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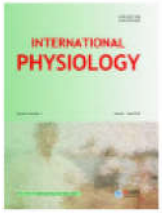

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A Comparative Study of Mean Auditory Reaction Time for Low Pitch and High Pitch in School Bus Drivers with Normal Population (Controls)

Garima Shah[1], Rajni Soni[2], Manjula Mehta[3]

Author's Affiliations:
[1]Junior Resident [2]Professor & Head [3]Assistant Professor, Department of Physiology, Mahatma Gandhi Memorial Medical College, Indore, Madhya Pradesh 452001, India.

Corresponding Author:
Manjula Mehta, Assistant Professor, Department of Physiology, Mahatma Gandhi Memorial Medical College, Indore, Madhya Pradesh 452001, India.
E-mail: drmanjulamehta@hotmail.com

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Abstract

The present study was carried out in the Department of Physiology, Mahatma Gandhi Memorial Medical College, Indore (M.P.). It is a type of cross-sectional study. Study was performed after taking permission from the Ethics and Scientific Review Committee M.G.M. Medical College M.Y. Hospital, Indore and permission letter from the Head of Department of Physiology MGM Medical College, Indore and from respective school authorities. The period of study was from March 2015 to February 2016. We had selected 100 school bus drivers of age group 20-50 years.

Study Design: Cross-sectional Study.

Keywords: Auditory Reaction Time; High & Low Pitch; BMI & Normal Population.

Introduction

Reaction time (RT) is defined as elapsed time between the presentation of a sensory stimulus and its behavioral response. Simple reaction time is usually defined as the time required for an observer to detect the presence of a stimulus. Reaction time is the time interval between the application of a stimulus and the appearance of appropriate voluntary response by a subject. It involves stimulus processing, decision making, and response programming. Reaction time has been widely studied as its practical implications may be of great consequence e.g., a slower than normal reaction time while driving can have grave results [1]. It is a measure of function of sensory-motor association[2] and performance of an individual [3]. It involves stimulus processing, decision making, and response programming. Reaction time studies have been documented in both sexes for visual and auditory stimuli. It has physiological significance and is a simple and non-invasive test for peripheral as well as central neural structures [4]. Reaction time provides an indirect index of the processing capability of CNS and it is a simple means to determine sensory motor performance, therefore, it represents the level of neuromuscular coordination via different physical, chemical, and mechanical processes decodes visual or auditory stimuli which travel via afferent pathways and reach the brain as sensory stimuli [5,6]. There are various factors that affect the reaction time to a stimulus. Factors like intensity and duration of the stimulus, age and gender of the participant, effect of practice can affect the reaction time of an individual to a particular stimulus. For example, there are relative differences between the reaction time to visual and auditory stimuli between genders.

Material & Method

The present study was carried out in the Department of Physiology, Mahatma Gandhi Memorial Medical College, Indore (M.P.). It is a type of cross-sectional study. The study was performed after taking permission from the Ethics and Scientific Review Committee M.G.M. Medical College M.Y. Hospital, Indore and permission letter from the Head of Department of Physiology MGM

Medical College, Indore and from respective school authorities. The period of study was from March 2015 to February 2016. We had selected 100 school bus drivers of age group 20-50 years and 100 controls (non-bus drivers) from normal population of same age group.

An informed written consent had been taken from these subjects after explaining the study procedure and a self-made questionnaire had been administered to every participant regarding their personal, present, past, family, socioeconomic and medical history in detail. Special information about the duration of bus driving, shift, duty hours, history of any addiction and history of any medicine which can affect central nervous regulation was obtained. Then after the assessment of related hearing tests we had done auditory reaction time test by audio-visual analyzer. Only those participants were taken into the study that fulfilled our inclusion criteria.

Inclusion and Exclusion Criteria

Inclusion

1. School bus drivers of age group 20-50 years (cases) and non-bus drivers (controls) of same age group.
2. School bus drivers driving the vehicle for more than one year.
3. All subjects included were healthy males.
4. All subjects with no auditory or visual disturbances.
5. Individuals giving consent for test participation in the study.
6. Those who are not taking any sedative or hypnotic or anti-allergic medicine.
7. Individuals with history of addiction (only smoking or tobacco chewing).

Exclusion

1. Individuals of age group <20 and >50 years.
2. School bus drivers driving the vehicle for less than one year.
3. Individuals with auditory or visual disturbances.
4. Individuals taking any sedative or hypnotic or anti-allergic medicine.
5. Individuals not giving consent for test participation in the study. These subjects were assessed for various physiological parameters mentioned below and a standardized protocol was followed while taking the measurements: height, weight, pulse, blood pressure, clinical examination (general & systemic), hearing tests (Rinnie's test, and weber's test) followed by auditory reaction time for high and low pitch [6].

Procedure

Before doing the reaction time test, subjects were assessed for various physiological parameters as mentioned above.

1. Hearing Tests

For the assessment of related auditory function we have used Rinnie's and Weber's test. Before testing for auditory reaction time we must be assured that all the subjects should have normal hearing capacity. For this Rinnie's and Weber's test were done. Rinnie's test: This test compares the ability of hearing through the medium of bone and that of air; that means there is comparison of bone conduction with air conduction of the same ear.

Procedure

1. After giving proper instructions to the subject we have asked them to raise the finger when they stop hearing the sound of the vibrating tuning fork (of 512 hz frequency).
2. The stem of the tuning fork was hold between the thumb and the index finger in such a way that the fingers do not touch the blades of the tuning fork.
3. For Rinnie's test - the tuning fork was made to vibrate by suddenly stroking the blades of the fork against the hypothenar eminence or the thigh. Immediately the base of the vibrating tuning fork was placed on the mastoid process of one side and the subject was asked to raise the his finger when he ceases to hear the sounds.
4. Once he stopped hearing, we have hold the tuning fork very close to his ear and asked him whether he hears the sound or not. If the hearing is normal, the subject will hear the vibrating fork by air conduction even after he ceased hearing by bone conduction i. e. in healthy subject's air conduction is better than bone conduction.
5. Weber's test- Weber's test compares bone conduction of both the ears. Base of the vibrating tuning fork is placed on the forehead and the

subject was asked to indicate whether the sound is heard equally in both the ears or is better heard in one of the ears. In healthy subjects, both the ears hear the sound equally. But in abnormal conduction sound is lateralized to the affected ear.

2. Reaction Time Test

Each subject was made familiar with the apparatus and procedure is explained before doing the test. In our study we had used choice reaction time test.

Apparatus

The "608 Audiovisual reaction timer" was used in this study. Display has 3 different types of light and sound on either side. Three visual stimuli red, green and yellow color light and three auditory stimuli low, moderate and high pitch sound system with independent operation are provided. The operating channel on the "experimenter's side" consisted of red, green and yellow lights. Digital time display in middle, below which a press button "reset to zero" button and low moderate and high pitch sound buttons are provided. The subject's side has the same buttons as in experimenter's side i.e. three buttons for red, green and yellow lights and three buttons for low pitch, medium pitch and high pitch sound. buttons. A power on and off button is present on the side of the instrument. A ready signal in the form of red light is present on the subject's side.

Test procedure: For auditory reaction time: Three practical trials were given each time before taking the observation. Before presenting a stimulus a ready signal or warning in the form of a verbal instruction READY was given. For auditory reaction time, the stimulus given was a continuous beep of three different frequency sounds i.e. High, medium and low pitch sound stimuli. The subjects sat to one side and examiner sat to other side of instrument. Subject has to react to three different frequencies of sound stimuli i.e. high, medium and low by pressing the respective key for the sound as soon as that respective frequency sound was produced which may be high, medium or low pitch sound. When subject pressed the key as a response to auditory stimuli, instrument stops counting the time. This time was directly taken as auditory reaction time. Three practical trials of auditory stimuli were given to each subject and the best (i.e. the lowest) was taken as the auditory reaction time of that subject.

Results & Observation

Data thus collected were compiled, tabulated, and analyzed statistically by using unpaired 't' test. p value < 0.05 was taken as statistically significant. The table 1 shows the comparison of auditory reaction time between the two groups – non-drivers and drivers for three pitches – low, medium and high.

The auditory reaction time for low pitch in non-drivers group was 1.29±0.44 and in drivers group it was 1.21±0.38. The auditory reaction time to low pitch was comparable between the two groups ($p > 0.05$).

The auditory reaction time for medium pitch in non-drivers group was 1.16±0.45 and in drivers group it was 1.18±0.52. The auditory reaction time to medium pitch was comparable between the two groups ($p > 0.05$).

The auditory reaction time for high pitch in non-drivers group was 1.16±0.45 and in drivers group it was 1.07±0.43. The auditory reaction time to high pitch was comparable between the two groups ($p > 0.05$).

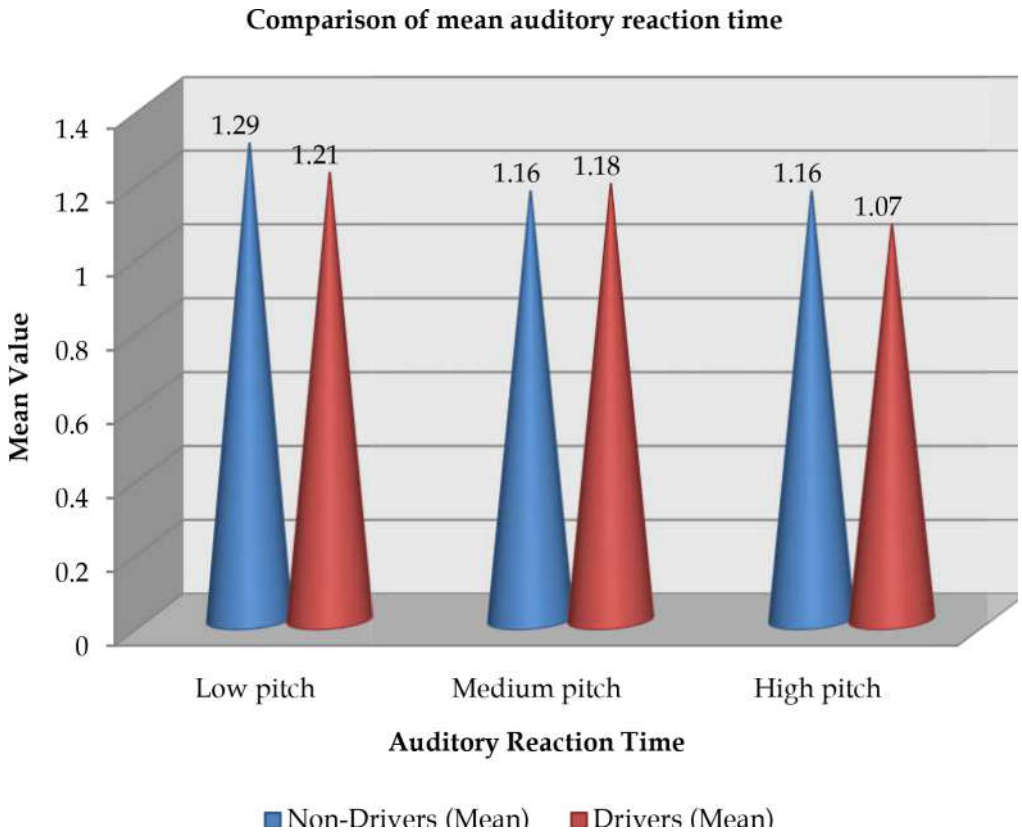
In our study we had found that auditory reaction time in drivers for low and high pitch was shorter and for medium pitch it was longer than non-drivers but the result obtained were statistically not-significant ($p>0.05$).

Following study of Herpeet et al. (2013)[7] support our study. They have included 50 drivers and 50 controls of age and sex matched. The result of their study was auditory reaction time of drivers was shorter than that of healthy controls.

Table 1: Comparison of mean auditory reaction time to three sounds Low pitch, medium pitch and high pitch between the two groups (N=200)

Auditory Reaction Time	Non-Drivers (n=100) [Mean±SD]	Drivers (n=100) [Mean±SD]	't' Value	P Value
Low pitch	1.29 ± 0.44	1.21 ± 0.38	-1.478, df=198	0.141, NS
Medium pitch	1.16 ± 0.45	1.18 ± 0.52	0.266, df=198	0.791, NS
High pitch	1.16 ± 0.45	1.07 ± 0.43	-1.460, df=198	0.146, NS

Unpaired 't' test applied. P value < 0.05 was taken as statistically significant



Graph 1: Comparison of Mean Auditory Reaction Time

Discussion

The primary aim of our study was to compare auditory reaction time of school bus drivers with normal population. The advantage of measuring auditory time reaction time in bus drivers is that we can reduce number of road traffic accidents by the assessment of audio-visual reaction time.

Most of our reactions in life are not like the simple reaction experiments. It is seldom in everyday life that we can be so sure of what is going to happen as to set ourselves to react automatically at maximum speed. Greater the complications, longer the reaction time.

Conclusion

From this we can conclude that driver's reaction time is faster which is a very important parameter for safe driving.

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Original Research Paper

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A Study of Perceived Stress Levels in Medical Students and Dental Students in South India

Arun Prakash M.

Author's Affiliations:
Assistant Professor, Dept of Physiology, Al azhar medical college and super speciality hospital Todupuzha Kerala 685605, India.

Corresponding Author:
Arun Prakash M.
Assistant Professor, Dept of physiology, Al azhar medical college and super speciality hospital Todupuzha Kerala 685605, India.
E-mail:
arunprakash314@gmail.com

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Abstract

Introduction: Medical and dental students during their course of education may experience stress when their curricular demands tends to exceed their resources to deal with them, and they have been also reported to suffer from higher perceived stress compared to the general population and students in other academic fields. Current study aims to compare the level of stress in first year medical and dental students. *Objective*: To assess the perceived stress levels in first year medical and dental students. *Method*: A cross-sectional study was conducted among first year medical students of Al-Azhar medical college and super specialty hospital and first year dental students of al azhar dental college. Where, perceived stress scale - 10(PSS-10) was used for assessing the perceived stress levels. The data was entered in Microsoft excel and analyzed using SPSS version 16. *Results*: Of the 250 first year medical and dental students. Students reported PSS-10 mean score of 23.83(SD 7.08) scores ranging from 7-28. The mean PSS-10 for the medical students was 24.56(SD 7.24) and scores ranging from 8-38 and the mean PSS-10 score of the dental students was 24.66 (SD 7.27) and scores ranging from 7-37. There was no difference in stress levels between the two groups and gender. *Conclusion*: The study reported that there is a higher level of stress among the medical and dental student than compared to the general population. Also there is no difference in stress level between the two groups.

Keywords: First Year Medical Students; First year Dental Students; Perceived Stress; South India.

Introduction

Stress by definition is "a condition or feeling experienced when a person perceives that the demands placed on them exceed the resources the individual has available" [1].

Many Medical students may experience stress during their medical course, when their curricular demands tends to exceed their resources to deal with them [2], and they have been also reported to suffer from higher perceived stress compared to the general population and students in other academic fields [3–7].

First year of the medical course is a very important phase of the medical course, Wolf TM et al. observed that Positive mood in the medical students decreased (joy, contentment, vigour, and affection) while negative mood increased (depression and hostility). End of the year first year students appear to be worse off psychosocially than when they entered [8].

There are many Studies conducted in Asian countries like Malaysia, Thailand, etc those have shown a high level of stress among the medical students [9-12].

Just like the medical students, even the dental students experience a high level of stress. Many studies conducted around the world have shown that the dental students also experience a high level of stress. [13,14].

Kharel Sushil et al. had conducted a study to compare the stress levels among medical and dental students in Nepal [15].

But hardly any study was conducted in south India to compare the stress levels experienced by medical

and dental students. This study is designed to compare the level of perceived stress experienced among dental and medical students.

Material and Method

This cross-sectional study was conducted among first medical students Al-Azhar medical college and super specialty hospital and al Azhar dental college. Students gave their consent and participated voluntarily. The approval to conduct this study was obtained from the ethical committee of the Al-Azhar medical college and super specialty hospital. Perceived Stress Scale (PSS 10) was used to assess the degree of perceived stress students experienced during their first year of MBBS and BDS course [12].

Items were designed to know how unpredictable, uncontrollable, and overloaded students would find their lives during the first year of their medical course. The scale also includes a number of direct queries about current levels of experienced stress.

Scoring

PSS scores are obtained by reversing responses (e.g., 0 = 4, 1 = 3, 2 = 2, 3 = 1 & 4 = 0) to the four positively stated items (items 4, 5, 7, & 8) and then summing across all scale items.

Statistical Analysis

The data was entered in Microsoft excel and analyzed using SPSS version 16. The descriptive statistics such as frequency, proportion and mean and standard deviation was analyzed.

To check the association between stress score and other factors student t-test was used and P value less than 0.05 was considered significant.

Results

All the 250 students who had enrolled in study completed and returned the questionnaire. . The mean age of the study populations was 18.83years (SD=0.94) with a range of 17-21 years. The mean age of the medical students was 18.83years (SD=0.84) with a range of 17-21 years. Whereas the mean age of the dental students was 18.84 years (SD=1.07) with a range of 17-21 years. Among the medical students 109 were female with mean age of 18.80 years (SD= 0.83) and 41 were males with mean age of 18.90 years (SD = 0.88) whereas Among the dental students 76 were female with mean age of 18.81 years (SD= 1.12) and 24 were males with mean age of 18.91 years (SD = 0.92) as shown in Chart 1 and Table 1.

Perceived Stress

The mean PSS-10 score of the study populations was 23.83 (SD 7.08) scores ranging from 7-28.

The mean PSS-10 score medical students was 24.56 (SD 7.24) and scores ranging from 8-38. The mean PSS-10 score among the female medical students was 24.55 (SD 7.36) and the mean score for male medical students was 24.60 (SD 6.98). There was no difference between the mean stress levels of male students and female students' p- value >0.05.

