascular ischemic and immunologic injury. In many types of peripheral neuropathy large diameter nerve fibres are predominantly affected. However, in diabetic neuropathy small diameter fibres are particularly liable to be involved[5]. Autonomic denervation is common in diabetics with neuropathic foot lesions[6-8] and Guy et al[9] have found that temperature appreciation (subserved by Aδ and C fibres) is more frequently abnormal than vibration perception threshold (large Aβ fibre function) in diabetic neuropathy. Involvement of large nerve fibres was shown by abnormalities in electrophysiological tests.

Reduced appreciation of noxious stimuli was observed in diabetic neuropathy patients; however hyperglycemic patients the pain thresholds were reduced[9]. Hyperglycemic states contribute to a decrease in pain threshold in the alloxan diabetic rats. In contrast, increase in pain threshold was observed in diabetic rats with normalization of blood glucose level[10]. We conclude from this study that measurement of pressure pain thresholds in diabetic neuropathy patients may give qualitative information about disturbances in pain pathways. However, it is of limited value as a quantitative measure of small nerve fibre dysfunction.

## Conclusion

1. There is increase in pain thresholds in DPN patients compared to healthy controls.
2. Pain thresholds determined by Digital Algometer is simpler, less time consuming, economical, easier to apply and non-invasive method.
3. Pain threshold is a useful parameter for assessing response to the treatment.
4. Can be used for defining the onset of diabetic neuropathy.
5. But not useful in diagnosis or even as a screening method.
6. Quantification of sensory function can be used to detect disruption of sensory pathways at all levels of the nervous system.

**Source of Support:** Nil

**Conflict of Interest:** None declared.

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# Assessment of Pulmonary Function in Type II Diabetes Patients

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## Abstract

Various metabolic and clinical disorders are associated with diabetes mellitus, the most prominent being vascular disease. There may be a relationship between diabetes and reduced lung function, so this study was designed to evaluate the impairment of lung function on spirometry among diabetic patients. The study included 50 type II diabetic patients and 50 healthy persons, confirmed by normal blood glucose levels, as control group. There was a significant reduction in spirometric pulmonary function tests (FEV1 and FVC) of a restrictive pattern in type 2 diabetic patients compared to control subjects. Since the diabetes affects the pulmonary vasculature and the connective tissue, therefore it can cause reduction in the pulmonary function tests. So, it is recommended that simple tests like spirometry may be performed in patients of type II diabetes as early as possible or be used as a preventive measure.

***Keywords:*** *Diabetes mellitus Pulmonary function FEV1 FVC*

## Introduction

Various metabolic and clinical disorders are associated with diabetes mellitus, the most prominent being vascular disease. It is generally agreed that hyperglycemic patients have a higher incidence of pulmonary infections may lead to develop tuberculosis, emphysema, asthma, fibrosis and mucormycosis during course of disease [1-6]. All these respiratory disorders cause altered pulmonary function tests [7]. Among others peripheral airflow obstruction increase significantly with age in diabetics as compared to healthy subjects which is obvious against environmental challenges e.g. smoking or minor airway infection. Deterioration of the pulmonary function is proportional to the degree of hyperglycemia [8,9]. Its complications give rise to micro and macrovascular diseases which affect eyes, kidneys, heart, blood vessels, nerves and also lungs. There may be a relationship between diabetes and reduced lung function, so this study was designed to evaluate the impairment of lung function on spirometry among diabetic patients.

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## Material and Method

The present study was a case control hospital based study conducted in the Department of Physiology in collaboration with the Department of Internal Medicine and Department of TB and Chest in Santosh Medical College and Hospital, Ghaziabad. The study included 50 type II diabetic patients and 50 healthy persons, confirmed by normal blood glucose levels, as control group. Control group were matched to the patients by age, BMI and WC. The patients were collected randomly from the outpatient department of internal medicine, Santosh Medical College and Hospital. Pulmonary function test was conducted in collaboration with the department of TB and Chest in Santosh Medical College and Hospital.

## Selection of subjects

Diabetic patients on oral medication and/or insulin administration for last 5 years of age group of 40- 60 yrs were included in the study. An informed consent was taken. Patients who had a history of smoking, chewing tobacco, chronic obstructive pulmonary disease, Asthma , Interstitial lung disease, Acute respiratory tract infection, occupational diseases like pneumoconiosis, neuromuscular diseases, chest surgeries or other major surgeries were excluded from the study.

## Method

A detailed medical history was taken from patients. The patients for participation in the study were divided into two Groups:

**Group 1**: Type II diabetic patients on oral and/or insulin administration (50 subjects)

**Group 2**: apparently healthy subjects, matched for age, BMI and waist circumference (50 subjects)

General physical examination was performed on all the subjects.

Pulmonary function tests of these patients were performed with the help of SPIROSCOUT LF 8 (Ganshorn medizin electronic). The subjects were made comfortable in sitting position for at least 5 minutes for a steady state. The following protocol was used for measurement of the spirometric indices [10]. The patient was explained the purpose of the test and demonstrated the correct technique before inviting the patient to use a spirometer. The patient's sex, age and height, was recorded as this is needed to compare FVC and FEV1 with the predicted normal values. A clean, disposable, one-way mouthpiece is attached to the spirometer. The patient is asked to wear a nose clip. He is asked to breathe in as deeply as possible (full inspiration) then to blow the breath out, forcibly, as hard and as fast as possible, until there is nothing left to expel. The procedure is repeated three times and the best reading is chosen.

All tests were carried out at a fixed time of the day (10.00- 14.00 hours) to minimise diurnal variation. After all the tests were performed, the necessary flow and volume data was plotted as parameter table.

**For FVC Test**: The subjects were asked to exhale through mouthpiece with full force after forceful inspiration. Results are usually given in both raw data (litres per second) and percent predicted- the test result as a percent of the 'predicted values' for the patients of similar characteristics (height, age, sex and weight). Generally speaking, results nearest to 100% predicted are the most normal and results over 80% are often considered normal. After the completion of the maneuver, four most important parameters i.e. FVC, FEV1, FEV3 and PEFR were recorded.

**Biochemical Parameters**

Estimation of blood glucose levels was done by Glucometer (Optium Xceed, Abbot, Alameda, USA) Statistical analysis was performed using Computer Software Microsoft Excel and SPSS version 21(IBM Inc.). Chi squared test was used to compare nominal data and student t test was used for the comparison of other types of data. A p value of $< 0.05$ was taken as significant.