The mean PSS-10 score of the dental students was 24.66 (SD 7.27) and scores ranging from 7-37. The mean PSS-10 score among the female Dental students was 24.51 (SD 6.94) and the mean score for male medical students was 25.12 (SD 8.73). There was no difference between the mean stress levels of male students and female students' p- value >0.05.

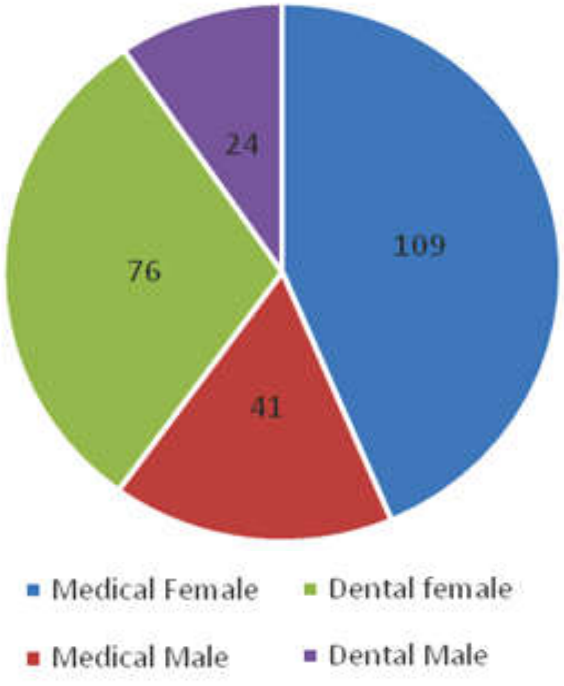

Chart 1: Showing the gender distribution of medical and dental students

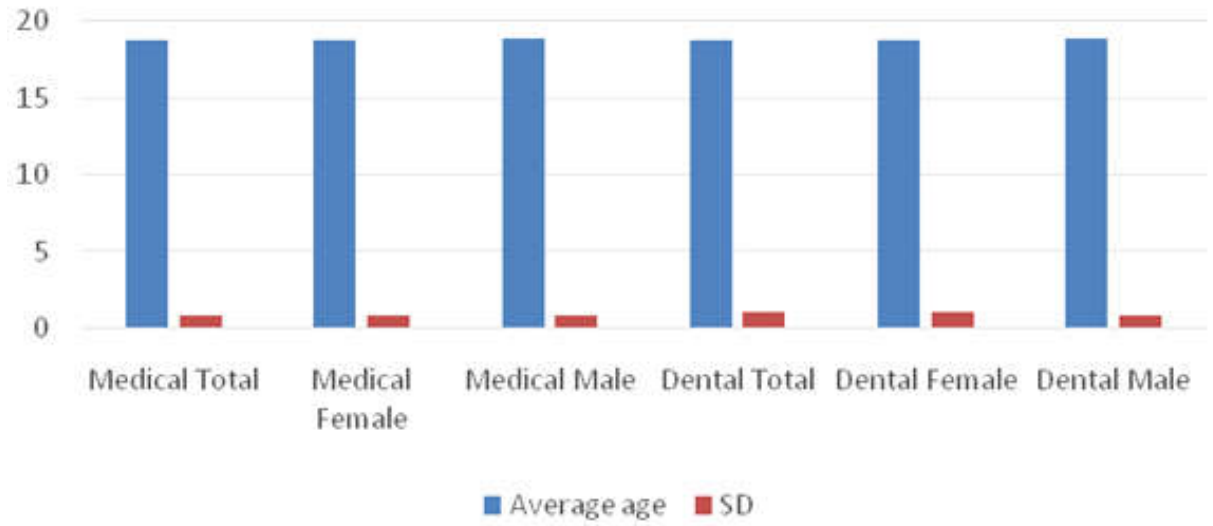

Chart 2: Showing the average age of the different group

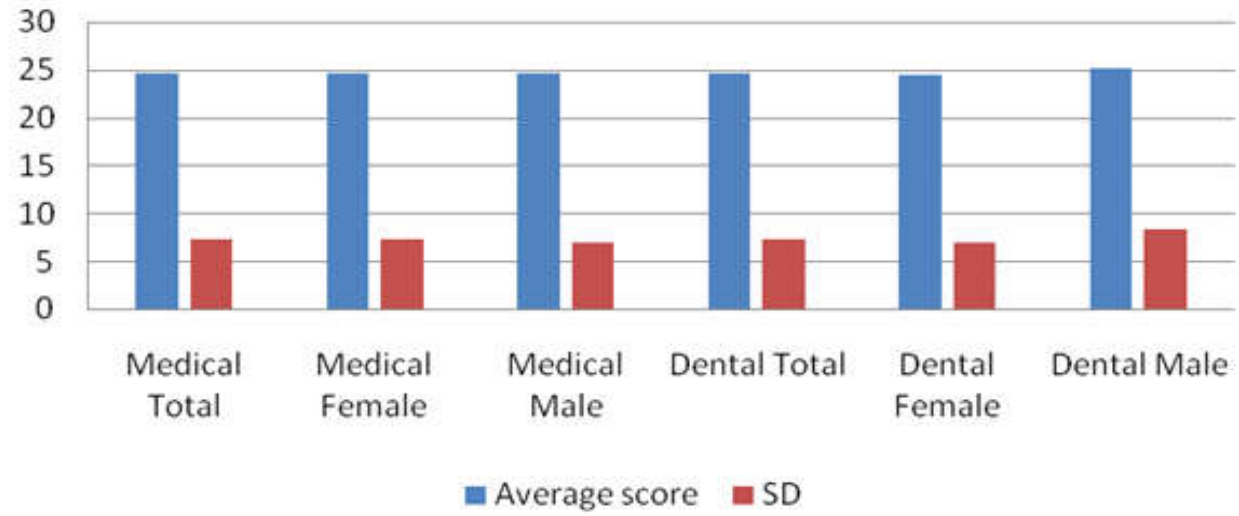

Chart 3: Showing the mean PSS-10 score of different group

	Medical			Dental			Grand total
	Total	Female	Male	Total	Female	Male	
N	150	109	41	100	76	24	250
Average age	18.83	18.8	18.9	18.84	18.81	18.91	18.83
SD	0.84	0.83	0.88	1.07	1.12	0.92	0.94
Average score	24.56	24.55	24.6	24.66	24.51	25.12	23.83
SD	7.24	7.36	6.98	7.27	6.94	8.378	7.08

When student t-test was applied between the mean scores of medical and dental students, there was no difference p- value >0.05.

Discussion

There have been many studies in medical colleges of many countries with respect to stress level in medical students. There are many studies have shown that very levels of stress and depression among medical students may also lead to suicide [16,17,18]. the academic stress is not only high in medical students, but also dentals students have reported a high level of stress [13,14]. Very few studies have been conducted around the world to compare the levels of stress experienced by medical and dental students. In present study, perceived

stress experienced by 250 first year medical and dental students was evaluated. Both Students reported a higher level of perceived stress than the general population which was for male 12.1±5.9 and females 13.7±6.6. [17].

However, there were no significant differences in mean scores of stress between the two group's i.e medical and dental students. Kharel Sushil et al. [15] had conducted a similar study, in which he found dental students had higher levels of stress, but in that study student t test was not done to statistically to prove the differences. In the current study student t test was done and it was found that there was no significant difference.

Conclusion

The study reported that there is a higher level of stress among the medical student and dental students than compared to the general population. Also there is no difference in stress level between dental or medical students. However a detailed study is required to identify the exact causes of the stress in first year medical and dental students.

Limitations

This study was able to show that that the first year medical and dental students experienced significantly high level stress. But, was not able to isolate the exact causes for high level of stress, further studies should be designed and conducted to isolate the causes for the high level of stress experienced by the first year medical students.

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Original Research Paper

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Association of Beck's Depression Score with Blood Pressure Load and Dipper State in Normotensive Young Adult Males

Jawahar Lal Agarwal[1], Sumit Garg[2], Rahul Sachan[3]

Author's Affiliations:
[1]Professor & Head [2]Associate Professor, Department of Physiology, [3]Medical Officer, TB Control, Saraswathi Institute of Medical Sciences, Hapur, Anwarpur, Uttar Pradesh 245304, India.

Corresponding Author:
Sumit Garg,
Associate Professor, Department of Physiology, Saraswathi Institute of Medical Sciences, Hapur, Anwarpur, Uttar Pradesh 245304, India.
E-mail: sumitgargdr@gmail.com
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Abstract

Context: Hypertension is a multifactorial disease and is a leading cause of cardiovascular morbidity. Depression is the most common psychiatric disorder in practice. Different studies have contradictory opinions about effect of depression on blood pressure. So, this study was planned to assess the association of depression scores and 24 hours ambulatory BP parameters. *Aims:* 1. To compare Beck's depression score with day and night blood pressure load. 2. To compare Beck's depression score in dippers and non-dippers. *Methods and Material:* The study included 60 healthy young adults of age between 20 to 35 years. Their day & night BP load and dipper state was assessed by 24 hours Ambulatory blood pressure measurement done by Contec Ambulatory Blood Pressure Monitor. Beck's Depression Inventory-II (BDI-II) was used to calculate the depression scores in them. Independent T test was used to compare the depression scores and dipper state & BP load. *Results:* The mean BDI II scores of non-dippers were significantly higher than dippers [10.11±4.22 vs 6.14±4.21; p = 0.02]. Similarly, the mean BDI II scores of subjects with increased systolic day and night BP load were significantly higher than normal BP load [13.0±3.39 vs 6.2±3.86; p< 0.01 for day] and [12.0±3.85 vs 6.17±3.95; p< 0.01 for night]. *Conclusions:* As subjects with higher systolic BP load had more depression scores and also depression scores were higher in non-dippers. So, depression can lead to future cardiovascular morbidity and mortality.

Keywords: Beck's Depression Score; Dipper State; BP Load.

Introduction

Hypertension is a major contributor to cardiovascular morbidity and mortality in the modern world. Prevalence of hypertension is increasing day by day worldwide as well as in India.

Hypertension has a multiple risk factors with obesity, sedentary behaviour, alcohol, smoking, salt intake, diabetes mellitus, family history of hypertension and psychological disorders being of great importance. Psychological status has an intricate relationship with cardiovascular system. Since cardiovascular system is regulated by the autonomic nervous system, psychological status like depression can have a profound influence on it especially the blood pressure. [1,2]

Depression is a state of low mood and aversion to activity that can affect a person's thoughts, behaviour, tendencies, feelings, and sense of well-being. It is an illness that affects both the mind and the body and is a leading cause of disability, workplace absenteeism, decreased productivity and high suicide rates. Depression is the most common psychiatric disorder in general practice and about one in ten patients seen in the primary care settings suffer from some form of depression [3].

According to Chennai Urban Rural Epidemiology Study (CURES), The overall age adjusted prevalence of depression in urban South India was 15.1%. [3] According to a study done by Sahoo et al depressive symptoms were present in 18.5% of the young adult population. [4] Whereas

in Amritsar the overall prevalence of depression among college going students was found to be 16.5%. Depression appear to have a high prevalence of physical or somatic health problems [5].

Different studies have contradictory opinions about effect of depression on blood pressure. Some studies suggest that individuals experiencing depression are at high risk for developing hypertension while others showed a decrease in blood pressure.

The present study aims to investigate the association of ambulatory blood pressure and depression in healthy young adults.

The Beck Depression Inventory-II (BDI-II) is a brief self-reported scale acceptable to patients and clinicians that is a reliable indicator of symptom & severity of depression. Its validity and case-finding capability as a screening instrument is well established [6].

Ambulatory blood pressure monitoring has gradually become a widely used clinical tool for diagnosis of hypertension. It is a simple, reliable and novel method to measure BP and various aspects of blood pressure monitoring such as dipping state and BP load because it measures BP at regular intervals even at night when the subject is sleeping.

Blood pressure follows a circadian variation. The decrease in BP during sleep is referred to as "nocturnal dipping" and is partly attributable to decrease in sympathetic output. Although arbitrary, a decrease of 10% to 20% in mean nocturnal BP (both systolic and diastolic) compared with mean daytime BP is considered normal. Conversely, an absence of nocturnal dipping, or non-dipping, is designated as a less than 10% decrease in nocturnal BP. Lack or diminished nocturnal dipping of BP is a strong, independent predictor of hypertension and cardiovascular risk in future [7].

BP load is defined as the proportion of 24-hour BP recordings that are increased relative to the thresholds for waking and sleep BP with threshold being 140/90 mm Hg during the awake period and 120/80 mm Hg during the sleep hours. Normal Day BP load should be less than 40% & night BP load less than 50%. Increased BP load is associated with future risk of target organ damage and stroke [7].

The present study tries to investigate the association between Beck's depression score with dipper state and BP load.

Objectives

1. To compare Beck's depression score with Day and night blood pressure load.
2. To compare Beck's depression score in dippers and non-dippers.

Subjects and Methods

The present study was conducted in the Department of Physiology of Saraswathi Institute of Medical Sciences, Hapur from the month March 2017 to July 2017. A convenient sample of 60 healthy young adult males of age between 20 to 35 years who volunteered for the study were enrolled after taking written informed consent from them. Ethical clearance was obtained from Institutional Ethical Committee. Subjects with any H/o hypertension, cardiovascular, renal disorders, diabetes mellitus, smokers, alcoholics, obese (BMI > 25 kg/m^2) and with family history of hypertension were excluded.

The subjects were supposed to report to the Department of Physiology at 10.30 am and measurement of Ambulatory BP recording was started by 11 am. The subjects were supposed to tie the cuff of Ambulatory BP monitor for 24 hours even during their sleep. As disturbed sleep may not decrease the sympathetic activity in the body and hence may not result in decrease in BP during sleep. the subjects who complained of disturbed sleep at night were also excluded from the study.

Subjects were allowed to sit quietly for 15 min prior to assessment of BP; three consecutive measurements were made 5 min apart, and baseline BP was determined as the lowest of the three readings. 24 hours Ambulatory Blood Pressure was measured using Contec Ambulatory Blood Pressure Monitor. The cuff of the BP apparatus was tied on the non-dominant arm. Subjects were enquired about daily morning wake up time and night bed time. AMBP was set to measure BP every 15 min during daytime and every 30-min in night time while sleeping. Subjects were divided into two groups according to their dipper profile, as defined: dippers (nocturnal decrease in systolic BP was ≥ 10% of daytime BP) and non-dippers (nocturnal decrease in systolic BP was <10% of daytime BP). The subjects were also divided in two groups based on day and night BP loads. Day systolic and diastolic BP load: normal being 40% BP values < 140/90 mm Hg. Night systolic and diastolic BP load: normal being 50% BP values < 120/80 mm Hg [8].

All the subjects were given the Beck's depression inventory II (BDI II) questionnaire to answer and by the assessment of their responses to all the questions, the depression score was calculated. BDI II is a 21-item self-reported validated instrument for assessing depression in an individual. Items on the BDI-II are rated on four-point scales ranging from zero to three, with a maximum total score of 63. Higher scores indicate more severe depressive symptoms [6].

Descriptive statistics was carried out in terms of means & standard deviations. Independent T test was used to compare depression scores in high & normal BP load and in dipper & non-dipper state.

Results

The mean age of the subjects was 24.36±4.58 years. None of subjects reported any disturbance in sleep. Out of the 60 subjects 9 were found to be non- dippers and 10 had high day & night BP load. The mean BDI II scores of non-dippers were significantly higher than dippers [Table 1]. Similarly, the mean BDI II scores of subjects with increased systolic day BP load was significantly higher than normal BP load [Table 1] and also the mean BDI II scores of subjects with increased systolic night BP load was significantly higher than normal BP load [Table 1]. As far as diastolic BP loads were concerned, there was no significant difference found in both day & night values.

Discussion

The present study was a retrospective study which intended to investigate the association of dipper state and BP load with Beck's depression scores. We found that BDI II scores were higher in non-dippers than dippers showing depression may lead to a non-dipping state.

Our study showed an increase in BDI II scores in subjects with high day and night systolic BP loads showing that depression can lead to increase in both day and night systolic BP above threshold in more proportion of the day.

Different studies have shown different views as far as association of BP and depression is concerned.

Symptoms of depression and anxiety were associated with a diagnosis of hypertension assessed 5 years later was the conclusion of Ginty et al. With regard to physiological dysregulation, altered activity of the hypothalamic–pituitary–adrenal axis has been observed in approximately 50% of depressed patients and this, in turn, may increase the risk of hypertension. Altered autonomic function has also been suggested as a possible psychophysiological mechanism [9].

Similar to the present study, several studies like that of Meng et al have shown depression as an independent risk factor of hypertension [10].

Negative affect was based on combined symptoms of depression and anxiety. Negative affect is predictive of development of hypertension. [11].

A study done in older subjects with age > 75 years showed that depressive symptoms in elderly subjects may contribute towards increasing the cardiovascular risk through a deregulation of the BP circadian profile. It showed that depressive symptoms presented a significantly lower night-time SBP fall than non-depressed ones with a significantly higher occurrence of non-dipper state [12].

Another study done in Japanese adults revealed that non-dipping was more frequent among subjects with mild depressive state than non-depressive normotensives [13].

A study done on depressive patients with chronic kidney disease showed positive association between depression and chronic kidney disease [14].

Table 1: Comparison of BDI II scores in dipper & non-dipper state and in high & normal BP load:

	Mean ± Standard deviation		P value
	Dipper (n = 42)	**Non-dipper (n = 18)**	
BDI II score	6.14 ± 4.21 **Normal Day BP Load (n = 50)**	10.11 ± 4.22 **High Day BP load (n = 10)**	0.02
BDI II score	6.2 ± 3.86 **Normal Night BP Load (n = 50)**	13.0 ± 3.39 **High Night BP load (n = 10)**	<0.01
BDI II score	6.17 ± 3.95	12.0 ± 3.85	<0.01

A study done by Nabi et al. suggested that the risk of hypertension increases with repeated experience of depressive episodes over time and becomes evident in later adulthood.