## Observations and Results

**Comparison of percentage of the predicted FVC and FEV1 between diabetic patients and control group Table1,2,3.** According to percentage of the predicted value of the spirometry, out of 50 patients in the diabetic group, 36 patients (71.5%) had percentage of the predicted FVC of < 80%, and 27 patients (54%) had percentage of the predicted FEV1 of < 80%. Out of 50 subjects in the control group, 9 subjects (18%) had percentage of the predicted FVC of < 80%, and 5 subjects (10%) had percentage of the predicted FEV1 of < 80%. On the other hand, all members of diabetic and control groups had FEV1% more than 70%. There was a significant reduction in the percentage of the predicted FVC and FEV1 in diabetic patients compared to the control group. According to the definition of restrictive and obstructive spirometric values, 27 patients (54%) of the diabetic group, and 5 subjects (10%) of the control group had a restrictive spirometric pattern. However, none of the participants had an obstructive spirometric pattern.

**Table 1: The percentage of the predicted Spirometric indices in diabetics & control group**

| Spirometric indices | | Diabetic group (n=50) | Control group (n=50) |
|---|---|---|---|
| FVC (% predict) | ≥80% | 14(28%) | 41(82%) |
| | <80% | 36(72%) | 9(18%) |
| FEV 1 (% predict) | ≥80% | 23(46%) | 45(90%) |
| | <80% | 27(54%) | 5(10%) |
| FEV 1 % | >70% | 50(100%) | 50(100%) |
| | ≤70% | --- | --- |

*p<0.0001

*p<0.0001

*p<0.0001

## Discussion

Diabetes is a slowly progressive disease that deteriorates the normal functioning of lung as can also be observed from the findings. There is growing evidence regarding the deleterious effect of DM on pulmonary function as reflected by spirometric measurement. The current study, which involved 50 type 2 diabetic patients, reveals a significant reduction of spirometric indices (FVC and FEV1), with FEV1 ratio (normal or high) suggestive of restrictive pattern, compared to a matched normal subjects. The results are in agreement with results of Davis *et al.* [11] who reported that the Forced Vital Capacity (FVC), Forced Expiratory Volume in 1 sec (FEV1), and Vital Capacity (VC) were reduced in diabetic patients compared to control group. Walter *et al.* [12] conducted a cross sectional study to assess the association between glycemic state and lung function, and reported that the FVC and FEV1 were significantly reduced in patients with diabetes, with FEV1% suggestive of restrictive ventilatory disorder. Rosenecker *et al.* [13] demonstrated that in patients with diabetes, FVC and FEV1 declined significantly over the five year study period, whereas patients without diabetes did not show a significant decline during this period. Meo *et al.* [14] reported that lung function parameters; Forced Vital Capacity (FVC) and Forced Expiratory Volume in 1 sec (FEV1), and Peak Expiratory Flow (PEF) in type 1 and type 2 diabetic patients were impaired, as compared to their matched controls. Bram *et al.* [15] meta-analysis shows that diabetes, in the absence of overt pulmonary disease, is associated with a modest, albeit statistically significant, impaired pulmonary function in a restrictive pattern. The results were irrespective of BMI, smoking, diabetes duration, and HbA1c levels. In sub analyses, the association seemed to be more pronounced in type 2 diabetes than in type 1 diabetes. There are different hypotheses that explain the reduced spirometric measurements in diabetic patients. Preliminary reports of histopathologic changes in the lungs of diabetic patients, reveal basal lamina thickening and fibrosis[16]. Other possible contributory factors include glycation of chest wall/bronchial tree proteins[17], autonomic and/ or phrenic neuropathy causing alterations in bronchial reactivity and respiratory muscle function[18], and an increased propensity to, and severity of, respiratory infections [19]. In both human and animal studies, diabetic lungs have demonstrated diabetic microangiopathy of the alveolar septal capillaries, with a thickened epithelial and capillary basement membrane, and increased extracellular matrix and connective tissue [20]. The strength and stability of the connective tissue is provided by the cross-link formation of both collagen and elastin components and the stocking mesh arrangement of these fibers[21]. In diabetic patients, chronic hyperglycemia can bring about a rise in collagen molecule synthesis and cross-linking via the acceleration of advanced glycation end-products, which can also negatively influence lung function [22]. Arnalich *et al.*[23] observed a reduction in serum markers of inflammation with the treatment of diabetes, which suggests that diabetes may itself be a cause of systemic inflammation. In addition, expression of the transmembrane receptor for advanced glycation end-points is seen in the lung, preferentially localized to the basal face of type I pneumocytes [24]. Defects in the bronchiolar surfactant layer, which is involved in maintaining airway stability and diameter, may be also considered a contributing factor to the impairment of calibre regulation in type 2 diabetes. When the alveolocapillary barrier is damaged, surfactant proteins leak into the bloodstream. A recent population-based random sample has described how increased circulating levels of surfactant protein A, the major surfactant-associated protein, were associated with altered glucose tolerance and insulin resistance. Therefore, surfactant defects in diabetic individuals may also lead to an increase in airway resistance and to a reduction in FEV1 and FEV1/ FVC ratio [25]. The proinflammatory effects of advanced glycation end-products (AGEs), which result from interaction between intracellular proteins and decomposing saccharides and polysaccharides, can alter matrix proteins, affect the expression of cytokines, alter expression of inflammatory mediators by endothelial cells and induce apoptosis [26]. Limited joint mobility that occurs as a consequence of changes in structural proteins of the joints of the chest and elastin, collagen abnormalities of the pulmonary capillaries and smooth muscles of airways may be the reason for reduced total lung capacity and the disordered lung mechanisms[27]. A reduction of inspiratory capacity is due to reduced capacity of the muscles. [28, 29, 30] However, a concomitant reduction in MVV among diabetics was seen only in subjects with severe obesity (Weight/ Height greater than 1.1 kg/cm) [31, 32, 33]

## Conclusions

There was a significant reduction in spirometric pulmonary function tests (FEV1 and FVC) of a restrictive pattern in type 2 diabetic patients compared to control

subjects. Since the diabetes affects the pulmonary vasculature and the connective tissue, therefore it can cause reduction in the pulmonary function tests. So, it is recommended that simple tests like spirometry may be performed in patients of type II diabetes as early as possible or be used as a preventive measure.

**Ethical Clearance**- Taken from Institutional Ethical committee, Santosh Medical College

**Source of Funding**- Self

**Conflict of Interest** - nil

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# Assessment of Heart Rate Variability in Patients with Fibroid Uterus

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## Abstract

**Background & Aims:** Uterine leiomyoma's represent 29.4% and 41.4% of the hysterectomies in women aged

18–44 and 45–64, respectively. They are characterized by an increase in smooth muscle cell proliferation and excessive deposition of extracellular matrix proteins, collagens type I and III. The reactive oxygen species (ROS) has been shown to be involved in the signaling pathways of several growth factors that stimulate proliferation of a variety of cell types. The underlying inflammation leads to the genesis of benign tumors and cardiac autonomic dysfunction. The cumulative effect of oxidative stress, inflammation and ageing make these patients more vulnerable for cardiovascular autonomic imbalance. Therefore, the study was conducted to assess the heart rate variability as a non-invasive tool for assessing cardiac autonomic function in these patients.

**Method:** Thirty four female patients in the age group of 25 -50 yrs with newly diagnosed uterine fibroid were recruited from the department of Obstetrics and Gynaecology of JIPMER. Thirty four female healthy volunteers aged between 25-50 years were recruited as controls. The parameters measured were Basal Heart rate (BHR), Systolic blood pressure (SBP), Diastolic blood pressure (DBP) and Heart rate variability parameters (time and frequency domain indices).

**Results:** SBP and diastolic BP were elevated in fibroid patients compared to controls. SBP was statistically significant (P value <0.001). Time domain indices were significantly reduced (SDNN: P < 0.001, RMSSD: P <0.001, PNN50: 0.001) in fibroid patients. Among frequency indices, Total power was significantly reduced (P<0.001), LFnu was significantly high (P<0.001), HFnu was significantly decreased (P<0.001) and LF-HF ratio was significantly increased (P<0.001) in fibroid patients.

**Conclusion:** We conclude that fibroid patients have altered autonomic tone in the form of increased sympathetic tone and decreased parasympathetic tone.

***Keywords:*** *Fibroid, heart rate variability, autonomic imbalance.*

## Background

Uterine leiomyomas represent 29.4% and 41.4% of the hysterectomies in women aged 18–44 and 45–64, respectively [(1)]. Uterine leiomyomas, or fibroids, are characterized by an increase in smooth muscle cell proliferation and excessive deposition of extracellular matrix proteins, primarily collagens type I and III [(2, 3,4)]. Oxidative stress is considered to be involved in pathogenesis of many disorders of the female genital tract [(5)]. The reactive oxygen species (ROS) producing NADPH oxidase complex has been shown to be involved in the signaling pathways of several growth

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factors, cytokines, and vasoactive agents that stimulate proliferation of a variety of cell types [6]. Oxidative stress marker level in the serum and tissue samples of fibroid uterus have been documented in earlier studies [7]. This was further evidenced from reports on decrease in size of the leiyomyoma following supplementation of antioxidants (Epigallocatechin gallate), which resulted in decrease in the levels of malondialdehyde MDA and TNF-α [8].The cumulative effect of oxidative stress, inflammation and ageing make these patients more vulnerable for cardiovascular autonomic imbalance. However, till date no study has been conducted to assess the autonomic dysfunction in uterine fibroids. Therefore, in this study we propose to assess the cardiovascular autonomic functions in fibroid uterus patients and age and BMI matched subjects and their correlation with the level of oxidative stress and inflammatory markers. Therefore, the study was conducted to assess the heart rate variability as a non-invasive tool for assessing the cardiac autonomic function in these patients.

## Objectives of the Study:

- To assess the Heart rate Variability in Fibroid uterus patients
- To compare the heart rate variability parameters between fibroid uterus patients and healthy controls.

## Materials & Method

- **Inclusion criteria**

After obtaining permission from the institute ethics committee, thirty four female patients in the age group of 25 -50 yrs with newly diagnosed uterine fibroid were recruited from the department of Obstetrics and Gynaecology of JIPMER.

Thirty four healthy female volunteers aged between 25 and 50 years were recruited as controls.

- **Exclusion criteria:**
- Patient with other gynaecological problems
- Patients with Hypothyroidism, Hypertension, Diabetes mellitus, Menstrual irregularities, hormonal therapy

**Statistical analysis**

The sample size was calculated using Open Epi version 2 Software. Assuming 30% prevalence of fibroid uterus in women beyond 30 years of age, with 95% CI and 10% allowable error (Absolute precision) the sample size calculated was 34 in each group

**Recording of HRV**

- Subjects were asked to lie down in supine position. After 15 minutes of supine rest baseline heart rate and blood pressure were recorded using oscillator (Omron MX3). Lead IIECG electrodes were connected from the subject to polygraph .After 10minutes. From Lead II ECG, RR intervals were extracted and analysed using Kubios Software. Time domain parameters were derived from normal R-R interval. Frequency domain HRV indices were obtained by Power Spectral Density (PSD) analysis using Fast Fourier transformation.

## Results

SBP was significantly high (table-1), statistically significant and diastolic high though statistically not significant in fibroid patients compared to controls. Time domain indices (Table -3) were significantly reduced (SDNN: $P < 0.001$, RMSSD: $P < 0.001$, PNN50: 0.001) in fibroid patients when compared to controls. Among frequency indices (Table -2), Total power was significantly reduced ($P<0.001$), LFnu was significantly high ($P<0.001$), HFnu was significantly decreased ($P<0.001$) and LF-HF ratio was significantly increased ($P<0.001$) in fibroid patients.

## BASAL PARAMETERS

**(Table-1) Comparison of baseline parameters between study and the control group.**

| Parameter | Fibroid Uterus (N=34) | Controls (N=34) | p Value |
|---|---|---|---|
| Age | 38.411 ± 6.035 | 28.688 ± 7.350 | 0.0001 |
| BMI | 23.278 ± 4.064 | 24.326 ± 4.457 | 0.314 |
| SBP | 112 ± 12.027 | 103.469 ± 11.648 | 0.004* |
| DBP | 70.176 ± 8.547 | 66.500 ± 8.710 | 0.08 |
| HR | 82.088 ± 12.263 | 73.313 ± 10.870 | 0.0027 |
| PP | 41. 823 ± 7.229 | 36.969 ± 9.114 | 0.017 |
| MAP | 84.117 ± 9.236 | 78.823 ± 8.795 | 0.0182 |
| RPP | 92.327 ± 19.087 | 76.411 ± 17.020 | 0.0006 |

Analysed by unpaired 't' test. *P values less than 0.05 were considered statistically significant