Several plausible mechanisms may explain this association. First, because hypertension develops over a long-time span, it may be that depressive symptoms in the long term rather than the short-term influence risk of high BP or hypertension. Thus, the trend toward an increase in the odds for hypertension in participants in the increasing depression group could be seen as a consequence of depressive symptoms that are likely to be persistent, severe, or less responsive to treatment. This could also explain why the risk of hypertension started to strengthen after the age of 55 years among men with increased depression scores. Second, it has been proposed that depressive symptoms could be linked to hypertension through their effect on the autonomic nervous system involved in the regulation of BP [15].

The American Heart Association has concluded that depression can accelerate atherosclerosis as well as promote the onset and severity of the coronary risk factors like hypertension, and high levels of low-density lipoprotein. The most important reason, depression increases the risk for cardiovascular disease, is its effects on lifestyle and compliance with recommended treatments. Depression has been shown to increase the risk of an unhealthy lifestyle, including smoking; diet higher in calories, salt, and saturated fat; and decrease in exercise. Each of these increases the risk of cardiovascular disease and worsens the outcome.

In addition to its effects on compliance, physiologically, depression is associated with an increase in the stress hormone cortisone. High levels of cortisone can lead to increased blood pressure. It can also increase other hormones (adrenaline), which can increase resting heart rate, blood pressure, and heart rate response to exertion, each of which may increase the risk of myocardial infarction, arrhythmias, and heart failure [16].

But some studies contradict the findings of our study. A study done by Licht et al. found that depressive disorder is associated with low systolic blood pressure and less hypertension [17]. Another study done by Hildrum et al. also showed that symptoms of anxiety and depression were associated with decrease in blood pressure [18]. The central monoamine system may be a possible source of this common factor. Depression and anxiety are characterized by altered levels of neuropeptide Y, an important modulator of norepinephrine signalling. The same alterations in neuropeptide Y may suppress sympathetic activity and decrease BP [19].

To our knowledge, the present study is the only study done in India to investigate the association of depression scores with 24 hours Ambulatory blood pressure and that too in normotensive healthy young adults.

Most of the studies are done either on diseased patients or in elderly age group. Our study results showed that depression leads to an increased risk of high systolic BP load and non-dipping state. Both these states are considered to be a risk of future hypertension and cardiovascular comorbidities.

It has been proved that subjects with mild hypertension and increased BP load have a higher target organ damage which include greater relative myocardial wall thickness and total peripheral resistance, retinopathy and lower cardiac index increasing the adverse cardiac risk profile [7,20].

Studies have shown that non-dipping state may result in increased risk of cardiovascular morbidities and mortality. Several cross-sectional studies have revealed that cardiac hypertrophy, silent cerebral infarction and microalbuminuria in normotensive or hypertensive populations were more common in non-dippers than dippers [7, 21,22].

Conclusion

We conclude that subjects with higher systolic BP load had more depression scores showing that depression is one of the contributing factors of rise in systolic BP. Secondly the depression scores were higher in non-dippers. So, depression can lead to non-dipping state which is itself a risk factor for future cardiovascular morbidity and mortality.

So, in patients suffering from depression, the 24-hour ABPM can be recommended to know about their dipper state and BP load so as to evaluate the future risk of hypertension and cardiovascular disorders in them.

Key Message

24-hour ABPM can be recommended in patients suffering from depression, to know about their dipper state and BP load, so as to evaluate the future risk of hypertension and cardiovascular disorders in them.

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Effect of Body Mass Index (BMI) on Mean Auditory Reaction Time for Low Pitch and High Pitch in School Bus Drivers

Garima Shah[1], Rajni Soni[2], Manjula Mehta[3]

Author's Affiliations:
[1]Junior Resident [2]Professor & Head [3]Assistant Professor, Department of Physiology, Mahatma Gandhi Memorial Medical College, Indore, Madhya Pradesh 452001, India.

Corresponding Author:
Manjula Mehta, Assistant Professor, Department of Physiology, Mahatma Gandhi Memorial Medical College, Indore, Madhya Pradesh 452001, India.
E-mail: drmanjulamehta@hotmail.com

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Abstract

The present study was carried out in the Department of Physiology, Mahatma Gandhi Memorial Medical College, Indore (M.P.). It is a type of cross-sectional study. Study was performed after taking permission from the Ethics and Scientific Review Committee M.G.M. Medical College M.Y. Hospital, Indore and permission letter from the Head of Department of Physiology MGM Medical College, Indore and from respective school authorities. The period of study was from March 2015 to February 2016. We had selected 100 school bus drivers of age group 20-50 years. *Conclusion:* With increase in BMI auditory reaction time also increases but the data obtained were statistically not significant ($p>0.05$). So from above findings we can conclude that shorter auditory reaction time in drivers makes important sense for safe driving and it can prevent road traffic accidents as well. *Study Design:* Cross-sectional Study.

Keywords: Auditory Reaction Time; High & Low Pitch; BMI & Bus Drivers.

Introduction

Reaction time is defined as an interval of time between the application of stimulus and the initiation of appropriate voluntary response under the condition that the subject has been instructed to respond as rapidly as possible [1]. Thus it indicates the time taken by an individual to react to external stimulus [2]. In everyday life one has to respond almost instantaneously to many diverse situations. Many simple situations of reaction time are usually at our home itself e.g. response to a door bell, telephone ring or whistle of pressure cooker.

One measure of information processing is reaction time and is used to judge the ability of the person to concentrate and coordinate. It provides an indirect index of the integrity and processing ability of the central nervous system [3] and a simple, non invasive means of determining sensorimotor co-ordination and performance of an individual [4]. With improving health care and services, the entire world has seen a spurt of growth in geriatric population. Some factors like nutrition, exercise, personal habits, environmental influences, substances like antioxidants in heroic doses can slow down the process of aging to some degree, still it has proved to be almost an inevitable process.

Material & Method

The present study was carried out in the Department of Physiology, Mahatma Gandhi Memorial Medical College, Indore (M.P.). It is a type of cross-sectional study. Study was performed after taking permission from the Ethics and Scientific Review Committee M.G.M. Medical College M.Y. Hospital, Indore and permission letter from the Head of Department of Physiology MGM Medical College, Indore and from respective school authorities. The period of study was from March 2015 to February 2016. We had selected 100 school bus drivers of age group 20-50 years.

An informed written consent had been taken from these subjects after explaining the study procedure

and a self-made questionnaire had been administered to every participant regarding their personal, present, past, family, socioeconomic and medical history in detail. Then after the assessment of related hearing tests we had done choice reaction time test by audio-visual analyzer. Only those participants were taken into the study that fulfilled our inclusion criteria.

Inclusion and Exclusion Criteria

Inclusion

1. School bus drivers of age group 20-50 years (cases) and non-bus drivers (controls) of same age group.
2. School bus drivers driving the vehicle for more than one year.
3. All subjects included were healthy males.
4. All subjects with no auditory or visual disturbances.
5. Individuals giving consent for test participation in the study.
6. Those who are not taking any sedative or hypnotic or anti-allergic medicine.
7. Individuals with history of addiction (only smoking or tobacco chewing).

Exclusion

1. Individuals of age group <20 and >50 years.
2. School bus drivers driving the vehicle for less than one year.
3. Individuals with auditory or visual disturbances.
4. Individuals taking any sedative or hypnotic or anti-allergic medicine.
5. Individuals not giving consent for test participation in the study.

These subjects were assessed for various physiological parameters mentioned below and a standardized protocol was followed while taking the measurements: height, weight, pulse, blood pressure, clinical examination (general and systemic), hearing tests (Rinnie's and Weber's). The BMI of all the participants was measured by taking height and weight into consideration and categorized into three groups - normal weight, over weight, and obese groups.

Procedure

1. Hearing Tests: For the assessment of related auditory function we have used Rinnie's and Weber's test. Before testing for auditory reaction time we must be assured that all the subjects should have normal hearing capacity. For this Rinnie's and Weber's test were done.

2. Rinnie's test:

This test compares the ability of hearing through the medium of bone and that of air; that means there is comparison of bone conduction with air conduction of the same ear.

Procedure

1. After giving proper instructions to the subject we have asked him to raise the finger when he stops hearing the sound of the vibrating tuning fork (of 512 hz frequency).
2. The stem of the tuning fork was held between the thumb and the index finger in such a way that the fingers do not touch the blades of the tuning fork.
3. The tuning fork was made to vibrate vibrate by suddenly stroking the blades of the fork against the hypothenar eminence or the thigh. Immediately the base of the vibrating tuning fork was placed on the mastoid process of one side and ask the subject to raise his finger when he ceases to hear the sounds.
4. Once he stopped hearing, we have hold the tuning fork very close to his ear and asked him whether he hears the sound or not. If the hearing is normal, the subject will hear the vibrating fork by air conduction even after he ceased hearing by bone conduction i. e. in healthy subjects, the air conduction is better than bone conduction.

   Weber's test: Weber's test compares bone conduction of both the ears. Base of the vibrating tuning fork was placed on the forehead and the subject was asked to indicate whether the sound is heard equally in both the ears or is better heard in one of the ears. In healthy subjects, both the ears hear the sound equally. But in abnormal conduction sound is lateralized to the affected ear.

3. Reaction Time Test

Each subject was made familiar with the apparatus and procedure was explained before doing the test. In our study we had used choice reaction time test.

Apparatus: The "608 Audiovisual reaction timer" was used in this study. Display has 3 different types of light and sound on either side. Three visual stimuli red, green and yellow color light and three auditory

stimuli low, medium, and high pitch sound system with independent operation are provided. The operating channel on the "experimenter's side" consisted of red, green and yellow lights. Digital time display in middle, below which a press button "reset to zero" button and low, medium, and high pitch sound buttons are provided. The subject's side has the same buttons as in experimenter's side i.e. three buttons for red, green and yellow lights and three buttons for low pitch, medium pitch and high pitch sound buttons. A power on and off button is present on the side of the instrument. A ready signal in the form of red light is present on the subject's side.

Test procedure: For auditory reaction time: Three practical trials were given each time before taking the observation. Before presenting a stimulus a ready signal or warning in the form of a verbal instruction READY was given. For auditory reaction time, the stimulus given was a continuous beep of three different frequency sounds i.e. low, medium, and high pitch sound stimuli. The subjects sat to one side and examiner sat to other side of instrument. Subject has to react to two different frequencies of sound stimuli i.e. high and low by pressing the respective key for the sound as soon as that respective frequency sound was produced which may be high or low pitch sound. When subject pressed the key as a response to auditory stimuli, instrument stops counting the time. This time was directly taken as auditory reaction time. Three practical trials of auditory stimuli were given to each subject and the best (i.e. the lowest) was taken as the auditory reaction time of that subject.

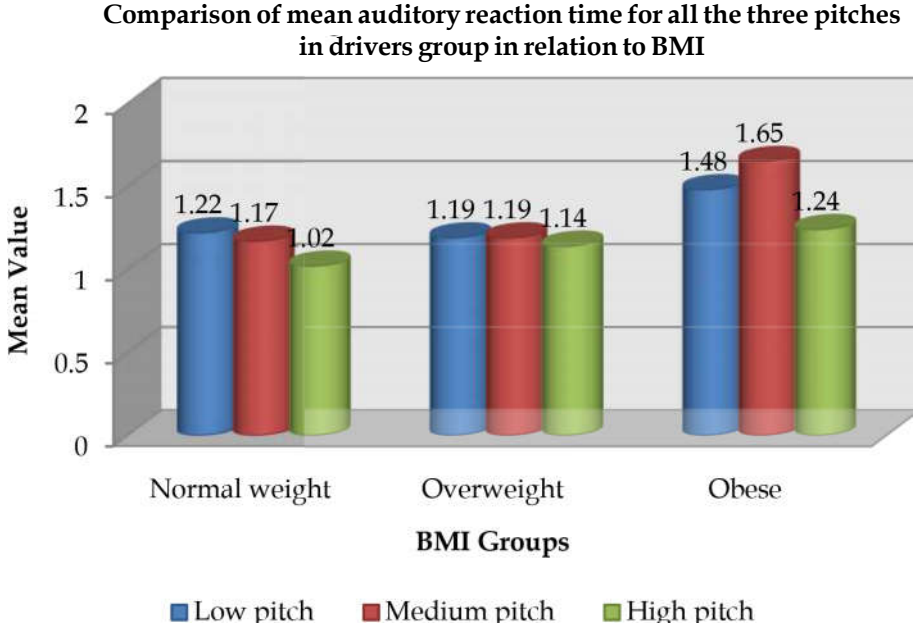
Observation and Results

Data thus collected were compiled, tabulated, and analyzed by using One-Way ANOVA test. p value < 0.05 was taken as statistically significant. The table 1 shows the comparison of auditory reaction time for different pitches in different BMI groups in the drivers group.

The mean auditory reaction time for low pitch in the normal weight group was 1.22±0.37, in the overweight group it was 1.19±0.41 and in the obese group it was 1.48±0.00. Though the mean auditory reaction time was higher for the obese person, the difference was found to be statistically not significant ($p > 0.05$), showing that the auditory reaction time for low pitch is quite comparable between all the BMI groups.

The mean auditory reaction time for medium pitch in the normal weight group was 1.17±0.59, in the over weight group was 1.19±0.39 and in the obese group was 1.65±0.00. Though the mean auditory reaction time was higher for the obese persons, the difference was found to be statistically not significant ($p>0.05$), showing that the auditory reaction time for medium pitch is quite comparable between all the BMI groups

The mean auditory reaction time for high pitch in the normal weight group was 1.02±0.43, in the overweight group it was 1.14±0.44 and in the obese group it was 1.24±0.00. Though the mean auditory reaction time was higher for the obese person, the



Graph 1: Comparison of mean auditory reaction time for all the three ptiches in the drivers group in relation to BMI

Table 1: Comparison of mean auditory reaction time for pitch in drivers group in relation to age (N=100)

Pitch	BMI	N	Mean±SD	F Value	P Value
Low pitch	Normal Weight	59	1.22 ± 0.37	0.301	0.741, NS
	Overweight	40	1.19 ± 0.41		
	Obese	1	1.48 ± 0.00		
Medium pitch	Normal Weight	59	1.17 ± 0.59	0.431	0.651, NS
	Overweight	40	1.19 ± 0.39		
	Obese	1	1.65 ± 0.00		
High pitch	Normal Weight	59	1.02 ± 0.43	0.982	0.378, NS
	Overweight	40	1.14 ± 0.44		
	Obese	1	1.24 ± 0.00		

difference was found to be statistically not significant ($p > 0.05$), showing that the auditory reaction time for high pitch is quite comparable between all the BMI groups. so our study shows that there is positive correlation between BMI and reaction time (statistically not significant $p>0.05$)

Discussion

Auditory reaction time is defined as time taken between the auditory stimulus and response obtained. The first part of auditory reaction time is sensory stimuli which may be in the form of horn in case of bus drivers, and then this sound reaches to auditory cortex via vestibulocochear nerve by auditory pathway.

Our findings match with the following study of Lalita H. Nikam and Jayshree V. Gadkari (2012)[5] who showed the effect of Age, Gender, and Body Mass Index (BMI). There was significant positive correlation between BMI and auditory reaction time. Subjects with greater BMI react slower than others (Skurvyas et al.)[7]. As shown in our study that overweight individual react slower than those individuals having normal weight. On comparing the reaction time of overweight individuals with normal weight individuals, similar findings were observed. Possible explanation for this could be obesity induced vascular disease. Other mechanisms suggested are secretions of adipose tissue like hormones, cytokines, and growth factors affecting brain health [6]. Different neurophysiological studies have shown influence of obesity and elevated body mass index on cognitive functions, memory deficits and executive dysfunction in young as well as middle aged individuals [8,9].

Conclusion

With increase in BMI auditory reaction time also increases but the data obtained were statistically not significant ($p>0.05$). So from above findings we can conclude that shorter auditory reaction time in drivers makes important sense for safe driving and it can prevent road traffic accidents as well.

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Conjugate Lateral Eye Movements (CLEMs) as an Index of Cerebral Functional Laterality

Mahantha M.[1], Karthik M.[2]

Author's Affiliations:
[1]Assistant Professor, Deprtment of Physiology, Kerala Medical College, Palakkad, Kerala 679503, India
[2]Assistant Professor, Deprtment of Physiology, Nimra Institute of Medical Sciences, Vijayawada, Andhra Pradesh 521456, India.

Corresponding Author:
Karthik M.,
Assistant Professor, Deprtment of Physiology, Nimra Institute of Medical Sciences, Vijayawada, Andhra Pradesh 521456, India.
E-mail: mkmy46@gmail.com

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Abstract

Background: Conjugate Lateral Eye Movements (CLEMs) may determine the extent of the relative activity of the two cerebral hemispheres during an on-going cognitive task. Several studies have documented more rightward CLEMs for verbal questions with left hemispheric activity and more leftward CLEMs for spatial questions with right hemispheric activity, while others have suggested CLEMs to be individual-specific independent of the questions. Thus previous findings are mixed and uncertain. This study questions the validity of CLEMs as a measure of functional laterality. *Methods:* The subjects were 400 healthy students in the age group 10-19 years. The subjects were required to orally respond to 10 verbal and 10 spatial questions. During each on-going cognitive process, the first observable CLEM direction was noted and categorised into rightward or leftward CLEM. Then whether this dependent on the type of question or was it an individual-specific stable trait was established. *Results:* In this study, majority of the subjects exhibited CLEMs pattern independent of the type of question (indicating subjects as either right- or left-movers) and was statistically significant. There was no statistical significant difference between genders for the CLEMs pattern. *Discussion:* This suggests that the direction of gaze shift when people are thinking during different types of questions does not reflect the lateralization of underlying cerebral activity. This reflects that during an on-going cognitive task, CLEMs do not depend on preferential hemispheric activation, are independent of question type and is subject-specific stable trait. Thus concluding that though CLEMs may have other neurophysiological implications, is not a valid index of functional laterality. The CLEMs pattern in future studies should be evaluated along with cerebral blood flow, positron emission tomography, etc.

Keywords: Conjugate Lateral Eye Movements; CLEMs; Functional Laterality; Verbal Questions; Spatial Questions; Cerebral Hemispheric Activation.