### HRV- FREQUENCY DOMAIN PARAMETERS

**(Table-2) Comparison of HRV frequency domain parameters between study and control group**

| Parameter | Fibroid Uterus (N=34) | Controls (N=34) | p Value |
|---|---|---|---|
| VLF | 117.281 ± 82.553 | 70.40 ± 80.259 | 0.0001 |
| LF | 236.188 ± 119.071 | 94.697 ± 117.475 | 0.0001 |
| HF | 108. 276 ± 174.903 | 325.875 ± 174.242 | 0.0001 |
| TP | 273.382 ± 335.565 | 679.344 ± 321.190 | 0.0001 |
| LF nu | 54.597 ± 17.837 | 44.900 ± 10.607 | 0.008 |
| HF nu | 45. 402 ± 17.837 | 55.100 ± 10.607 | 0.008 |
| LF:HF | 1.639 ± 1.386 | 0.758 ± 0.343 | 0.005 |

Analysed by unpaired 't' test. *P values less than 0.05 were considered statistically significant

**HRV- TIME DOMAIN PARAMETERS**

**(Table-3) Comparison of HRV time domain parameters between study and control group**

| Parameter | Fibroid Uterus (N=34) | Controls (N=34) | p Value |
|---|---|---|---|
| Mean RR | 0.730 ± 0.158 | 0.818 ± 0.122 | 0.0154 |
| SDNN (ms) | 30.441 ± 18.986 | 46.188 ± 23.870 | 0.001 |
| RMSSD | 24. 279 ± 16.593 | 49.181 ± 20.606 | 0.001 |
| NN50 | 20.617 ± 40.482 | 79.313 ±40.350 | 0.0001 |
| p NN50 | 5.147 ± 10.385 | 39.022 ± 17.031 | 0.0001 |

Analysed by unpaired 't' test. *P values less than 0.05 were considered statistically significant

## Discussion

The regulation of heart rate relies on the balance between sympathetic and parasympathetic branches of the autonomic nervous system [10]. Though there are numerous methods to assess the autonomic modulation of the cardiovascular system, HRV has been one of the most reliable non-invasive method to evaluate heart rate regulation.

Oxidative stress has been implicated in cardiovascular autonomic imbalance. A relation also exists between an impaired immune system, especially the process of inflammation and the pathogenesis of these tumors[7]. Also in normal women, alterations of mitochondrial bioenergetics in the heart, consequence from normal aging process, result in decreased fatty acid oxidation and accumulation of fatty acid intermediates in the cardiacmyocyte cytosol, resulting in lipotoxicity and increases the cardiovascular risk [6].

The pathophysiology of uterine leiomyomas is similar to that of other fibrotic conditions such as atherosclerosis, vascular restenosis, and liver, pancreatic, and renal interstitial fibrosis, in which an injury triggers the quiescent cells to dedifferentiate into a myofibroblast-cell like, more proliferative phenotype [7, 8]. Inadequate sympathetic preponderance and stimulation in individuals with uterine fibroids independent of sex steroids was observed in study conducted by Yun AJ etal(2005)[9]. Our study corroborates with the findings of Yun AJ et al. Increased exposure of the uterine environment to seminal fluid that contains catecholamines, aldosterone, prostaglandins and earlier age of pregnancy enables helper Th(2) cell activation and decreased fibroid growth. Also exposure of the uterine environment to intra uterine devices enabled $Th(_1)$ helper mediated immune response to foreign body may also be attributed to the genesis of fibroid in the study subjects. Also decreased intercourse also could be one of the attributes. Sympatheic function variables seem to be increased amongst the subjects in comparison to the parasympathetic function which may be due to the sex steroid influence. Lesser exposure of the uterine environment to the seminal fluid could be another reason for the increased sympathetic response. Also increased non specific inflammatory markers could influence the sympathetic nervous system. Though statistically not significant the diastolic blood pressure was observed to be high in the study group as compared to the controls due to sympathetic preponderance.

## Conclusion

We conclude that fibroid patients have altered autonomic tone in the form of increased sympathetic tone and decreased parasympathetic tone.

**Conflict of Interest:** We authors declare that we do not have any conflict of interest.

**Source of Funding:** Nil.

**Ethical Clearance:** We have obtained ethical clearance from the institute ethics committee for conducting this study.

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# Etiological Profile of Azoospermic Patients attending Male Biological Reproductive Unit of Mahatma Gandhi Institute of Medical Sciences, Sewagram (Maharashtra), India

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## Abstract

**Introduction-** The term "Azoospermia" is defined as the complete absence of sperm in the ejaculate, is identified in approximately 1% of all men and in 10 to 15% of infertile males. The semen analysis should be performed according to the 2010 WHO guidelines, and at least two semen samples obtained more than two weeks apart should be examined.

**Material and Method-** The present cross sectional hospital based study was conducted in reproductive biology unit of department of physiology, MGIMS, Sewagram (M.S.) India, during study period September 2011 to August 2013. Subjects belonged to age group of 21 to 45 year. The semen samples were obtained from male partner (referred from gynecology department) of infertile couples attending the reproductive biology unit. 90 freshly diagnosed patients were selected for study. The patients were interviewed about their case histories, their reproductive problems, and their family background. All WHO Guidelines was strictly fallowed so that identity of subject should not be revealed. In subject with absence of spermatozoa in semen three consecutive semen analysis were performed at an interval of one month each.

**Observations-** The prevalence rate of Azoospermic patient was found to be 19.90%. We observed that out of 90 azoospermic patients, 40 % of patient was of Obstructive Azoospermia and remaining 60 % was of Non- Obstructive Azoospermia. We found that the most common aetiology of obstruction was Epididymal cyst (23 patients), contributing 63.89 % to its aetiology. Most common aetiology of Non-obstruction was Varicocele (23 patients) contributing 42.59%.

**Conclusions-** The current study highlighted the etiological spectrum of azoospermia cases.

***Keywords-*** *Infertility, Azoospermia, Obstructive, Non obstructive, Varicocele.*

## Introduction

From the time of the earliest records in every culture there has been reference to infertility & in every culture there are prayers or ceremonies to try to ensure fertility. Fertility denotes the ability of a men & woman to reproduce. Conversely infertility denotes lack of fertility, an involuntary reduction in the ability to reproduce children. Infertility is relative; sterility is total inability to produce.

According to World Health Organization, **"**Infertility is the inability of a sexually active non contracepting couple to achieve pregnancy in one year". Infertility is a common condition with important psychologic, economic, demographic and medical implications. Demand for infertility services has grown substantially even though the prevalence of infertility has been stable.

The misconception that infertility is typically associated with the female is commonly faced in the

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management of infertile men. It is uncommon for a patient to present for an infertility evaluation with an abnormal semen analysis report before an extensive female partner workup has been performed. Usually, even men with potentially treatable causes of infertility are treated with assisted reproductive techniques (ARTs) instead of specific therapy.

However, once the diagnosis of azoospermia is established, no sperm can be found in the ejaculate; as a consequence, assisted reproduction cannot be applied due to the absence of sperm. Therefore, an understanding of azoospermia is very important for us. Infertility varies across regions of the world and is estimated to affect 8 to 12 per cent of couple worldwide (**Sciarra J. et.al., 1994**)[1]. Underlying these numbers exists a core group of couples, estimated to be 3 to 5 per cent, who are infertile due to unknown or unpreventable conditions. A prevalence of infertility above this level suggests preventable or treatable causes (**Fathalla MF et.al., 1991**)[2]. Infertility tends to be highest in countries with high fertility rates, an occurrence termed "**barrenness amid plenty**" (**van Balen F et.al., 2001**)[3].

Definitions of Primary infertility vary between studies, but the operational definition, put forth by the WHO, defines Primary infertility as the "Inability to conceive within two years of exposure to pregnancy (*i.e.*- sexually active, non-contracepting, and non-lactating) among women 15 to 49 yr old" (**Reproductive health indicators Report Geneva: WHO; 2001**)[4]. Secondary infertility refers to the inability to conceive following a previous pregnancy. Globally, most infertile couples suffer from Primary infertility (**Inhorn MC. Global et.al.,2003**)[5].

The term "Azoospermia" is defined as the complete absence of sperm in the ejaculate, is identified in approximately 1% of all men and in 10 to 15% of infertile males (**Jarow JP et.al.,1989**)[6]. This diagnosis must be confirmed by centrifugation of a semen specimen for 15 min at room temperature with high-powered microscopic examination of the pellet and a centrifugation speed of at least 3,000 rotation per minute. The semen analysis should be performed according to the 2010 WHO guidelines, and at least two semen samples obtained more than two weeks apart should be examined.(**WHO Lab. Manual**. **Geneva:WHO Press,2010**[7] and **Schlegel PN et.al.,2004**[8]).

There are scarcity of studies on the current topic in the study area. With the above background, the present study was planned to see the aetiological profile of azoospermic infertile males attending a tertiary care hospital of Central India region.

## Material and Method

The present cross sectional hospital based study was conducted in reproductive biology unit of department of physiology, MGIMS, Sewagram (M.S.) India, during study period September 2011 to August 2013. Subjects belonged to age group of 21 to 45 year. The semen samples were obtained from male partner (referred from gynecology department) of infertile couples attending the reproductive biology unit.

We obtained an informed written consent from all study participants. The use of confidential patient data in this study was fully within the recent guidelines.

**Selection of Patient :-**

During the above mentioned period 603 patients visited the reproductive biology unit, out of which 120 patients were diagnosed as Azoospermic. Out of 120 azoospermics patients 30 were follow up cases. They were excluded and 90 freshly diagnosed patients were selected for study. The patients were interviewed about their case histories, their reproductive problems, and their family background. All WHO Guidelines was strictly fallowed so that identity of subject should not be revealed.

Samples were analyzed as per WHO guidelines (**WHO laboratory Manual, 2010**)[7]. In subject with absence of spermatozoa in semen three consecutive semen analysis were performed at an interval of one month each. Finding of absence of spermatozoa was confirmed by centrifuging the sample at 3000 rpm for 15 min and examining the sample under compound microscope.

**Inclusion criteria :-**

Subjects belonged to active Reproductive age group and which demonstrated azoospermia in semen analysis.

**Exclusion criteria :-**

Unmarried male attended reproductive unit for complaints other than infertility & vasectomized subject.

Semen analysis :-

The semen samples were collected after a sexual abstinence of 3 to 5 days (**Preidt.R.,2003**)[9] . The most preferred method for collection of sample was Masturbation (Self-Stimulation), another method was Coitus interruptus (withdrawal of penis just prior to ejaculation during sexual intercourse). The semen specimen was collected in a small, clean wide mouthed jar of 10 to 20 ml. Micro & Macroscopic examination of Semen was performed. The following parameters were studied for confirmation of etiology of azoospermia:

Hormonal assay of FSH, LH & free testosterone.

Karyotyping for detecting defect in sex chromosomes.

Testicular size measurement by Electronic Digital Caliper.

Fructose test for estimation of fructose in seminal plasma.

Transrectal ultrasonography.

Scrotal ultrasonography.

All the data was abstracted on a standardized data collection form. We used a spreadsheet to enter the data electronically and used statistical software SPSS.

**Observations**

Our study was conducted during the period of September 2011 to August 2013 and total 603 patients were visited out the Biological Reproductive Unit. Out of these, 120 patients were Azoospermic. Out of 120 Azoospermic patients, 30 follow-up patients were excluded from the study. Only 90 newly diagnosed Azoospermic Patients along with 10 controls (exhibiting normal seminogram characteristics) were selected for study.

**Table- 1: Distribution of Infertile male with different Seminogram characteristics**

| Seminogram characteristics | No. of Patient | Prevalence (%) |
|---|---|---|
| Normozoospermia | 46 | 7.63 |
| Oligo-astheno-teratozoospermia | 252 | 41.79 |
| Astheno-teratozoospermia | 185 | 30.68 |
| Azoospermia | 120 | 19.90 |
| Total | 603 | 100.00 |

The prevalence rate of Azoospermic patient was found to be 19.90. The prevalence rate of Astheno-teratozoospermia was 30.68, of Oligo-astheno-teratozoospermia were 41.79, and of Normozoospermia were 7.63 respectively. 90 newly diagnosed Azoospermic patients were distributed depending upon their Aetiological factor. The incidence rate of each Aetiological factor causing Azoospermia was calculated separately.**[Table-1]**

**Table 2: Distribution of patients according to Pathophysiology of Azoospermia**

| Type of Azoospermia | No. of patient | Percentage (%) |
|---|---|---|
| Obstructive Azoospermia | 36 | 40 |
| Non-Obstructive Azoospermia | 54 | 60 |
| Total | 90 | 100.00 |

In this study, 90 Azoospermic patients were classified on the basis of Pathophysiology diagnosed in Sonological findings as Obstructive and Non-Obstructive Azoospermic patient.

We found 36 cases had obstruction and were classified into Obstructive Azoospermia while in 54 cases obstruction was not seen and were classified into Non- Obstructive Azoospermia.