Introduction

The cerebral cortex is divided into left and right hemispheres. Though the two cerebral hemispheres are roughly symmetrical in appearance, there is asymmetry in their structure and more so with functions. The left hemisphere is concerned with language and logical processing whereas the right hemisphere is involved in spatial recognition, aspects of directed attention and emotional expression. The functional asymmetries can be assessed by central and peripheral measures. This study is concerned with one of the peripheral measures - conjugate lateral eye movements.

Conjugate Lateral Eye Movements (CLEMs) and Functional Laterality

When subjects are posed a question that requires reflective thought, their gaze shifts either to the right or left. This is referred to as conjugate lateral eye movement (CLEM) [1]. It is proposed the side the eye deviates during a thought process implies the cerebral hemispheric activity [2].

There are two concepts of CLEMs found in neurophysiology and neuropsychology literature.

The first suggests that CLEMs vary with the type of question. Earlier studies have shown that verbal problems elicit rightward CLEMs since verbal tasks are processed by the left cerebral hemisphere,

whereas spatial problems elicit leftward CLEMs since spatial tasks are processed by the right cerebral hemisphere [3].

According to the second concept, CLEMs is considered as a trait that reflects individual subject differences in hemispheric specialization. Such that regardless of question type, subjects predominantly move their gaze to right side (right movers) or subjects often shift their gaze to the left (left movers).

The observed patterns of CLEMs are at variance [3] and there are discrepancies about CLEMs being an index of hemispheric asymmetry and the nature of CLEMs has not been unambiguously established. Thus there is lack of consensus regarding CLEMs and this study tries to clarify the issue of whether CLEMs is a valid index of functional lateralization. Against this background, this study attempts to broaden the findings of previous studies and report new evidence.

The implications of this present study can be used in neurophysiological, neuropsychological and other clinical and experimental work.

Aims and Objectives

Aims

To measure the functional lateralization of underlying cerebral activity during an on-going cognitive task using CLEMs, thereby assessing its validity as an index of functional laterality.

Objectives

To evaluate whether conjugate lateral eye movements (CLEMs) can be used as a valid measure of cerebral functional laterality.

Materials and Methods

Source of Data

- School students and college student from Krishna district, Andhra Pradesh, India.
- Number of students randomly selected – 400
- Both male (200) and female (200) students were included.
- Students belonged to the age group of 10 to 19 years.

Inclusion Criteria

- Healthy school and college going students.
- Both boys and girls in the age 10-19 years

Exclusion Criteria

- All unwilling students/ unwilling parents of students.
- Age<10years and >19years.
- No history of any neurological, psychiatric diseases and head trauma.
- No history of long term medication.

Methods of Collection of Data

Institutional ethical committee clearance was obtained. Informed written consent were obtained from the parents of the minor students, and directly from the students in age group 18 and 19 years. It was stressed that no invasive method was being used and confidentiality of the subjects would be maintained.

The school and college students were instructed that few verbal and spatial questions would be posed to them and were required to orally answer them. The test was not demonstrated to the students since CLEMs pattern had to be observed without the knowledge of the subjects.

Conjugate Lateral Eye Movements (CLEMs)

Ten verbal and 10 spatial questions, intended to elicit CLEMs were used in accordance with the age and educational curriculum of the children. The verbal questions involved definition of words, synonyms and antonyms, interpretation of proverbs, spelling. Examples are, "Tell the antonyms of the words BEGIN and SIMILAR", and "What is the spelling of the words UMBRELLA and CREATE". The spatial questions included visualization, places in map and image manipulation, spatial relationships. Examples are, "How many edges are there in a cube?", "With Vijayawada as your reference point, in which direction is Hyderabad located?", "How many left turns do you have to take from your house to the school/college?" The subject was required to sit on a stool. The investigator sat facing the subject 1.5m away. A table was placed between them. Precaution was taken that there was nothing in the room to distract the subject. The questions were orally posed by the investigator facing the subject and the first

observable CLEM for each question was monitored without the knowledge of the subjects. CLEMs were scored using the response categories: rightward CLEMs, leftward CLEMs. The subjects showing CLEMs that depended on question type would have right-CLEMs to verbal questions (indicating left-hemispheric activation which is concerned with verbal/ analytical tasks) while left-CLEMs to spatial question (indicating right-hemispheric activation which is concerned with non-verbal/ intuitive). And the subjects showing an individual-specific stable CLEMs pattern irrespective of question type (either only right-movers or only left-movers) were recorded. The total number of such subjects showing lateralization pattern of CLEMs depending on question types and those showing CLEMs patterns irrespective of question type were determined.

Results

Of the 400 children, 236 subjects showed subject-specific CLEMs lateralization pattern regardless of question type and 164 subjects showed question type specific CLEMs pattern. Thus 59% of the subjects were either right - or left- movers irrespective of the questions, while in only 41% of the subjects CLEMs were dependent on the type of question.To compare the data for statistical significance, one sample t-test was used for Table 1 and Table 2, whereas two sample t-test was used for Table 3. Conventional p value< 0.05 was considered as statistically significant. In Table 1, a one sample t-test between proportions was performed and a significant difference was found between the percent showing question type specific CLEMs and subject-specific CLEMs. Table 2 also shows a significant difference between the number showing each CLEMs pattern for both male and female students. Thus, statistically majority of subjects showed subject specific CLEMs irrespective of the question type (where either right-movers or left-movers with respect to CLEMs). A two sample t-test between male students and female students for each CLEMs pattern was not statistically significant suggesting no gender difference for CLEMs patterns exhibited in this age group.

Discussion

This study questions the validity of CLEMs as an index of functional cerebral laterality. In that it explores whether the pattern of CLEMs are dependent to question's type (indicating differential hemispheric activation during ongoing cognitive activity) or they are subject specific regardless of question type (indicating subjects as either right- or left- movers). The outcome of this study shows that

Table 1: Number of Question specific and Subject specific lateralization patterns of CLEMs

N	Conjugate lateral Eye Movements(CLEMs) Question Type specific (Task specific)- N (%)	Subject Specific- N (%)	t	P
400	164 (41%)	236 (59%)	3.66	0.0003

Task specific= normal lateralization pattern for verbal and special questions.
Subject specific= either right or left movers irrespective of question type.

Table 2: Number of Question specific and Subject specific lateralization patterns of CLEMs according to males and females

N	Question type specific CLEMs- N(%)	Subject specific CLEMs- N(%)	t	P
Male (200)	85(42.5%)	115(57.5%)	2.146	0.033
Female (200)	79(39.5%)	121(60.5%)	3.038	0.002

Table 3: Number of men and women showing each CLEMs pattern

CLEMs pattern	Male (200) –N (%)	Female (200) – N (%)	t	P
Question type specific CLEMs-	85(42.5%)	79(39.5%)	0.610	0.542
Subject specific CLEMs	115(57.5%)	121(60.5%)		

in majority of subjects, there is no association between CLEMs and question type and they are categorised as either right- or left- movers.

The findings of this study with regards to CLEMs are in contrast to earlier studies by Gur [4], Kinsbourne [2], Ehrlichman et al. [5], Schwartz et al. [6], Crouch WW [7], Shevrin H et al. [8], Galluscio EH et al. [9] who have reported more right-CLEMs to verbal and more left-CLEMs to spatial questions. Several studies have implied right-CLEMS with left cerebral hemispheric activity and left-CLEMs with right cerebral hemispheric The left hemispheric blood flow pattern was also found to be high during a verbal assignment.

The present study is in agreeing with a subject-specific brain hemispheric specialization model of CLEMs laterality and is individual specific. This is in support of the study by Day [10] who argued that CLEMs is a steady trait, and people grouped as either right- or left-movers. Taking into account the mixed and uncertain noticed patterns of CLEMs, Deijen et al. [11], Jamieson et al. [12], Reynolds CR et al. [13], Zenhausern et al. [14], Hatta T [15], De Gennaro L et al. [16] have suggested that CLEMs are individual specific rather than question type specific. Initially it was Day who classified his subjects as either right- or left- movers and suggested that CLEMs are a stable trait. Hiscock showed when subjects are questioned (i.e., verbal and spatial questions), they can reliably be differentiated into those who predominantly shift their gaze to the right (right movers) and to the left (left movers) [17]. Gur RE found that when facing the questioner, the same subjects moved their eyes predominantly in only one direction, either right or left, regardless of problem type. Thus he concluded that the cerebral hemispheres, though specialized for problem type, are preferentially activated within the same individual [18]. Reynolds CR investigated the lateral eye movement phenomenon in children aged 2-8 to 9-11, using both spatial and verbal-analytic questions. CLEMs have been proposed to be an individual specific constant trait of usage of hemisphere regardless of each question type [19,20].

However, other studies have shown left-movers with greater EEG alpha activity than right movers [21] and are also more prone to hypnosis [22], while the right movers are higher on verbal [23] and mathematical ability [24].

Though CLEMs have neuropsychological implications, the present study concludes that CLEMs is not a valid measure of underlying cerebral hemispheric processing and CLEMs are subject-specific rather than question type-specific. This implies that the eye gaze during thought process according to the nature of question does not suggest the cerebral hemispheric laterality of ongoing activity. Thus implying that CLEMs is a individual-specific unchanging trait.

Future studies should explore the relationship of handedness with CLEMs and functional laterality since handedness is also considered to be peripheral measure of functional asymmetry, also with the right-handers having a normal cerebral laterality pattern while the left-handers showed discrepant pattern. Future studies while observing model of CLEMs should include EEG pattern, regional cerebral blood flow, anatomic MRI diffusion tensor imaging and positron emission tomography ,etc. that would typically indicate hemispheric activation based on question type or subject specific hemispheric reliance.

Limitation

Since every task demands the integrated functioning of the whole brain, the results may be overgeneralizing. CLEM patterns observed and reported by the examiner by directly monitoring may not be always reliable. Hence, CLEMs pattern should be monitored by more sophisticated techniques like infrared eye tracking device.

Conclusion

The question type dependent normal lateralization pattern of CLEMs were seen in only 41% of the sample, whereas the remaining 59% showed subject specific CLEMs lateralization pattern independent of the type of question. There is no gender difference for the CLEMs pattern exhibited .It indicates subject-specific mode of CLEMs which are independent of question type. Our study proves CLEMs to be individual-specific and thus an invalid index of functional laterality.

This suggests that in majority of the subjects, there is no differential hemispheric activation during an on-going cognitive task. So it can be considered that CLEMs are a stable trait reflecting individual differences in hemispheric reliance. Thus CLEMs do not reveal the underlying cerebral hemisphere which is active. The present study included only healthy children. Further studies should explore CLEMs with right- left handedness, also in clinical populations and can be linked with imaging studies

investigating development patterns in children. Also CLEMs should be assessed along with cerebral blood flow, EEG, positron emission tomography, etc.

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Influence of Blood Groups on Bleeding and Clotting Time

Rupali Vijaykumar Waghmare[1], N.S. Muniyappanavar[2]

Author's Affiliations:
[1]Assistant Professor
[2]Associate Professor, Department of Physiology, Karwar Institute of Medical Sceinces, Karwar, Karnataka 581301, India.

Corresponding Author:
N.S. Muniyappanavar,
Associate Professor,
Department of Physiology
Karwar Institute of Medical Sceinces,
Karwar, Karnataka 581301, India.

E-mail:drmunins@gmail.com

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Abstract

Background: Blood grouping, Bleeding and Clotting time are routinely performed useful hematological tests, mainly done before blood transfusion and any surgery in hospitals. *Aims and Objectives*: To determine the blood group and to evaluate the association of ABO blood groups with BT and CT among medical students. *Materials and Methods*: This study was conducted on medical students, in the Department of Physiology at Karwar Institute of Medical Sciences (KRIMS), Karwar. Total of 299 medical students participated. Out of which 161 were males and 138 females. Blood was collected by finger prick method. Blood grouping was done with the standard anti sera technique. BT and CT were determined by the Duke's filter paper method and Wright's capillary glass tube method respectively. Blood group distribution was expressed in percentage and their correlation with BT, CT was analyzed by Chi-square analysis and Z-test. *Results:* In our study it was found that the percentage distribution of 'ABO' blood group showed predominance of blood group 'O' followed by 'B', 'A' & 'AB'. Our study also shows that bleeding and clotting times are influenced by blood group and gender. Bleeding time was more in females than males and it was statistically significant ($p<0.0180$). Bleeding time was more in females of blood group O and B, but it was statistically significant only in O blood group ($p<0.0016$). Clotting time was more in females than males and it was statistically significant ($p<0.0118$). Clotting time was more in 'O', 'B' & 'AB' blood group in females as compared to males & it was statistically significant ($p<0.05$). *Conclusion:* In our study, O was the most common while blood group AB was the least. Bleeding time was more in females of blood group O and B, but it was statistically significant only in O blood group. Clotting time was more in 'O', 'B' & 'AB' blood group in females as compared to males and the difference was statistically significant.

Keywords: ABO Blood Group; Bleeding Time; Clotting Time; Medical Students.

Introduction

Haemostasis is the process of forming clots in the walls of damaged blood vessels and preventing blood loss while maintaining blood in a fluid state within the vascular system. A collection of complex interrelated systemic mechanisms operates to maintain a balance between coagulation and anticoagulation [1].

Blood group plays a vital role in the field of transfusion medicine. The relationship between bleeding time, clotting time, and blood group is important in certain clinical conditions such as epistaxis, surgery, and thrombosis. Arrest of bleeding from damaged blood vessels is hemostasis, an essential factor to be checked before any surgical procedures. Hence blood test is a routine test for hospital prior to surgeries. The discovery of the ABO blood groups by Karl Landsteiner was an important achievement in the history of blood transfusion that was followed by discovery of Rh (D) antigen [2,3].

Some studies have shown clear association between ABO blood group status and von Willebrand factor [4,5]. Von Willebrand factor is a large glycoprotein produced by vascular endothelial cells and platelets. Its main role is in haemostasis. Deficiency of vWF leads to hemorrhagic disorders, while elevated levels are a risk factor for thrombosis [6-8].

Some studies have also shown that people with O blood group have a low vWf expression compared to other groups of ABO system. Hence, ABO blood group system strongly influence bleeding and clotting times [9].

In this regard, present cross sectional study was conducted to observe the percentile distribution of blood groups and to study the influence of blood groups, gender with bleeding time and clotting time in medical students of KRIMS, Karwar.

Methodology

This study was conducted on undergraduate first and second year medical students, in the Department of Physiology at Karwar Institute of Medical Sciences (KRIMS), Karwar. The Institutional ethical committee clearance was obtained and informed consent was taken from volunteers. All subjects of the study were 18 to 22 years of age group, healthy and were apparently free from diseases. The information of the students regarding their age, gender, blood group, bleeding time and clotting time were collected by pre-designed questionnaire. Total of 299 medical students, volunteered to participate in the study. Out of 299 students, 161 were males and 138 females. Those with history of bleeding disorders and subjects taking NSAIDS were excluded from the study.

The ABO blood grouping and Rh typing was determined by glass slide method. Three slides were marked as A, B, and C and one drop of anti A serum was placed on slide A, one drop of anti B serum on slide B and one drop of anti D serum on slide C. One of the middle three fingers was pricked with aseptic precautions and transferred one drop of blood on the slide C with anti D serum and another drop of blood is transferred to one of the depressions on the tile with normal saline making 5% suspension. A drop of this cell suspension was placed on anti A serum on slide A, similarly on anti B serum with separate droppers for this purpose. Separate applicator pins were used for mixing the blood suspension with anti sera. After waiting for one to two minutes slides were inspected with naked eye to see whether clumping and agglutination has taken place or not. Then clumping and agglutination is confirmed under the microscope especially in the case of micro agglutination for confirmation and carefully compared with the control.

Bleeding Time (BT) was determined by Duke's filter paper method. It was determined under aseptic precautions by pricking the one of the middle three fingers deep and gently blotting the blood after 15 seconds. Procedure was repeated with fresh site of blotting paper every 15 seconds till no blood appeared on the paper. Number of blots counted and multiplied by 15 (seconds) which gives the bleeding time.

Clotting Time (CT) was determined by capillary tube method. It was determined by pricking one of the middle three fingers with aseptic precautions and the time of appearance of blood noted. The blood was made to flow through capillary tube. At an interval of thirty seconds the capillary tube of 0.5 cm length was broken. The procedure was continued till fibrin threads formed and bridged between the broken ends. Clotting time was obtained by noting the time interval between the appearance of blood and appearance of fibrin thread.

The normal BT by Duke's filter paper method is usually in the range of 1–5 min and the normal Clotting Time valued by the capillary tube method ranges between 5–11 min [10].

The glass slide method of blood group determination is based on antigen antibody agglutination. The antigen present on the membrane surface of RBC agglutinates with the agglutinins present in the anti sera. Hence, blood group was determined based on agglutination with the corresponding anti sera. If agglutination was observed in the blood drop on slide marked A, then it belongs to A blood group, agglutination in blood drop slide B, B group, agglutination in both A and B drops, AB group and if there was no agglutination in both A and B drops, then O group. Similarly, agglutination in blood drop on glass slide marked D was considered as Rh-positive and no agglutination as Rh negative. The data was expressed as percentages

Statistical Analysis

The blood group data was analyzed and the results were listed according to percentage distribution of ABO and Rh blood groups and were expressed in percentages. The Chi-square analysis was carried out to examine gender wise relation between BT and CT. The 'Z' test was applied to examine gender wise relation between BT, CT and Blood groups. The p-value of <0.05 was considered to be statistically significant.

Results

In the present study out of 299 medical students, 161 were males and 138 females. Gender wise distribution of 'ABO' blood group is shown in Table1. The distribution of 'ABO' blood group system among Males & Females was same but the 'O' blood group had highest frequency followed by 'B', 'A' & 'AB'.