We observed that out of 90 azoospermic patients, 40 % of patient was of Obstructive Azoospermia and remaining 60 % was of Non- Obstructive Azoospermia. **[Table-2]**

**Table-3: Aetiological factors of Obstructive Azoospermia in the Study Population**

| Aetiological factors of Obstructive Azoospermia | No. of patient | Percentage (%) |
|---|---|---|
| Seminal vesicle cyst | 3 | 8.33 |
| Epididymal cyst | 23 | 63.89 |
| Epididymal nodules | 5 | 13.89 |
| Calcification in Seminal vesicle | 5 | 13.89 |
| Total | 36 | 100.00 |

36 Obstructive patients diagnosed by Sonological study were distributed on the basis of their Aetiology. We found that the most common aetiology of obstruction was Epididymal cyst (23 patients), contributing 63.89 % to its aetiology. Epididymal nodules and Calcification in Seminal vesicle were the second most common aetiology seen which account for 13.89 % each. It is followed by Seminal vesicle cyst obstruction with 8.33 %.**[Table-3]**

**Table-4: Aetiological factors of Non-obstructive Azoospermia in the Study Population**

| **Aetiological factors of Non-Obstructive Azoospermia** | **No.** | **(%)** |
|---|---|---|
| Klinefelter's syndrome | 4 | 7.40 |
| Microdeletion | 5 | 9.25 |
| Hypergonadotrophic hypogonadism (Primary testicular failure) | 19 | 35.20 |
| Varicocele | 23 | 42.59 |
| No detectable aetiology | 3 | 5.56 |
| Total | 54 | 100.00 |

54 Non-Obstructive patients were distributed on the basis of their Aetiology. We found that the most common aetiology of Non-obstruction was Varicocele (23 patients) contributing 42.59%. Hypergonadotrophic hypogonadism (Primary testicular failure), was the second most common aetiology (19 patient) seen in with 35.20 %. It is followed by next aetiology Microdeletion contributing 9.25%. Next to it, Klinefelter's syndrome was observed which account for 7.40%. Lastly, No detectable aetiology were observed in 3 cases with the Incidence rate of 3 %. **[Table-4]**

## Discussion

In the present study in population of central India region, we observed that the prevalence rate of Azoospermic patient was 19.58 % which is similar to those reported by American society for Reproductive Medicine.

Azoospermia have various etiologies. The most common Aetiological factor causing Azoospermia observed in this study was Epididymal Cyst and Varicocele with the Incidence rate of 25.56 % each. It is followed by Hypergonadotrophic hypogonadism (Primary testicular failure) with the Incidence rate of 21.10 %. Next to this, the Incidence rate of Y-Chromosome Microdeletion, Epididymal Nodule and Seminal Vesicle calcification was observed at the rate of 5.56 % each. It is then accompanied by Klinefelter's syndrome with the Incidence rate of 4.44 %. The Incidence of seminal vesicle cyst and idiopathic azoospermia ranked last with the least contribution of 3.33% each. We did not find any case of Hypogonadotrophic hypogonadism.

**Moon M H et.al.,2006**[10] studied on "Scrotal US for Evaluation of Infertile Men with Azoospermia" and found that Epididymal Obstruction was the major cause in obstructive azoospermia. Our observation of higher incidence of epididymal cyst in obstructive azoospermia is supported by this study.

**T. XA et.al,2010**[11] studied 56 cases of obstructive azoospermia and found 23.21% (13 cases ) of them had epididymal obstruction.

In our study, we found that the incidence rate of Epididymal obstruction was 25.56 %

Varicocele is an abnormally dilated pampiniform plexus, which is the venous network that drains blood from the testicles. The impaired venous drainage leads to disruption of the counter-current exchange of heat mechanism from the spermatic cord, which elevates scrotal temperature and impairs spermatogenesis. Other postulated mechanisms include impaired drainage of gonadotoxins from the testes and hypoxia (**Goldstein M.,1989**) [12].

The detrimental effects of varicoceles on fertility and the benefit gained by their repair have been debated for so many year. One of the primary benefits of varicocelectomy in NOA patients is that it has the potential to produce motile sperm; however, the value of varicocelectomy in patients with NOA remains unclear. Nonetheless, cumulative data reveal that varicocelectomy can improve spermogram results (**Cakan M et.al.,2004**) [13].

**Gorelick JI et al.,1993**[14] studied , the role of varicocelectomy in patients with NOA-related infertility. He found that among the patient with primary infertility, Varicocele was observed with the incidence of 35%

A study conducted by the **Marcello Cocuzza et.al.,2007**[15] reported that varicocele presence in 25.4% of infertile men.

**Kubilay Inci.,2013**[16] from Turkey provides a critical appraisal on the role of varicocele repair for men with NOA.

In our study, we found that the incidence rate of varicocele was 25.56 %. So from the above discussion we can conclude that Varicocele should be taken under consideration while evaluating Azoospermic subject.

In this study, We classified 90 Azoospermic patients were on the basis of Pathophysiology diagnosed in Sonological findings as Obstructive and Non-Obstructive Azoospermic patient.

**Kim ED et.al.,1999**[17] suggested that in azoospermic patients, it is important to distinguish nonobstructive azoospermia from obstructive azoospermia because not all men with azoospermia are ideal candidates for intracytoplasmic sperm injection.

**Jing Du et.al.,2010**[18] China did study in on Evaluations of male infertility and found in his study that, out of 100 infertile men with azoospermia, 64 were found to have obstructive azoospermia, and the remaining 36 had nonobstructive azoospermia.

**M. Moon et.al.,2006**[10] evaluated prospectively the accuracy of scrotal ultrasonography in distinguishing obstructive azoospermia from nonobstructive azoospermia in infertile men and found 61 % were found to have non-obstructive azoospermia, and the remaining 39 % had obstructive azoospermia.

In our study, we found 36 cases had obstructions and were classified into Obstructive Azoospermics. While in 54 cases obstructions was not seen and were classified into Non- Obstructive Azoospermics. We conclude that from the study population, the Incidence rate of Obstructive Azoospermia was 40 % and that of Non-Obstructive Azoospermia was 60%.

Our study also observed similar incidence of Obstructive and Non-obstructive azoospermia as seen in the study of M. Moon et al.[10]

We distributed 36 Obstructive cases On the basis of their Aetiology, diagnosed by Sonological study. We noticed that the most common aetiology of obstruction was Epididymal cyst with the incidence of 63.89%. Epididymal nodules and Calcification in Seminal vesicle were the second most common aetiology seen with the Incidence of 13.89 % each. It is followed by Seminal vesicle cyst obstruction with the incidence rate of 8.33 %.