Gender wise distribution of bleeding time with Chi-square analysis is shown in Table 2. It shows bleeding time was more than 2.30 minutes in 9.03% females as compared to 5.35% in males. This variation was statistically significant. Distribution of bleeding time according to 'ABO' blood groups in males & females is shown in Table 3. The bleeding time was more in 'O' & 'B' blood group of females as compared to males but it was statistically significant ($p<0.05$) in 'O' blood group only. Gender wise distribution of clotting time with Chi-square analysis is shown in Table 4. The clotting time was more than 4 minutes in 14.05% of females as compared to 9.70% in males. This variation was statistically significant ($p<0.05$). Distribution of clotting time according to 'ABO' blood groups in males & females is shown in Table 5. The clotting time was more in 'O', 'B'& 'AB' blood group in females as compared to males & it was statistically significant ($p<0.05$) .

Table 1: Gender wise distribution of 'ABO' blood group system

Blood Group	Males	Females
A	41(13.71%)	36(12.04%)
B	43(14.38%)	38(12.71%)
AB	8(2.68%)	10(3.34%)
O	69(23.07%)	54(18.06%)
Total	161(53.85%)	138(46.15%)

Table 2: Distribution of bleeding time according to gender with 'Chi-square' analysis

Bleeding time	Gender		Total	χ^2=5.5934
	Male	Female		
≤ 2.30 min	145(48.50%)	111(37.12%)	256(85.62%)	p=0.0180
>2.30 min	16(5.35%)	27(9.03%)	43(14.38%)	The result is significant at
Total	161(53.85%)	138(46.15%)	299(100%)	p<0.05

Table 3: Distribution of bleeding time according to 'ABO' blood groups in males & females

Blood Group	Males (N=161) Mean + SD	Females (N=138) Mean +SD	SE	Z' value	'p' Value
A	127.32 +28.2864	126.69 +27.8773	6.4111	0.0983	0.4801
B	124.88+38.1334	127.89 +40.4808	8.7716	-0.3432	0.3632
O	126.09 +29.3667	145+38.9848	6.3752	-2.9661 *	0.0016*
AB	135 +22.6779	120 +37.4166	14.2929	1.0495	0.1469

*p<0.05 is significant

Table 4: Distribution of clotting time according to gender with 'Chi-square' analysis

Clotting time	Gender		Total	χ^2=6.3327
	Male	Female		
≤4 minute	132(44.15%)	96(32.10%)	228(76.25%)	p=0.0118
>4 minute	29(9.70)	42(14.05%)	71(23.75%)	The result is significant at
Total	161(53.85%)	138(46.15%)	299(100%)	p<0.05

Table 5: Distribution of Clotting time according to 'ABO' blood groups in males & females

Blood Group	Males (N=161) Mean + SD	Female (N=138) Mean +SD	SE	Z' value	P value
A	212.44 + 42.8241	199.17 +41.9098	9.6705	1.3722	0.0885
B	211.40 + 55.4025	253.42 +76.9442	15.0726	-2.7878*	0.0031*
O	229.57 +54.4069	272.59+103.1062	15.4845	-2.7783*	0.0031*
AB	203.75 +48.67898	297 +74.0945	29.0724	-3.2075*	0.0006*

*p<0.05 significant

Discussion

Evaluation of blood groups, bleeding and clotting time are the most important and initial haematological parameters. They are done as a routine clinical evaluation for anesthesiologist and surgeons before doing surgical procedures. The correlation among the blood groups, bleeding and clotting time is important in some clinical conditions like epistaxis, thrombosis and surgery etc. Blood grouping has important role before blood transfusion.

Many studies are conducted so far to correlate the association between blood groups and the Bleeding and Clotting time. Studies have shown that people with O blood group have less risk of venous thromboembolism when compared with the individuals of A, B and AB. The main reason might be that, the von Willebrand factor and factor VIII levels are on the higher side in non-O group individuals [11,12]. Several studies have shown the influence of ABO blood groups on plasma VWF levels [13-15]. These studies indicate that CT and the BT will be elevated among the O group individuals compared to the other groups. Study conducted by Kaur M et al, shown that BT was more prolonged in blood group O followed by B, AB and A, but the difference was not statistically significant [16].

In our study it was found that the percentage distribution of 'ABO' blood group showed predominance of blood group 'O' followed by 'B', 'A' & 'AB'. The similar prevalence O>B>A>AB has been noted by many research studies [17-20]. Dissimilar to our study prevalence of blood group B>O>A>AB was observed in other studies [21-23]. Our study also shows that bleeding and clotting times are influenced by blood group and sex of an individual. Bleeding time was more in females than males and it was statistically significant ($p<0.0180$). Bleeding time was more in females of blood group O and B, but it was statistically significant only in O blood group ($p<0.0016$). Clotting time was more in females than males and it was statistically significant ($p<0.0118$). Clotting time was more in 'O', 'B' & 'AB' blood group in females as compared to males & it was statistically significant ($p<0.05$). Studies conducted by Baishya R et al. [24], Ambreen Aleem, Muqeet Wahid [25], showed similar increase in BT, CT in blood group O and female subjects compared to males. Studies conducted by Mahapatra and Mishra [18], Sasekala and Saikumar [20], noted prolonged CT in blood group B followed by O, AB, A which was statistically significant. Some other studies also observed similar findings of sta-tistically significant prolonged BT and CT in females as compared to males [26-27].

Females have more estrogen levels and low levels of plasma fibrinogen. This could be the possible physiological basis for prolongation of bleeding and clotting time in female subjects than males [28]. The subjects with blood group "O" have the highest values of CT and BT which could be due to low expression of vWf (von Willebrand factor) in this blood group.

Further research at different centers should be carried out with greater sample size and other than ABO blood group system must be evaluated along with measuring plasma levels of vWF to rule out any reasons for the differ-ence in clotting and bleeding time among ABO blood groups, so that preventive measures could be adopted at the earliest.

Conclusion

In our study, O was the most commonly occurring blood group while blood group AB was the least. Bleeding time was more in females of blood group O and B, but it was statistically significant only in O blood group. Clotting time was more in 'O', 'B' & 'AB' blood group in females as compared to males and the difference was statistically significant. Therefore, it can be concluded from our study that blood groups and gender have influence over bleeding and clotting times. Females especially belonging to blood group 'O' are more susceptible for bleeding tendencies compared to males. Screening for bleeding disorders and preventive measures must be initiated before the onset of such disorders.

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Prevalence of Coronary Risk Factors in Patients with Type II Diabetes

Vikas Jain[1], S.K. Dwivedi[2], R.K. Sharma[3]

Author's Affiliations:
[1]Associate Professor, Department o Physiology, G. R. Medical College Gwalior, Madhya Pradesh 474009, India. [2]Associate Professor [3]Assistant Professor, Department of Physiology, Late Baliram Kashyap Memorial Government Medical College, Dimrapal, Jagdalpur, Chhattisgarh 494001, India.

Corresponding Author:
S.K. Dwivedi,
Associate Professor, Department of Physiology, Late Baliram Kashyap Memorial Government Medical College, Dimrapal, Jagdalpur, Chhattisgarh 494001, India
E-mail: drskd05@yahoo.com

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Abstract

Context: Patients with diabetes have more number of coronary risk factors. Early identification of these risk factors is essential to prevent morbidity and mortality among them. *Aims:* To study prevalence of coronary risk factors in patients with type II diabetes. *Settings and design:* hospital based cross sectional study carried out at Department of Physiology Gandhi Medical College, Bhopal. *Methods and material:* 60 patients of type II diabetes were included as per criteria of World Health Organization (1999). All patients were examined for presence of coronary risk factors like age, BMI, waist circumference, waist hip ratio, smoking, physical activity, hypertension, and dyslipidemia. *Statistical analysis:* The data was presented as mean and standard deviation and proportions. *Results:* Prevalence of overweight and obesity was equal among both the sexes. Higher waist circumference prevalence was more in males but central obesity was equal in both the sexes. Prevalence of smoking or tobacco use was very high in males. Overall physical inactivity prevalence was more in females. Prevalence of hypertension as well as that of dyslipidemia was also more in females. As the BMI increased, as the waist circumference increased, and as the duration of disease increased, the prevalence of coronary risk factors increased. *Conclusion:* Prevalence of coronary risk factors was very high in the present study.

Keywords: Smoking; Hypertension; Dyslipidemia; Diabetes; Risk Factors; BMI; Waist Circumference.

Introduction

Diabetes represents a spectrum of metabolic disorder which has become a major health challenge, world-wide. Diabetes is characterized by a metabolic disorder of multiple etiologies characterized by chronic hyperglycemia with disturbances of carbohydrate, fat and protein metabolism resulting from defects of insulin secretion, insulin action or both (WHO 1999). Often the hyperglycemia sufficient to cause pathological and functional changes is present for a long time before the diagnosis is made [1].

Diabetes prevalence has tremendously increased. International diabetic federation estimated about 246 million diabetics worldwide in the year 2007 with the prevalence rates of 6% among the adults 0f 20-79 age groups. As per World health organization (WHO), globally around 180 million population was having diabetes. This is estimated to be double by 2030. As per WHO estimates nearly 1.1 million died due to diabetes in 2005 [2].

WHO predicts that developing countries will bear the brunt of this epidemic in the 21st century, with 80% of all new cases of diabetes expected to appear in the developing countries by 2025. In India it has been estimated that the number of people living with diabetes will escalate from 40.6 million in 2006 to 79.4 millions by 2030. Diabetes in Indian population is reported to be almost 10 years earlier than in the Western countries [3].

Type 2 diabetes mellitus constitutes about 85-95% of all the diabetes in developed countries accounting for an even higher percentage in developing countries. The unprecedented economic development and rapid urbanization in Asian countries

particularly India has led to shift in health problem from communicable to non-communicable disease. [4]

It may seem strange that developing world which is often associated with hunger and inadequate nutrition for children, is now experiencing an epidemic of type 2 diabetes, a disease related to wealth and unhealthy life style. This can be explained on the basis of high degree of urbanization in the countries like India that have made people adapt the life style from the industrial countries. It is also a fact that some people genetically have a higher risk of developing diabetes and combined with great changes in lifestyle this risk has turned to reality for the people in these countries. The risk factors peculiar for developing diabetes among Indians include high familial aggregation, central obesity, insulin resistance and urbanization leading to lifestyle changes. Sedentary life is one of the most significant factors associated with diabetes in this population [5].

Patients with diabetes have more number of coronary risk factors. Early identification of these risk factors is essential to prevent morbidity and mortality among them. Hence present study was carried out to study prevalence of coronary risk factors in patients with type II diabetes.

Methods

Present study was hospital based cross sectional study carried out at Department of Physiology, Gandhi Medical College, Bhopal over a period of one year from April 2016 to March 2017.

During the study period it was possible to study a total of 60 patients of type II diabetes in the age group of 40-50 years. All the cases were proved cases of diabetes mellitus type-II as per criteria of World Health Organization (1999) [1].

Inclusion Criteria

1. Type II diabetic patients
2. Age of 40-50 years
3. Willing to participate in the present study

Exclusion Criteria

1. Age less than 40 years and more than 50 years
2. No willing to participate in the present study

Criteria for Diagnosis of Diabetes Mellitus [1]

- Symptoms of diabetes plus random blood glucose concentration ≥ 11.1 mmol/L (200 mg/dl) or
- Fasting plasma glucose ≥ 7 mmol/L (126 mg/dl) or
- Two hour plasma glucose ≥ 11.1 mmol/L (200 mg/dl) during an oral glucose tolerance test.

Approval has been taken from the ethical committee of the Institute.

All procedures were carried out in agreement with the treating physician.

All patients data was collected in the pre designed, pre tested, semi structured study questionnaire finalized for the present study after taking consent from the patients selected.

Anthropometric measurements were recorded in accordance to guidelines given by WHO [6].

BMI more than 25 kg/m^2 was taken as one of the coronary risk factor. WHR > 0.95 for men and > 0.85 for women was considered as central obesity [8].

Total Physical activity was classified using Singh R. B. et al guidelines [9].

WHO guidelines were used to measure and classify blood pressure [10].

The data was entered in the Microsoft Excel worksheet and analyzed using mean values and two standard deviations. Proportions were also used to analyze the data.

Results

Table 1 shows relevant baseline anthropometric data of type-II diabetic patients. In both the age groups, males were more than females. Prevalence of overweight and obesity (BMI > 25 kg/m^2) was equal among both the sexes. Higher waist circumference prevalence was more in males but central obesity was equal in both the sexes.

Table 2 shows age wise prevalence of coronary risk factors in type-II diabetic patients. Prevalence of smoking or tobacco use was very high in males. Overall physical inactivity prevalence was more in females. Prevalence of hypertension as well as that of dyslipidemia was also more in females as compared to males.

Table 3 shows prevalence of coronary risk factors in study population according to BMI categories. It

Table 1: Relevant baseline anthropometric data of type-II diabetic patients (n=60)

Variables		Men (n=38) Mean ± SD	No. (%)	Women (n=22) Mean ± SD	No. (%)	Overall (n=60) Mean ± SD
Age (Years)	40-45 (n=30)	42.66 ± 1.65	21 (70)	42.11 ± 1.45	9 (30)	42.5 ± 1.5 (50)
	45-50 (n=30)	48.23 ± 1.52	17 (57)	48.15 ± 1.34	13 (43)	48.2 ± 1.42 (50)
BMI (Kg/M²)	< 25 (n=30)	23.5 ± 1.09	23 (77)	22.88 ± 0.80	7 (23)	23.4 ± 1.05 (50)
	> 25 (n=30)	28.24 ± 2.011	15 (50)	28.22 ± 2.41	15 (50)	28.29 ± 2.18 (50)
Waist Circumference (cm)	Men (< 90) Women (< 80) (n=11)	83.0 ± 1.8	9 (82)	75.0 ± 0.0	2 (18)	81.54 ± 3.61 (18)
	Men (> 90) Women (> 80) (n=49)	93.31 ± 4.49	29 (59)	95.7 ± 7.9	20 (41)	94.28 ± 6.17 (82)
Waist Hip Ratio	Men (< 0.9) Women (< 0.8) (n=21)	0.84 ± 0.03	18 (86)	0.77 ± 0.01	3 (14)	0.83 ± 0.04 (35)
	Men (> 0.9) Women (> 0.8) (n=39)	0.98 ± 0.04	20 (51)	0.94 ± 0.10	19 (49)	0.96 ± 0.08 (65)

(numbers in parenthesis are percents)

Table 2: Age wise prevalence of coronary risk factors in type-II diabetic patients

Risk Factor	Age Categories (Years)			
	Men		Women	
	40-45 (n=21)	45-50 (n=17)	40-45 (n=09)	45-50 (n=13)
Smoking / Tobacco	14(67)	11(65)	2(22)	6(46)
Physical Inactivity	8(38)	12(70)	4(44)	12(92)
Obesity				
- Generalized	7(33)	8(47)	5(55)	10(77)
- Abdominal	15(71)	14(82	8(88)	12(92)
Hypertension	9(43)	13(76)	5(55)	11(85)
Dyslipidemia	8(38)	11(65)	5(55)	9(69)

(Numbers in parenthesis are percents)

Table 3: Prevalence of coronary risk factors in study population according to BMI categories

Risk Factors	Patients	BMI Categories (Kg/M²)		
		18-24.9	25-29.9	30-34.9
	Men	23	11	04
	Women	7	12	03
Smoking / Tobacco	Men	13(56)	10(91)	04(100)
	Women	2(28)	4(33)	2(66)
Physical Inactivity	Men	10(43)	6(54)	4(100)
	Women	3(43)	10(83)	3(100)
Abdominal Obesity	Men	14(61)	12(100)	4(100)
	Women	5(71)	11(100)	3(100)
Hypertension	Men	8(34)	10(91)	4(100)
	Women	3(43)	10(83)	3(100)
Dyslipidemia	Men	5(22)	10(91)	4(100)
	Women	2(28)	9(75)	3(100)

(numbers in parenthesis are percents)

Table 4: Prevalence of coronary risk factors in study population according to waist size categories

Risk Factors	Patients	Waist Size Categories (Cm)			
		70-79	80-89	90-99	≥ 100
	Men	-	09	23	06
	Women	02	03	11	06
Smoking / Tobacco	Men	-	2(22)	22(95)	4(66)
	Women	-	1(33)	4(36)	2(33)
Physical Inactivity	Men	-	1(11)	15(65)	3(50)
	Women	-	2(66)	8(72)	6(100)
Generalized Obesity	Men	-	-	11(48)	4(67)
	Women	-	-	9(82)	6(100)
Hypertension	Men	-	1(11)	16(59)	5(83)
	Women	-	1(33)	9(82)	6(100)
Dyslipidemia	Men	-	-	15(65)	4(66)
	Women	-	-	8(73)	6(100)

(numbers in parenthesis are percents)

Table 5: Prevalence of coronary risk factors in type-ii diabetic patients in relation to duration of disease

Risk Factor	Duration of Disease (Years)					
	Men			Women		
	1-4 yr (n=15)	4-7 yr (n=08)	7-10 yr (n=15)	1-4 yr (n=07)	4-7 yr (n=06)	7-10 yr (n=09)
Smoking/ Tobacco	5(33)	6(75)	15(100)	2(28)	1(17)	5(55)
Physical Inactivity	1(7)	8(100)	14(93)	2(28)	5(83)	9(100)
Obesity						
- Generalized	3(20)	5(62)	8(53)	3(43)	4(67)	8(89)
- Abdominal	7(47)	8(100)	14(93)	6(86)	5(83)	9(100)
Hypertension	1(7)	7(87)	14(93)	2(28)	5(83)	9(100)
Dyslipidemia	1(7)	7(87)	11(73)	2(28)	5(83)	7(77)

(numbers in parenthesis are percents)

was found that as the BMI increased, the prevalence of coronary risk factors like dyslipidemia, hypertension, abdominal obesity, and physical inactivity increased in both males and females.

Table 4 shows prevalence of coronary risk factors in study population according to waist size categories. It was found that as the waist circumference increased, the prevalence of coronary risk factors like dyslipidemia, hypertension, generalized obesity, and physical inactivity increased in both males and females.

Table 5 shows prevalence of coronary risk factors in type-ii diabetic patients in relation to duration of disease. It was found that as the duration of disease increased, the prevalence of coronary risk factors like dyslipidemia, hypertension, generalized obesity, abdominal obesity, physical inactivity increased in both males and females.

Discussion

The duration of diabetes in 60% of the subjects was ≤ 7 years and in remaining 40% was more than 7 years. Positive family history of diabetes mellitus, hypertension & obesity was found in 78%, 45% & 51% of study-population respectively. Majority (63%) of study population were on oral anti-diabetics treatment and 37% were on combined (oral + insulin) therapy. 65% diagnosed cases of hypertension were on antihypertensive treatment (b-Blockers). None of the subjects were having any endocrinal disorder other than diabetes, musculoskeletal disorder and/orthopaedic impairment. Study of cardiovascular risk factor distribution revealed that the major risk factors in subjects with metabolic syndrome were obesity, hypertension dyslipidemia. Physical inactivity was

also found in appreciable number of cases. The more risk factors one has, greater is the chance of developing coronary heart disease. Also greater the level of each risk factors greater the risk. Increasing age is an non modifiable risk factor over 83% of people who die of coronary heart disease are 65 years or older. At older ages incidence of heart attack is more in women as compared to men.

In the subjects aged more than forty-five years irrespective of gender, greater prevalence of coronary risk factors was observed. The main risk factors identified in the age group 40-45 years were abdominal obesity (77%) & smoking (53%). In patients aged 45-50 years the important risk factors were abdominal obesity (87%), hypertension (80%) and physical inactivity (80%). The present study showed that physical inactivity of any-type work related or leisure-time influences health adversely.

The prevalence of cardiovascular risk factors was found to be very high in subjects having BMI > 25 kg/m2 and waist size category > 90 cm. In Framingham study Hubert HB et al. [11], Garrison RJ et al. [12] reported that for both the sexes obesity was found to be an independent coronary risk factor. They defined obesity as weight exceeding 20% more than the desirable body mass index.

Ming W et al. [13] studied the relationship between low cardio respiratory fitness and mortality in normal weight, over weight and obese men. A total of 25714 adult men (43.8±10.1 years) participated in their study. They found that obese men were 2-3 times more likely to develop cardiovascular disease. This risk increased to 3.1 for males having both obesity and hypertension. Half of males in their study were found to have improper physical fitness.

The association between BMI, waist size category and cardiovascular parameters was examined and significant positive correlation of BMI was observed with fasting serum glucose, total cholesterol triglyceride, LDL cholesterol and cardiovascular exercise parameters, resting pulse, blood pressure. Serum glucose was positively correlated with waist size.

The present study found that as the waist size increased, the prevalence of coronary risk factors increased. Similar findings were given by Gupta R et al. [14]

Krauss RM et al. [15] studied the impact of obesity, cardiovascular disease and reported that obese subjects on an average have higher blood pressure, total cholesterol, triglyceride, fasting glucose and plasma insulin level and lower HDL cholesterol level than lean persons. The findings of present study corroborates with the above finding.

It is now generally accepted that excess visceral fat is associated with insulin resistance. Metabolic risk factors for coronary vascular disease metabolic syndrome are a clinical concept that facilitates the identification of patients who have metabolic derangements, making them more prone to arteriosclerosis and thus a risk for adverse cardiovascular events.

A steep increase in prevalence of hypertension was observed at waist circumference more than 90 cm. In addition to this, 69% subjects in this category had history of tobacco use and physical inactivity.

None of the coronary risk factor was found to present in waist circumference category less than 80 cm. Central obesity is the key feature of coronary risk factors reflecting the fact that the coronary risk factors prevalence is driven by the strong relationship between waist size and increasing adiposity. Sharma P et al. [16] suggested that inflammation or oxidative stress may be important underlying etiology of metabolic syndrome, which are reported to be associated with metabolic syndrome. Several reports suggested that for any given BMI, Indian tends to have increased waist circumference. The finding of the present study identified abdominal obesity in 66% type-II diabetic patient having BMI less than 25 kg/m^2. McKeigue PM et al. [4] reported that Indian have excess body fat, abdominal and trunk obesity.

The observations revealed that greater the duration of disease more was the prevalence of cardiovascular risk factors. Dryberg et al. [17] reported an association between autonomic dysfunction and duration of disease. Curtis BM et al. [18] studied altered autonomic tone as a cardiovascular risk factor and associated autonomic nervous system with sudden cardiac death.

The present study compared the prevalence of cardiovascular risk factors and came out with the finding that prevalence of cardiovascular risk factors was more among diabetic subjects. Nurcan Arat et al. [19] conducted a study in 61 patients with angiographically normal coronary arteries. They divided the patients in two groups according to presence (32) or absence (29) of metabolic syndrome. The patients with metabolic syndrome exhibited hypertension (44%); increase blood glucose (37%), hypertriglyceridemia (31%) a low HDL cholesterol level (30%) and these proportions were found to be significantly higher as compared to the patients in the non metabolic syndrome group.

Conclusion

Prevalence of coronary risk factors was very high in the present study. There is a need to educate young diabetic patients to avoid smoking, do more exercise, and take good nutritious diet to prevent coronary risk factors and thereby prevent future morbidity and mortality.

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Immediate Effect of Exercise on Auditory and Visual Reaction Time in Medical Students

Sunita Nighute[1], Kiran Buge[2], Sivakumar Uppara[3]

Author's Affiliations:
[1]Professor [2,3]Assistant Professor, Department of Physiology, DVVPFS Medical College, Ahmednagar, Maharashtra 414111, India.

Corresponding Author:
Kiran Buge,
Assistant Professor,
Department of Physiology, DVVPFS Medical College Ahmednagar, Maharashtra 414111, India.
E-mail:
bugekiran@gmail.com

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Abstract

Introduction: Reaction time (RT) denotes time taken by an individual to react to external stimulus. RT plays a very important role in our lives as its practical implications may be of great consequences. Fast RTs can give rewards (e.g. in sports), whereas slow RT can lead to grave consequences (e.g. driving and road safety matters). Factors that can affect the human auditory and visual reaction time include age, gender, left or right hand, practice, fatigue, exercise etc. The present study was conducted, which was aiming to find out immediate effect of exercise on auditory and visual reaction time in medical students. *Material and Methods:* For determination of VRT(Visual Reaction Time) and ART(Auditory Reaction Time) we have used reaction time apparatus designed by Anand agency pune.VRT and ART were determined in 120 healthy medical students in the age group of 17 to 25 years before exercise. All the subjects were asked to perform 5 minute warm up followed by 15-20 minutes exercise on the stationary bicycle (Body Gym Stamina Air Bike) at the speed of less than 5 mph. Data was analyzed by unpaired "t" test. We found both ART and VRT was significantly decreased immediately after physical exercise ($p<0.05$). *Conclusion:* Thus our study showed both VRT and ART was significantly decreased in medical students immediately after physical exercise on stationary bicycle.

Keywords: Auditory Reaction Time; Physical Exercise; Reaction Time; Visual Reaction Time.

Introduction

Reaction time (RT) denotes time taken by an individual to react to external stimulus. RT is defined as the time interval between the onset of stimulus and appearance of appropriate voluntary response by the subject [1,2]. Reaction time is decisive for our everyday lives and needs intact sensory and motor system [3]. Reaction time represents the level of neuromuscular coordination in which the body through different physical, chemical and mechanical processes decodes visual or auditory stimuli. Reaction time is one of the simplest methods for assessing the sensory and motor performance of an individual. The ability of animal to cope up with environmental changes for their survival and existence depends upon the responses given by animal. Quickness of response depends on the integrity of cell communication, sensory perception, central processing and motor response [4].

Factors that can affect the human RT include age, gender, left or right hand, central versus peripheral vision, practice, fatigue, intelligence of the subject, fasting, exercise etc. [5 -7]. Exercise is claimed to have beneficial effects on various body functions including performance of central nervous system. Audio-visual reaction time is the speed with which an individual can respond to an auditory stimulus and visual stimulus respectively. Hence, present study was conducted, which was aimed to find out immediate effect of exercise on auditory and visual reaction time in medical students.

There are three basic types of reaction time experiments [8]

1. *Simple reaction time experiments:* there is one stimulus and one response. Thus in simple reaction time task, only one stimulus is presented which commands a single response. (e.g. spot the dot and react to sound; both measure simple reaction time).
2. *Choice reaction time (Disjunctive reaction time) experiments:* involve presentation of multiple stimuli each calling for a specific response. Thus in choice reaction time task several (minimum two) stimuli are presented and the subject is required to respond correspondingly (e.g. pressing a key in response to the appearance of a particular light on a screen).
3. *Associative reaction time experiments:* involve responding in the form of verbal association to a stimulus which can be either verbal or pictorial.

Aim

To find out immediate effect of exercise on VRT (Visual reaction Time) and ART (Auditory Reaction Time) in the medical students

Materials and Methods

After obtaining approval from research and ethical committee, DVVPF's medical college a total 120 medical (80 male and 40 female) students of 2016 batch were selected and written informed consent was taken from all the participants. The present observational study was conducted in the research lab, Department of Physiology, Vikhe Patil Medical College, between 3.00pm and 5.00pm for period of 6 months (April 2016-September 2016).

Inclusion Criteria

The present study was conducted in 120 medical students in age group of 17-25 yrs both male and females. All were physically and mentally healthy students.

Exclusion Criteria

1. History of smoking, alcoholism
2. Those having any history of hearing disorders, visual disorders and color blindness,
3. History of any medications affecting cognitive performance was excluded from the study.
4. Those having any major illness in the present or past
5. History of any neurological abnormality affecting sensory and motor function

Visual Reaction time and auditory reaction time were recorded by using audiovisual Reaction time apparatus designed by Anand agencies Pune in the year 2004 [9]. It works on 230 volts AC. The instrument is specially designed to measure reaction time in seconds. It has Inbuilt digital chronoscope present on examiners side which measures the reaction time in seconds [9]. All the subjects were thoroughly acquainted with the apparatus. All tests were done in quite room at room temperature of 26-32 degree Celsius. VRT and ART were measured in all participants before physical exercise.

Then all the subjects were asked to perform warm up for 5 minutes followed for stationary bicycle exercise for 15-20 minutes at the speed of less than 5 mph [10]. We have used Body Gym Stamina Air Bike bicycle which was designed by RK Fitness PVT. LTD [11]. After physical exercise VRT and ART were recorded again.

Auditory reaction time - The auditory stimulus was provided in the form of high (beep tone) frequency sound. After connecting the instrument to mains, subject was asked to sit on chair in front of the instrument. He/she was asked to press the response switch using the thumb as soon as, he/she hears the tone. Like wise 3 readings were taken before and also after physical exercise and average of these three readings was taken as the subject's best reading.

Visual reaction time– The visual stimulus was provided in the form of green and red color light. Both visual stimuli were given separately. Subject was asked to press response switch as soon as the red or green color light blinks. 3 readings were taken and average of these 3 readings was taken as the subject's best reading.

The data was statistically analyzed by using student unpaired't' test.

Results

Table 1 show that visual reaction time for green color light was significantly faster after exercise (0.191±0.031) than before exercise (0.201±0.035)

Table 2 show that visual reaction time for red color light was significantly faster after exercise (0.176± 0.027) than before exercise (0.197±0.034)

Table 3 show that auditory reaction time in was significantly faster after exercise (0.195±0.037) than before exercise (0.206±0.041)

Figure 1 showing faster VRT and ART after exercise as compared to before exercise

Table 1: Comparison of visual (green color light) reaction time in seconds before and after exercise

	N	Mean ± SD	'p' value
Before exercise	120	0.201 ± 0.035	
After exercise	120	0.191 ± 0.031	0.02*

* p<0.05 statistically significant ** p<0.001 statistically highly significant

Table 2: Comparison of visual reaction (red color light) time in seconds before and after exercise

	N	Mean ± SD	'p' value
Before exercise	120	0.197± 0.034	0.0012*
After exercise	120	0.176 ± 0.027	

Table 3: Comparison of auditory reaction time in seconds before and after exercise

	N	Mean ± SD	'p' value
Before Exercise	120	0.206 ± 0.041	0.0301*
After Exercise	120	0.195 ± 0.037	

* p<0.05 statistically significant ** p<0.001 statistically highly significant

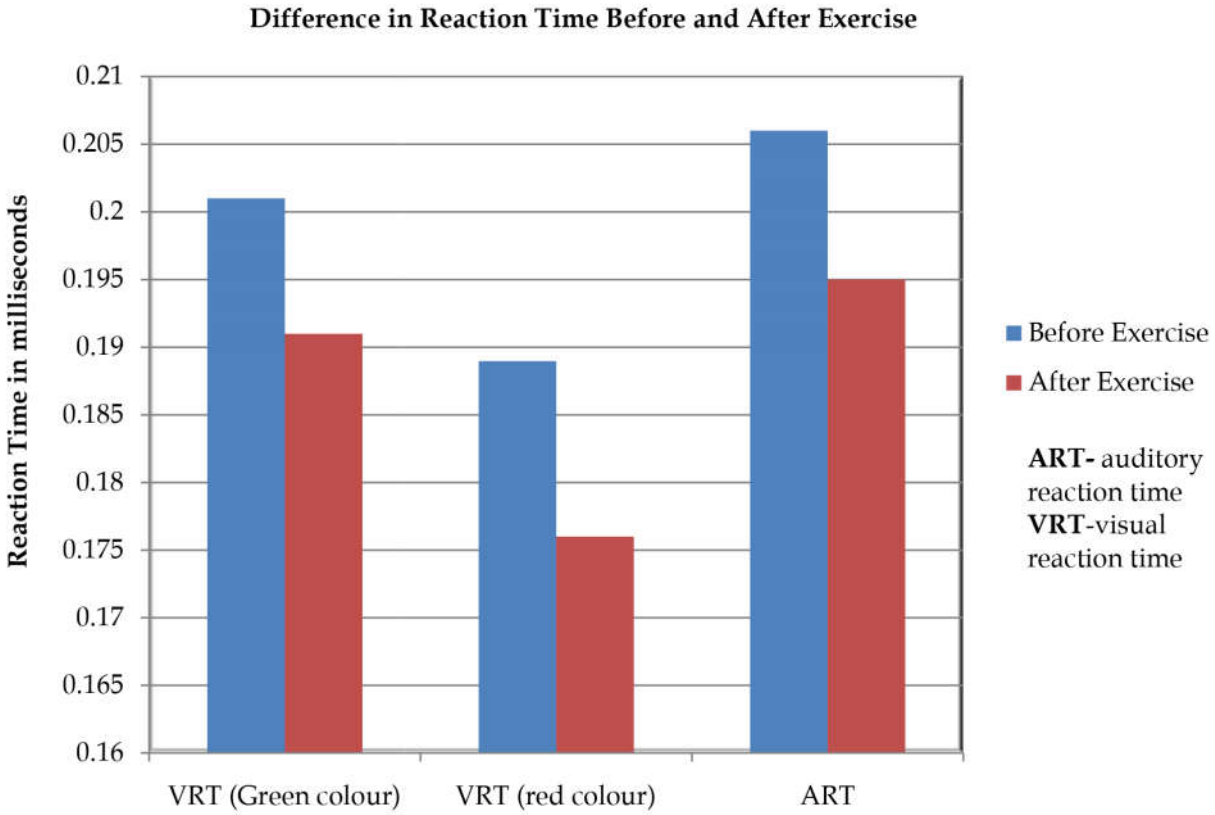

Fig. 1: Comparison of ART and VRT before and after exercise in (n=120) medical students

Discussion

The present study was aimed to find out immediate effect of exercise on visual reaction time (VRT) and auditory reaction time (ART) in medical students. Visual reaction time (red and green color light) and Auditory reaction time were recorded in 120 healthy medical students (80 male and 40 female) before and immediately after exercise. In the present study we found that both VRT and ART were significantly faster immediately after exercise. Table 1, Table 2 and Figure 1 shows faster visual reaction time for green and red color light after exercise ($p<0.05$) . Table 3 and Graph 1 shows auditory reaction time was faster after exercise ($p<0.05$).

Reaction time is dependant on several factors like arrival of stimulus at the sensory organ to neural signal, neural transmission, processing and muscular activation. Malhotra V etal showed that reaction time was faster immediately after exercise. [12] Fastest reaction time was observed when subjects were exercising sufficiently to produce a heart rate of 115 beats per minute [13]. Increased heart rate leads to increase in cortical blood flow which in turn causes increased supply of nutrients like glucose and oxygen to brain thereby enhancing cognitive function of brain [14]. Exercise also increases cognitive function due to great state of arousal [15].

During exercise, exchange of oxygen from blood to the tissue is more rapid which in turn leads to increased transmission of impulse along nerve fibres [16]. Another study reported that reaction time was decreased after 30 minute exercise irrespective of age and gender [17].

Following are the probable mechanisms that can explain why there is decrease in reaction time immediately after exercise [12,14,18,19].

a. After exercise, cortical blood flow increases leading to increased cognitive function
b. Alteration in the levels of neurotransmitter such as serotonin, norephinephrine, dopamine
c. Increasing oxidative enzyme activity which normally protects CNS from oxidative stress

Conclusion

There was decrease in reaction time following exercise in medical students which suggests that there was an improvement in the cognitive functions after exercise. Thus it is evident that even 10 minute of exercise can bring improvement in the cognitive function. We conclude that reaction time (ART and VRT) were faster immediately after exercise. It may be valuable for personnel like soldiers, fire fighters, miners where a person is being asked to make decisions while performing physical works.

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Appendixes

RT- Reaction Time

ART- Auditory Reaction Time

VRT- Visual Reaction Time

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Study of Cardiac Autonomic Activity using Heart Rate Variability in Normotensive Children of Hypertensive Patients

Deepika Kamath M.[1], Niranjan Murthy H.L.[2], Naveen S. Kotur[3], Vijayanath V.[4]

Author's Affiliations:
[1]Assistant Professor, Department of Physiology, KS Hegde Medical Academy, Mangaluru, Karnataka 575018, India. [2,3]Associate Professor, Department of Physiology, [4]Professor & Head, Department of Forensic Medicime, ESIC-MC & PGIMSR, Bangalore, Karnataka 560010, India.