Similarly, on aetiological basis we distributed 54 Non- Obstructive cases diagnosed by Sonological study. We found that the most common aetiology of Non-obstruction was Varicocele contributing 42.59% (23 patients). Hypergonadotrophic hypogonadism (Primary testicular failure), was the second most common aetiology (19 patient) with 35.20 % incidence. It was followed next by Microdeletion contributing 9.25%. Klinefelter's syndrome as a cause of azoospermia had a incidence of 7.40%. Lastly, Idiopathic azoospermia was observed in 3 cases with a incidence of 5.56 %.

## Conclusions

The current study highlighted the etiological spectrum of azoospermia cases. Finding of the present study will be useful for early diagnosis & appropriate management of these types of cases.

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**Ethical approval**: The study was approved by the Institutional Ethics Committee.

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# Effect of Modified Valsalva Maneuver on Heart Rate and ECG among Young Non –Athletes and Athletes

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## Abstract

**Introduction:** Valsalva maneuver (VM) is an indicator of cardiac Autonomic function as well as it is used clinically for testing patency of Eustachian tube in Ear examination. According to one Cochrane systematic review, the modified maneuver may be effective in 19-54% of cases and there is insufficient evidence to either recommend it or advise against it in supra-ventricular tachycardia.

**Material and Method:** The present cross sectional study was conducted in research lab, Department of Physiology, Late Shree Barat Ratana Atal Bihari Vajpeyi Memorial Medical college, Rajnandgaon (C.G) India, during study period April to october 2016. There are two study groups – young athletes engaged in endurance sports and non athletes, first year students of medical college. All the subjects had been demonstrated and practiced modified Valsalva Maneuver and after that subjects was selected for the study (30 in each group comprising of males and females). During modified Valsalva Maneuver continuous recording of Heart Rate and ECG is done. Data obtained so will be recorded and analyzed.

**Observations-**Heart rate was significantly higher after Modified Valsalva Maneuver in athlete, while it was significantly lower in non athlete after Modified Valsalva Maneuver. No significant difference in heart rate between athlete & non athlete group before Modified Valsalva Maneuver. But there was significant difference heart rate between both groups after Modified Valsalva Maneuver. Significantly higher no. of Athletes showed increase t wave duration & prolonged TP Segment as compared to non athletes.

**Conclusion:** Modified Valsalva Maneuver is good index of cardiovascular system.

***Keywords***- *Modified Valsalva Maneuver, Athletes, Non athletes, Supraventricular tachycardia.*

## Introduction

Valsalva maneuver (VM) is an indicator of cardiac Autonomic function as well as it is used clinically for testing patency of Eustachian tube in Ear examination. [(1)] The Valsalva Manoeuvre is a tactic that demonstrates a basic cardiovascular physiologic feedback loop. The purpose of it is to induce vagal firing from the cardiovascular control centre in the medulla, in order to slow the heart rate, and interrupt the rapid ventricular rate in a supraventricular tachycardia.

The Valsalva maneuver or Valsalva manoeuvre is performed by moderately forceful attempted exhalation against a closed airway, usually done by closing one's mouth, pinching one's nose shut while pressing out as if blowing up a balloon. Variations of the maneuver can be used either in medical examination as a test of cardiac function and autonomic nervous control of the heart, or to "clear" the ears and sinuses (that is, to equalize pressure between them) when ambient pressure changes, as in diving, hyperbaric oxygen therapy, or air travel. [(2)]

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The technique is named after Antonio Maria Valsalva, a 17th-century physician and anatomist from Bologna whose principal scientific interest was the human ear. [3] He described the Eustachian tube and the maneuver to test its patency (openness). He also described the use of this maneuver to expel pus from the middle ear.

A modified version is done by expiring against a closed glottis and maintaining pressure of a mercury column at 40mm Hg by lying down face up and raising legs with the help of an assistant. [4] This will elicit the cardiovascular responses described below but will not force air into the Eustachian tubes.

Modified Valsalva maneuver is used to terminate an attack of abnormal heart rhythm (arrhythmia)

According to one Cochrane systematic review, the modified maneuver may be effective in 19-54% of cases and there is insufficient evidence to either recommend it or advise against it in SVT. [5]

Modified version of Valsalva maneuver has therapeutic role in terminating Supraventricular Tachycardia (SVT). The hemodynamic Effect of Vaslava maneuver is well known- it affects Cardiac output, Blood Pressure, Stroke volume and Heart rate. Few studies had done in this context but data regarding the effect of VM among athletes and non athletes is lacking. [6, 7, 8] Hence we tried to explore Modified Valsalva maneuver as a test for cardiac function with respect to its effect on Heart Rate and ECG.

In the Present study we tried to evaluate modified Valsalva maneuver and its effect on two hemodynamic parameters first Heart rate and secondly on ECG (wave morphology and durations) among young athletes and non athletes.

**Aims and objectives:**

To evaluate effect of modified Valsalva Maneuver on hemodynamic parameters Heart rate and ECG (wave morphology and durations) among young athletes and non athletes.

## Material and Method

The present cross sectional study was conducted in research lab department of physiology. There are two study groups – young athletes engaged in endurance sports and non athletes, first year students of medical college. Consent from IEC had been taken before the study.

All the subjects had been demonstrated and practiced modified Valsalva Maneuver and after that subjects was selected for the study (30 in each group comprising of males and females). Informed consent from the subjects was taken. Basic anthropometric parameters like Age, Height, Weight, BMI was recorded in both the groups.

Heart rate was recorded by using pulse oximeter and ECG is recorded by ECG machine (Philips ECG) in supine and resting condition. After that the subject is encouraged to perform modified Valsalva Maneuver of 25 to 30 seconds by exerting maximum effort and keeping the mercury column in the sphygmomanometer to value of 40 mm of Hg and lying down face up and raising legs with the help of an assistant.

**Inclusion criteria:**

We included 60 subjects out of which 30 subjects are athlete and practising daily exercise.

**Exclusion criteria**

Pt. With P/H/O high Blood pressure, Coronary Artery Disease, Flutter & Fibrillation.

Also we took 30 non athlete student who are not practising any kind of exercise. We excluded subjects who is suffering from hypertension as well as hypotension, who is having Diabetes or having any kind of respiratory diseases. Along with that we also excluded smokers and alchoholic.

During modified V Maneuver continuous recording of Heart Rate and ECG is done. Data obtained so will be recorded and analyzed. Statistical analysis was done by using descriptive and inferential statistics using students paired and unpaired t test and chisquare test and software used in the analysis were SPSS17.0 version and GraphPad Prism 6.0 version and $p<0.05$ is considered as level of significance($p<0.05$).