Corresponding Author:
Niranjan Murthy H.L., Associate Professor, Department of Physiology, ESIC-MC & PGIMSR, Bengaluru, Karnataka 560010, India.
E-mail: drvijayanath@rediffmail.com

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Abstract

Introduction: Hypertension is an iceberg disease which is a risk factor for cardiovascular mortality. 45% of children with hypertensive parents have got a possibility of developing hypertension. HRV is a tool to identify autonomic dysfunction. *Materials and Methods:* 50 normotensive male cases with the parental history of hypertension and 50 age-matched healthy male controls were selected for the study. ECG was digitally recorded using BPL Cardiart 1087 ECG machine & Analog Digital Converter (NI-DAQ 7.5) and analyzed for SDNN, LF, HF, LF/HF ratio and E: I ratio. *Results & Conclusion:* SDNN, E: I ratio, HFnu were significantly reduced and LFnu & LF/HF ratio was significantly increased in cases. This indicated a reduced parasympathetic activity and increased sympathetic activity.

Keywords: Heart Rate Variability; Cardiac Autonomic Activity; Hypertension; Sympathetic Overactivity; Parasympathetic Withdrawal.

Introduction

Globally, hypertension (HTN) is an "iceberg" disease. It is one of the major risk factors for cardiovascular mortality which accounts for 31% of all deaths. Hypertension can lead to a variety of complications such as cardiac failure, stroke, and renal damage. Thus, research to identify potential risk factors causing HTN is of great importance.

Early identification of risk factors can be used to prevent HTN and complications of HTN by suitable lifestyle modifications [1]. Family studies have shown that the possibility of developing HTN in children of hypertensives is 45% [2]. Normotensive siblings with a parental history of hypertension are known to be characterized by altered cardiovascular morphology and reactivity. Although the reason for this has not yet been completely clarified, it has been suggested that an imbalance in the autonomic nervous system (ANS) might play an important role.

Sympathetic overactivity and parasympathetic withdrawal are seen in overt HTN. It is also known that all the children of hypertensives will not progress to overt hypertension. This study intends to evaluate the autonomic functions in the children of hypertensives so as to identify the risk factor for hypertension development. Dysregulation of the ANS has been implicated in the development of HTN [3]. There are several tests to determine the autonomic activity. Recently the most accepted tool is Heart Rate Variability (HRV) [4]. HRV is a noninvasive tool to quantitatively estimate cardiac autonomic activity and has been used to document decreased cardiac autonomic activity in HTN. If autonomic dysfunction can be detected before the occurrence of overt HTN, it might help in designing of a scheme for early detection of HTN. Early identification of autonomic dysfunction in an individual will provide an opportunity for implementation of lifestyle modifications, such as weight reduction, moderate-intensity aerobic exercise program, which may prevent or postpone the occurrence of HTN. This study is an effort to assess the cardiac autonomic activity using HRV in normotensive subjects with the parental history of HTN.

Methodology

This is a case-control study done on the student community of Sri Siddhartha University, Tumkur. The study period is of 1-year duration between July 2009 and June 2010. Among the students who had the family history of HTN, 50 males who met with our inclusion criteria were selected for the study.

Inclusion Criteria

1. Healthy normotensive children of hypertensives (either or both parents are hypertensives) in the age group between 18-25 years. The hypertensive status of the parents was based on the information given by the subjects.

Exclusion Criteria

1. Subjects with HTN
2. Subjects with cardio-respiratory diseases.
3. Subjects on drugs like antihypertensives (amlodipine, atenolol, etc), drugs affecting the autonomic nervous system like alpha blockers (phentolamine), beta-blockers (propranolol) and others which might have an effect on HRV.
4. Subjects with the parental history of diabetes mellitus.

Fifty (50) healthy subjects, matched for age and gender, without the family history of HTN were selected from the same student community. These formed the control group.

Informed written consent was taken from all the subjects prior to the investigation. The cases and the controls were examined for general physical health. Weight, height, waist circumference & hip circumference were measured using standard procedures. Body mass index (BMI) was calculated as

BMI = Weight (kilograms) / Height (Meters^2)

Waist/Hip ratio was calculated as WHR = Waist circumference (cms) / Hip circumference (cms).

Resting pulse rate was counted for one minute using the radial artery. Average of three pulse readings was taken as resting pulse rate. BP was measured on the left arm in a supine position using mercury column sphygmomanometer. An average of three readings was taken as BP.

Procedures were conducted in the presence of subject's attendant.

Measurement of Heart Rate Variability (HRV) parameters[4]

A patient was explained in detail about the ongoing procedure and ECG was digitally recorded using BPL Cardiart 1087 ECG machine & Analog Digital Converter (NI-DAQ 7.5). The patient was made to lie down on a couch for 10 minutes and allowed to relax. ECG was recorded in lead II only, as the requirement for the procedure was only peak detection for the determination of RR intervals. First, a 5 minutes ECG in supine position was recorded, with subject breathing normally. Then, a deep breathing ECG was recorded for 2 minutes. The subject was trained to breathe at a rate of 6 cycles/min under oral instructions with each cycle comprising of 5seconds of inhalation and 5seconds of exhalation. The ECG recordings were converted from analog format to digital format using the Analog Digital Converter and the data was stored in notepad which was subsequently analyzed using HRV soft version 1. 1 software.

Instruments used

- ECG machine (BPL Cardiart 1087/MK-V) was used to acquire the analog ECG signal from the subject.
- Analog to digital converter (National Instruments NI-DAQ 7.5 USBD 6008) was used as the hardware, which converted the analog to digital signal and processed it to the computer with the help of the NI-DAQ software.
- HRV soft (version 1.1) was used to detect the peak to peak intervals and to analyze HRV parameters.

Parameters used [4]

The following are the parameters recorded in each group-

The analysis of HRV was considered under two headings – Time Domain analysis & Frequency Domain analysis. All the various parameters of HRV like Standard deviation of Normal to Normal intervals (SDNN), Low-frequency power (LF), High-frequency power {HF), LF/HF ratio, LF normalized units (LFnu) and HF normalized units (HFnu) were deduced using resting ECG recording. Expiratory: Inspiratory ratio (E: I ratio) was deduced using the deep breathing ECG recording. The analysis of the data was done by the principal investigator. Random cross verifications of data analyses were done by co-investigator.

Statistical Software

The Statistical software namely SPSS 15.0 was used for the analysis of the data and Microsoft Excel has been used to generate graphs & tables. The data was analyzed for descriptive statistics like numerical data expressed as mean±standard deviation and non-numeric data expressed as percentages. Inferential statistics like Chi-square test was used to calculate significance. p value <0.05 was considered significant.

Results

This study included 100 subjects of which 50 were cases and 50 were age- and gender-matched controls.

The physical parameters of the cases and controls were matched. There were no significant differences in the systolic and diastolic blood pressures between the groups (Table 1).

The ECG recordings were analyzed for HRV parameters using HRVsoft. SDNN was significantly reduced in the cases (81.32±37.98) compared to the controls (48.56±26.05) (Table 2).

E: I ratio was significantly less in the cases (1.65±0.22) in comparison to the controls (1.42±0.25) (Table 2).

HFnu was significantly less whereas LFnu was significantly more in the cases compared to the controls (Table 3).

There was a significant increase in the LF/HF ratio in the study group in comparison with the control group. (Table 3).

Table 1: Comparison of basic characteristics between controls and cases

	Group Statistics				
	Group	**N**	**Mean**	**Std. Deviation**	**T**
Age(Yrs)	Controls	50	19.2800	1.51240	1.732
	Cases	50	18.8000	1.24540	p=0.086
Height (cms)	Controls	50	168.7400	13.28619	0.351
	Cases	50	167.9400	9.09678	p=0.726
Weight (cms)	Controls	50	65.4000	11.64965	2.003
	Cases	50	60.9500	10.54255	p=0.048
Waist-hip Ratio (WHR)	Controls	50	0.8510	0.04367	1.498
	Cases	50	0.8346	0.06393	p=0.136
Heart Rate (beats per minute)	Controls	50	78.1600	6.91747	1.074
	Cases	50	79.5800	6.29250	p=0.286
SBP (mm/Hg)	Controls	50	115.2800	5.85205	0.225
	Cases	50	115.5600	6.59363	p=0.283
DBP (mm/Hg)	Controls	50	76.6000	6.93115	0.116
	Cases	50	76.7600	6.91511	p=0.908

Results are presented as Mean ±SD
p<0.001 –Significant

Table 2: Comparison of Time Domain parameters between controls and cases

	Group	**N**	**Mean**	**Std. Deviation**	**T**
SDNN(ms)	Controls	50	81.32	37.98	5.029
	Cases	50	48.56	26.05	P<0.001
E:I	Controls	50	1.65	0.22	4.854
	Cases	50	1.42	0.25	p<0.001

Results are presented as Mean ±SD
p<0.001 –Significant

Table 3: Comparison of Frequency Domain parameters between controls and cases

	Group	N	Mean	Std. Deviation	t
LF(nu)	Controls	50	39.54	12.03	8.231
	Cases	50	63.58	16.79	p<0.001
HF(nu)	Controls	50	60.41	11.77	8.280
	Cases	50	36.40	16.78	p<0.001
LF/HF	Controls	50	0.76	0.62	6.25
	Cases	49	2.50	1.87	p<0.001

Results are presented as Mean ±SD
p<0.001 –Significant

Discussion

This study intended to evaluate the autonomic function in children of hypertensives. Because of a paucity of female subjects, who didn't voluntarily get recruited for the study, only male subjects were recruited. 50 cases and 50 age, gender, BMI, and WHR matched controls were recruited from the same student community.

The cardiac autonomic activity can be assessed by several methods like Valsalva maneuver, deep breathing test, handgrip test, cold pressor test, lying down to standing test, etc. But HRV has evolved as a specific and sensitive noninvasive tool to evaluate cardiac autonomic activity, which expresses the total amount of variation of both instantaneous heart rate and RR intervals. HRV indicates the extent of neuronal damage to an autonomic nervous system [4].

The SDNN values reveal the alterations in the autonomic tone that are predominantly vagally mediated [4-8]. In this study, the SDNN values were significantly reduced in children of hypertensives thus suggesting the reduction in the resting parasympathetic activity. The E/I values also reveal the contribution of the parasympathetic component in altering the heart rate during respiratory cycles [4-8]. In this study the values of E/I ratio were also significantly reduced in children of hypertensives thus further supporting the above finding of reduced parasympathetic activity [9].

The LF nu values are considered as a measure of sympathetic activity [4,5-8]. In this study, the LF nu values were significantly increased in children of hypertensives thus suggesting the presence of elevated cardiac sympathetic activity in them. This correlates with the results of the study done by Stolarz K et al. [10].

The HF nu values are considered as a measure of parasympathetic activity [4,5-8]. In this study the HF nu values were significantly reduced in children of hypertensives, which further adds on to the earlier finding of decreased cardiac parasympathetic activity [11].

The LF/HF values reveal the global sympathovagal balance [4-8]. In this study the LF/HF values were significantly higher in children of hypertensives when compared to children of normotensives thus suggesting the alteration in the sympathovagal balance towards the sympathetic component. This is in corroboration with the recent report that exaggeration of increased sympathetic activity facilitates the onset of hypertension in prehypertensives [12].

The fact that the offspring of hypertensive parents were still normotensives indicates that the observed changes in cardiovascular responsiveness occur at an early stage. They are probably of genetic origin and could play a role in the pathogenesis of hypertension. Indeed, a hyper-reactivity of the SNS has long been suspected in the development of hypertension, but most studies have yielded inconsistent results [13].

Emily B, Schroeder et al. [3], have investigated the temporal sequence linking hypertension and HRV. According to them, individuals with HTN had decreased HRV at baseline, and this association was present across the full blood pressure range.

The Framingham heart study showed that the presence of reduced LF in men is a risk factor for developing hypertension [14].

Sevre K et al. [15] showed that in hypertensive subjects there was decreased HRV compared to controls using 2-hour Holter ECG recordings. Virtanen R et al. [16] have studied the relations between HRV, HTN, lifestyle factors and renin-angiotensin-aldosterone system According to this study, all absolute measures of HRV were reduced in hypertension.

HTN is a major cause for morbidity and mortality in developed and developing countries.

Development of HTN is dependent on a number of environmental and dietary factors. There is strong evidence to suggest that HTN runs in families. The manifestation of HTN is likely to be affected by dietary and environmental factors to varying extent. An insight into the heritability, the contribution from father and mother to the expression of HTN will give ample opportunities to modify the other factors in order to prevent or postpone the onset of hypertension.

Syed Faraz Kazim et al. have studied the relationship between blood pressure levels and BMI between children of hypertensive and normotensive parents. Children of hypertensive parents had a significantly higher mean systolic, diastolic blood pressure and BMI [17]. Based on the observation, they have concluded that there is a strong genetic basis for essential hypertension and significant inheritability [18,19]. Asymptomatic children of hypertensive parents are reported to develop essential hypertension during the first two decades of life [20] Jens Tank et al., based on a study on the normal twins, have concluded that baroreflex sensitivity is strongly influenced by genetic factors. Identification of gene influencing baroreceptor sensitivity will provide an important clue for a comprehensive understanding of cardiovascular regulation and pathogenesis of cardiovascular disease [21].

Thus the study shows the presence of reduced parasympathetic activity & reactivity in children of hypertensives. In addition, this study also showed an elevated level of resting sympathetic activity in children of hypertensives. Thus, it showed a definite shift in the sympathovagal balance towards the sympathetic component.

The autonomic nervous system plays a crucial role in blood pressure and heart rate control and may thus be an important pathophysiological factor in the development of hypertension [22]. An early detection of risk of developing HTN can be used to institute prevention strategies, to decrease associated morbidity and mortality.

Our study has a shortfall of not having female subjects. It has also not accounted for the effect of the history of hypertension in single parent and both parents on autonomic functions.

Summary

This is a case-control study of 50 normotensive male children of hypertensives and 50 normotensive healthy age-matched males. The heart rate variabilities of these groups were analyzed using HRV soft. The cases were found to have increased sympathetic activity and reduced parasympathetic activity. This increases the risk for developing hypertension in later life. A further study including female subjects and a long-term follow-up is needed.

Conclusion

From our study, it can be concluded that there are increased sympathetic activity and a parasympathetic withdrawal in children hypertensives. This can act as a risk factor for the development of hypertension in later life. These children have to undergo lifestyle modification to reduce the risk of developing hypertension.

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Original Research Paper

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Effect of Short Term Yoga Practices on Blood Pressure in Medical Students

Manjula Mehta[1], Amarjeet Singh Chhabra[2], R. Wadhwani[3]

Author's Affiliations:
[1]Assistant Professor
[2]Associate Professor
[3]Associate Professor, Department of Physiology , Mahatma Gandhi Memorial Medical College, Indore, Madhya Pradesh 452001, India.

Corresponding Author:
R. Wadhwani
Associate Professor
Department of Physiology
Mahatma Gandhi Memorial Medical College, Indore, Madhya Pradesh 452001, India.
E-mail:
drmanjulamehta@hotmail.com

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Abstract

Background: Yoga is a physical, mental, and spiritual discipline that began in India. Since its inception, around the 5th or 6th century BC, yoga has attained lot of importance as far as the physical and mental health of a common man is concerned. The most common parameter to assess the physical fitness is cardiovascular function usually blood pressure; more the stress, high the blood pressure. The young generation is facing more stress in present scenario in all walks of life and medical students are not exceptions. *Objective:* To study the effect of short-term yogic practices on blood pressure in young healthy medical students. *Methodology:* The study was conducted on 36 healthy medical students (21 males and 15 females) in the age group of 17-21 years in the Department of Physiology, M.G.M. Medical College, and Maharaja Yashwantrao Hospital, Indore. An informed consent was taken after fulfilling the inclusion and exclusion criteria. Blood pressure was measured by using mercury sphygmomanometer before the participants started yoga practices. The participants performed yoga practices in the morning for one hour daily, six days in a week, for four weeks under the guidance of yoga teacher. The yoga practices consisted of Prayer, Omkar recitation, asana, Pranayama, and breathing exercises. Blood pressure was again measured after the completion of yoga session. Data thus collected compiled, tabulated, and analyzed statistically by using students''t' test. *Observation and Result:* There was significant reduction in both systolic and diastolic blood pressure. The reduction in systolic blood pressure was more marked in males (p value 0.006) while reduction in diastolic blood pressure was more marked in females (p value 0.015). *Conclusion:* On the basis of these results we can conclude that yogic practices lowers blood pressure; which can be useful not only therapeutically but also as a preventive measure.

Keywords: Yoga; Blood Pressure; Syphygmomanometer; Students 't' Test.

Introduction

Yoga is a physical, mental, and spiritual discipline that began in India. Since its inception, around the 5th or 6th century BC, yoga has attained lot of importance as far as the physical and mental health of a common man is concerned.

Yoga is a mind-body therapy based on movement and breathing. Over the last few years, research into the potential health benefits of yoga, especially regarding blood pressure; have brought out some beneficial results. In addition to practicing asana, Yogic breathing has been shown to have a positive effect on blood pressure. ... conscious breathing lowers blood pressure [1]. Yogic practices not only help in lowering down the high blood pressure in hypertensive patients [2]; but also prevents blood pressure to rise [3]. Pranayama can also be extremely beneficial in quickly lowering down blood pressure [4]. Even 15 days' yogic breathing like regular pranayama and meditation have beneficial effects on cardiovascular functions irrespective of age, gender, and BMI in normal healthy individuals [56]. Alternate-nostril breathing and bhastrika pranayam brings reduction in blood pressure [7].