## Observations

**Table-1: Comparison of heart rate in athletes and non athletes before and after Valsalva Maneuver (VM)**

| | | Mean | N | Std. Deviation | Std. Error Mean | Mean Difference | t-value | p-value |
|---|---|---|---|---|---|---|---|---|
| Athletes | Before VM | 76.00 | 30 | 5.63 | 1.02 | 6.63±4.49 | 7.26 | 0.0001,S |
| | After VM | 69.36 | 30 | 6.86 | 1.25 | | | |
| Non Athletes | Before VM | 76.56 | 30 | 5.03 | 0.91 | 8.53±9.22 | 5.06 | 0.0001,S |
| | After VM | 85.10 | 30 | 10.23 | 1.86 | | | |

**Table 2: Comparison of heart rate in athletes and non athletes before and after VM**

| | | No. | Mean | Std. Deviation | Std. Error Mean | Mean Difference | t-value | p-value |
|---|---|---|---|---|---|---|---|---|
| Before VM | Athletes | 30 | 76.00 | 5.63 | 1.02 | 0.56±1.37 | 0.41 | 0.68, Non Significant |
| | Non Athletes | 30 | 76.56 | 5.03 | 0.91 | | | |
| After VM | Athletes | 30 | 69.36 | 6.86 | 1.25 | 15.73±2.24 | 6.99 | 0.0001 Significant |
| | Non Athletes | 30 | 85.10 | 10.23 | 1.86 | | | |

Heart rate was significantly higher after Modified Valsalva Maneuver in athlete, while it was significantly lower in non athlete after Modified Valsalva Maneuver. No significant difference in heart rate between athlete & non athlete group before Modified Valsalva Maneuver. But there was significant difference heart rate between both groups after Modified Valsalva Maneuver. **[Table-1, 2]**

**Table 3: Comparison of T Wave duration (ECG) findings in two groups**

| ECG Finding | Athletes | Non Athletes | Chi square value, d. f. , p value |
|---|---|---|---|
| Normal | 11 (%) | 14(%) | 27.745, 2, <0.0001 Highly Significant |
| Increase T Wave duration | 18 (%) | 0 | |
| Short T Wave duration | 1 (%) | 16 (%) | |
| Total | 30 (100%) | 30 (100%) | |

Significantly higher no. of Athletes showed increase t wave duration as compared to non athletes. **[Table-3]**

**Table 4: Comparison of other ECG findings (TP Segment & QRS complex) in athletes group**

| ECG Finding | Athletes | Non Athletes | Chi square value, d. f. , p value |
|---|---|---|---|
| Prolonged TP Segment | 15 (%) | 0 | 28.125, 3, <0.00001<br>Highly Significant |
| Reduce TP Segment | 0 | 17 (%) | |
| Short QRS complex | 1 (%) | 0 | |
| Normal ECG | 14 (%) | 13 (%) | |
| Total | 30 (100%) | 30 (100%) | |

Significantly higher no. of Athletes showed prolonged TP Segment as compared to non athletes. **[Table-4]**

## Discussion

Valsalva manoeuvre is defined as the effort to breathe out forcibly while the mouth and nose are firmly closed or the vocal cords pressed together. The valsalva manoeuvre is employed while straining at stool and in other circumstances. It causes a rise in blood pressure followed by a sharp drop and then a second sharp rise in blood pressure. This may be dangerous in people with heart disease and should be avoided.

A modified valsalva manoeuvre is done by expiring against a closed glottis and maintaining pressure of a mercury column at 40mm Hg by lying down face up and raising legs with the help of an assistant. This will elicit the cardiovascular responses described below but will not force air into the Eustachian tubes. Modified Valsalva maneuver is used to terminate an attack of abnormal heart rhythm (arrhythmia). [9]

Seyed Mehran Hosseini et.al in 2015 did study on Valsalva Maneuver and Strain-Related ECG Changes and saw that Following the Valsalva Maneuver, the RR and PR intervals, corrected QT interval (QTc), P wave duration and amplitude, T wave amplitude, and the ratio of T/R amplitudes showed significant changes. The QRS duration and R wave amplitude did not show significant changes. The Valsalva Maneuver caused time and voltage changes in some ECG waves during the strain phase. [8]

Alterations in heart or lung volume, electrode-related alterations, and autonomic tone may cause these changes. In the current study found that, after practising the modified Valsalva maneuver in athletes we observe that there occur increase in T wave duration and also they had prolonged TP segment. While, in non-athletes subject we saw that there occur decrease in T wave duration and with reduced TP segment.

Looga in 2005 did study on The Valsalva manoeuvre--cardiovascular effects and performance technique and found that the changes in heart rate and blood pressure during an expiratory Valsalva Maneuver are greater than the responses observed during completition of an inspiratory Valsalva Maneuver.[9] In the present study we found that in athlete initially heart rate is more ( but within physiological limit) and after practicing Modified Valsalva Maneuver the heart rate reduces significantly in them. We, also concluded in this study that in non- athlete initially heart rate is more (but within physiological limit) but after practicing Modified Valsalva Maneuver the heart rate increases significantly in non- athlete subject even it crosses physiological limit in some subjects .

De jong et.al in 1997 studied The Valsalva manoeuvre as a cardiovascular reflex test in healthy children and teenagers and observe that the Valsalva manoeuvre seems applicable as a cardiovascular reflex test to assess neurocardiovascular control in children and teenagers. [10] We also concluded that after regular exercising the modified Valsalva manoeuvre there occur significant reduction in the heart rate with more ventricular filling during ventricular repolarization by increasing the T wave duration.

A.E. Navarro et.al in 1996 assess Heart rate changes during the Valsalva maneuver in patients with isolated aortic insufficiency and found that When compared to the normal sedentary controls the Valsalva ratio was slightly lower in the asymptomatic patients with aortic insufficiency. [11] Our study also prove that with regular practicing Modified Valsalva Maneuver the cardiac

output increases with increase in duration of ventricular filling time period which ultimately reduces the chances of aortic insufficiency.

## Conclusion

Modified Valsalva Maneuver is good index of cardiovascular system. By regular practicing Modified Valsalva Maneuver subject can enhance the autonomic response. Modified Valsalva Maneuver indirectly help in increasing the the cardiac output by increase in duration of ventricular filling time period.

Modified Valsalva Maneuver also decreases the heart rate with prolonged T wave duration meaning it provide a good time period for ventricular filling. Therefore, our study stress to practise the Modified Valsalva Maneuver by healthy individual so get a better cardiovascular response for betterment of life.

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**Conflict of Interest**: None declared

**Ethical approval**: The study was approved by the Institutional Ethics Committee.

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