The most common parameter to assess the physical fitness is cardiovascular function usually blood pressure; more the stress, high the blood pressure. The young generation is facing more stress in present

scenario in all walks of life and medical students are not exceptions. Hence the purpose of this study was to study the effect of short-term yogic practices on blood pressure in young healthy medical students.

Aims and Objectives

To assess the effect of short-term yogic practices on blood pressure in medical students.

Material and Method

This study was carried out in the department of physiology, Mahatma Gandhi Memorial Medical College, and Maharaja Yashwantrao hospital, Indore.

Study Design: Prospective

Sample type: Purposive

Sample Size: Thirty six (36) participants – first year medical students of Mahatma Gandhi Memorial Medical College, Indore.

Compliance: Participants had 80% attendance in yoga session

Material Used

- Electronic Weighing Machine for recording weight of the participants.
- Standard Stadiometer for measuring height of the participants.
- Mercury Sphygmomanometer for recording Blood Pressure of the participants.
- Stethoscope for measuring blood pressure

Inclusion Criteria

1. Participants giving consent for participation in the study
2. Participants free from any cardiovascular or other chronic illness
3. Participants not involved in yoga practices previously
4. Participants not involved in any other physical activities

Exclusion Criteria

1. Participants not ready to give consent for participation in the study
2. Smokers (biddi, cigarette etc), alcoholics
3. Participants suffering from any cardiovascular or any other illness

Methodology

This study was carried out on healthy medical students (21 males and 15 females) of age group 17-21 years. After obtaining the informed consent, all the participants were subjected to a self-made questionnaire to obtain details regarding their present, past, personal and medical history. Once the inclusion & exclusion criteria have been satisfied, height and weight were recorded using standard protocol along with recording of pulse and temperature. Then a complete general physical examination was done to rule out any physical ailments. Then the blood pressure of the participants was measured on the first day before starting of yoga practices. Then the participants were briefed about the yoga programme and made oriented with the programme for initial 2 days. Then the participants performed the yoga practices every morning for one hour for four weeks under the supervision of expert yoga teacher. The yoga practices include Prayer, Omkar recitation, Asana, Pranayama and scheduled as follows -

1. Prayer and Omkar recitation meditative postures - Padmasana/Sukhasana (Easy pose)
2. Loosening or stretching exercises – Warm ups: starting from the head working towards the toes. Neck rotation, shoulder rotation, arm rotation, elbow movements, wrist movements, finger movements, waist movements, knee rotation, ankle rotation, and toe movements.
3. Quick relaxation in Shavasana (Corpse Pose)
4. Asana

   Standing Yogic Postures

   Tadasan

   Tiryak Tadasan

   Trikonasana

   Pawanmuktasana

   Katichakrasana

   Padhastasana

   Sitting Yogic Postures

   Shshankasana

   Padangusthan

   Bhunamanasana

   Janushirasana

Paschimuttanasana
Utthit Padmasana

Surya Namaskar

5. Deep relaxation in Shavasana (Corpse Pose)
6. Pranayama (Breathing Exercises)
   - ssKapalbhati (forceful exhalation)
   - Nadi shuddhi (alternate nostril breathing)
   - Bhramari (Honeybee sound during expiration)
7. Omkar recitation in Padmasana/ Sukhasana (Easy Pose)

After the completion of yoga session of four weeks, again the blood pressure of all the participants was measured using the same mercury sphygmomanometer.

Blood pressure was measured by using mercury sphygmomanometer. All the participants were explained regarding the method of measuring the blood pressure. Blood pressure of all the participants was measured with standard size riva rocae cuff in the right arm in sitting position on the same time of the day before and after yoga to avoid the effect of posture and diurnal variation respectively. All the participants were asked to sit completely relaxed with no anxiety for at least 10 minutes then the blood pressure was measured taken 2 times for accuracy with a one minute interval between each test on the right arm. All the data thus obtained were compiled, tabulated and analyzed statistically by using students 't' test.

Observations

Table 1 shows that mean systolic blood pressure is less in all the three groups after yoga but the reduction is statistically significant in males with p value of 0.006 as compare to females with p value of 0.457.

Table 2 shows that before yoga 30.56% (n=11) participants were in a range of systolic blood pressure 90-110 mm Hg which is increased by 16.66% after yoga while 11.11% (n=4) participants were having SBP >130 mmHg which got reduced to 0% after yoga. The reduction was less marked where SBP was in a range of 110-130 mm Hg. The similar trend followed when the analysis was gender-wise which is more significant in males than females.

Table 3 shows that mean diastolic blood pressure is less in all the three groups after yoga but the reduction is statistically significant in females with p value of 0.015 as compare to males with p value of

Table 1: Mean Systolic Blood Pressure (mm Hg) before and after yoga

Group	Number of Participants	Mean Systolic Blood Pressure (mm Hg) Before Yogsa ± SD	Mean Systolic Blood Pressure (mm Hg) After Yoga ± SD	t value	P value
Male	21	122.381 ± 9.604	117.904 ± 6.495	3.108	0.006
Female	15	112.933 ± 9.346	111.2 ± 7.513	0.765	0.457
Total	36	118.444 ± 10.486	115.111 ± 7.611	2.635	0.012

Table 2: % of participants in various range of Systolic Blood Pressure (mm Hg) before and after yoga

Range of Systolic Blood Pressure in mm Hg	Male				Female				Total			
	Before Yoga		After Yoga		Before Yoga		After Yoga		Before Yoga		After Yoga	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
90-110	3	14.29	7	33.33	8	53.33	10	66.67	11	30.56	17	47.22
111-130	14	66.67	14	66.67	7	46.67	5	33.33	21	58.33	19	52.78
>130	4	19.05	0	0	0	0	0	0	4	11.11	0	0
Total	21	100	21	100	15	100	15	100	36	100	36	100
Total	21	100	21	100	15	100	15	100	36	100	36	100

Table 3: Mean Diastolic Blood Pressure (mm Hg) before and after yoga

Group	Number of Participants	Mean Diastolic Blood Pressure (mm Hg) Before Yoga ± SD	Mean Diastolic Blood Pressure (mm Hg) After Yoga ± SD	T value	P value
Male	21	75.238 ± 8.52	73.238 ± 5.309	1.345	0.194
Female	15	75.333 ± 6.789	70.80 ± 4.647	2.767	0.015
Total	36	75.277 ± 7.741	72.222 ± 5.122	2.757	0.009

0.194.

Table 4 shows that before yoga 41.67% (n=15) participants were in a range of diastolic blood pressure 60-70 mm Hg which is increased by 22.22% (n=8)after yoga while 16.67% (n=4) participants were having DBP in a range of 81-90 mmHg which got reduced to 0% after yoga. The reduction in diastolic blood pressure was less marked where DBP was in a range of 71-80 mm Hg. The similar trend followed when the analysis was gender-wise which is more significant in females than males

Table 4: % of participants in various range of Diastolic Blood Pressure (mm Hg) before and after yoga

Range of Diastolic Blood Pressure in mm Hg	Male				Female				Total			
	Before Yoga		After Yoga		Before Yoga		After Yoga		Before Yoga		After Yoga	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
60-70	9	42.86	12	57.14	6	40	11	73.33	15	41.67	23	63.89
71-80	9	42.86	9	42.86	6	40	4	26.67	15	41.67	13	36.11
81-90	3	14.29	0	0.00	3	20	0	0.00	6	16.67	0	0.00
Total	21	100	21	100	15	100	15	100	36	100	36	100

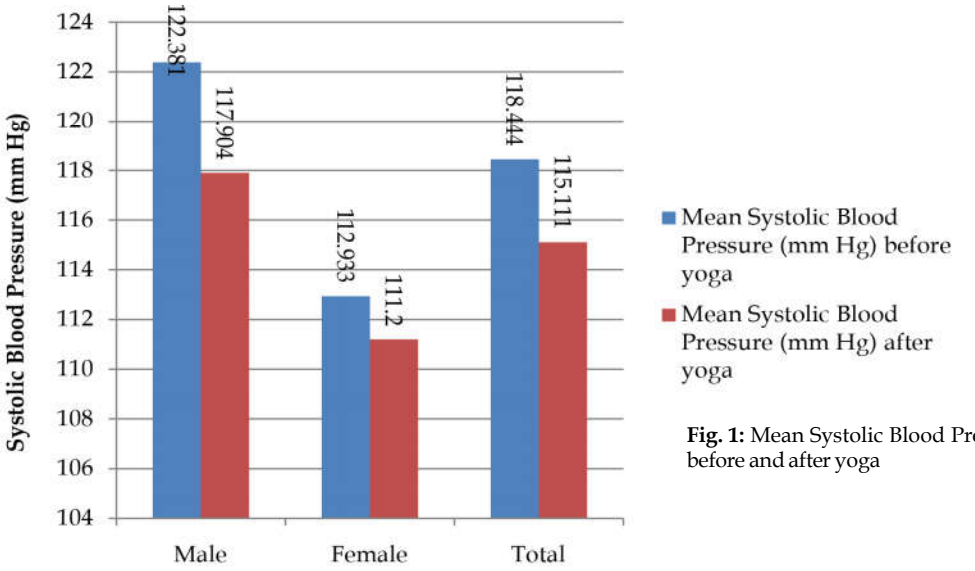

Fig. 1: Mean Systolic Blood Pressure (mm Hg) before and after yoga

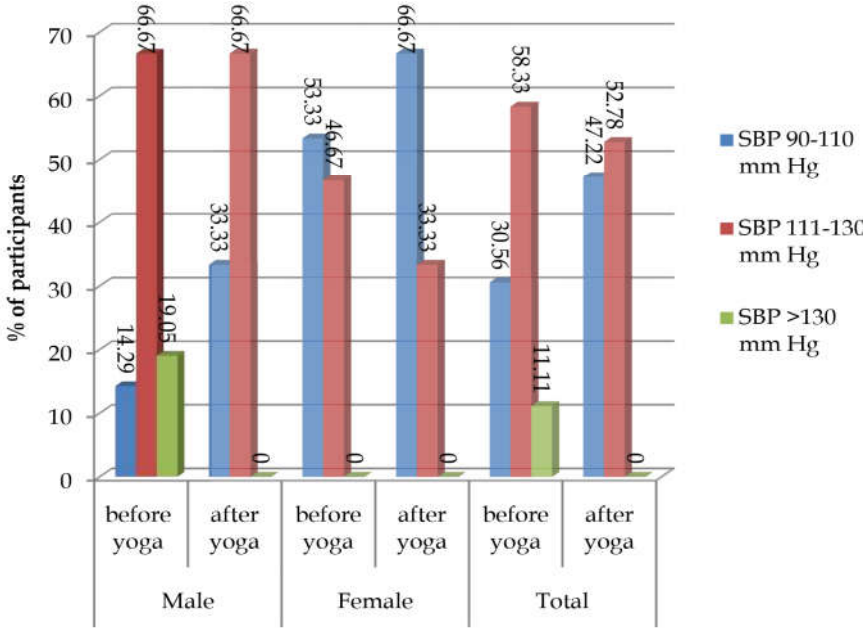

Fig. 2: % of participants in various range of systolic blood pressure (mmHg)

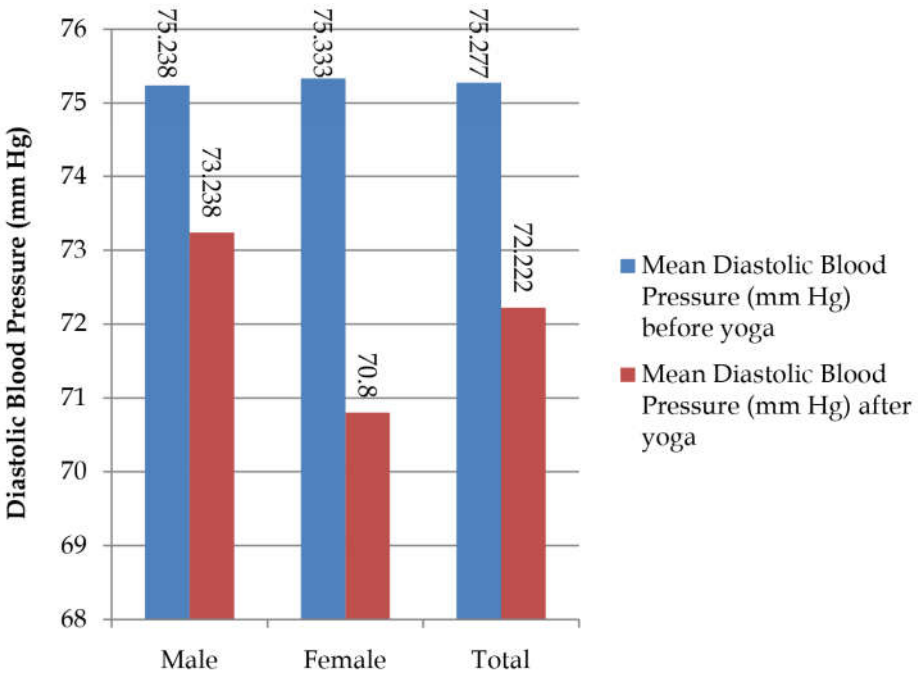

Fig. 3: Mean Diastolic Blood Pressure (mm Hg) before and after yoga

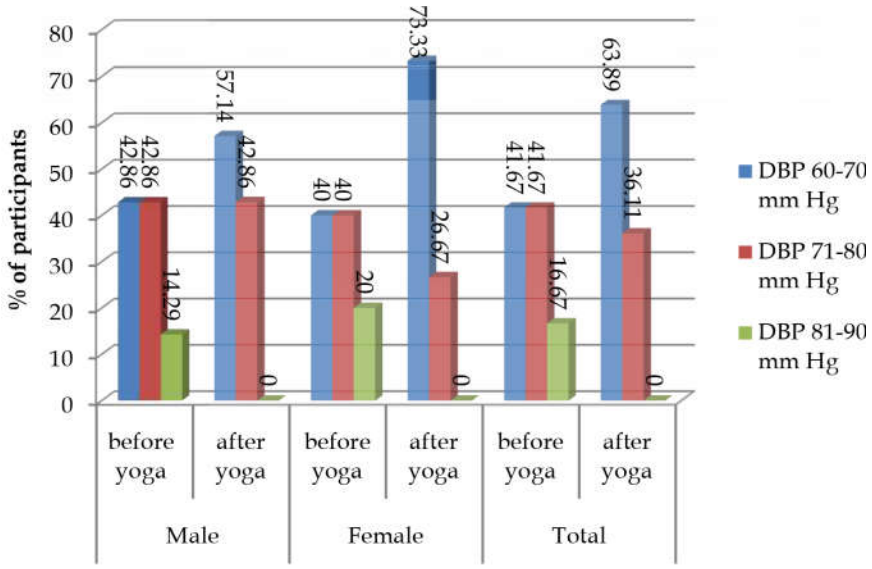

Fig. 4: % of participants in various range of Diastolic Blood Pressure

Discussions

Yoga is known to have beneficial effects on blood pressure. Data obtained for blood pressure before and after yoga for four weeks when analyzed showed a definite decrease in both systolic and diastolic blood pressure; but the change in systolic and diastolic blood pressure did not follow the same trend in all the three groups. The whole group showed decrease in both systolic and diastolic blood pressure; while systolic blood pressure showed greater reduction in

males and diastolic blood pressure showed greater reduction in females. The reduction is more from a higher range (>130 mm Hg) to lower range (90-110mmHg) as compare to from optimal range (110-130 mmHg) to lower range in case of systolic blood pressure. Similar trend is observed in case of diastolic blood pressure. It can be stated from such observations that yoga not only reduces blood pressure in hypertensive individuals but also modulates blood pressure in healthy adults [8,9].

Practice of Yoga brings harmony among all the systems of body especially nervous system and hormonal system. In nervous system – Yogic practice creates a good balance between two divisions of ANS and brings good control over blood pressure [10,11,12]. Relaxation in yoga and Pranayama decrease sympathetic nervous system activity [13,14] and creates parasympathetic dominance there by reducing blood pressure by reducing vagal tone [15,16].

In hormonal system, it brings down the level of stress hormone, cortisol, in the body hence controlling blood pressure [17]. Pranayama increases frequency and duration of inhibitory neural impulses by activating pulmonary stretch receptors during above tidal volume inhalation as in Hering Bruer reflex, which bring about withdrawal of sympathetic tone in the skeletal muscle blood vessels, leading to widespread vasodilatation, thus causing decrease in peripheral resistance and thus decreasing the diastolic blood pressure. Baroreceptor sensitivity can be enhanced significantly by slow breathing (supported by a small reduction in the heart rate observed during slow breathing and by reduction in both systolic and diastolic pressure). Slow pace bhastrika and bhramari pranayama (respiratory rate 6/min) exercise thus shows a strong tendency to improving the autonomic nervous system through enhanced activation of the parasympathetic system [18,19]. This may be due to a normalization of autonomic cardiovascular rhythms with increased vagal modulation and/or decreased sympathetic activity along with improvement in baroreflex sensitivity [20]. Further studies are required to enable a deeper understanding of the mechanisms involved as well as determine how long such a BP lowering effect persists.

Conclusion

From the present study we can conclude that short term (4 weeks) regular yogic practices produce relaxed state where parasympathetic activity overrides the sympathetic activity thus lowering blood pressure in normal young healthy adults.

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Declaration of Interest

The authors report no conflict of interest

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Short Communication

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Ageing: The Cellular Basis

Reena Rani Verma[1], Amit Kant Singh[2]

Author's Affiliations:
[1]Junior Resident [2]Professor
Dept. of Physiology, Uttar Pradesh University of Medical Sciences, Saifai, Etawah, Uttar Pradesh 206130, India.

Corresponding Author:
Amit Kant Singh
Professor, Department of Physiology, Uttar Pradesh University of Medical Sciences, Saifai, Etawah, Uttar Pradesh 206130, India.
E-mail:
amitbhu2008@gmail.com

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Abstract

Ageing/ Aging is the process of becoming older. Ageing can refer to single cells within an organism which have ceased dividing (cellular senescence) or tothe population of a species (population ageing). Aging occurs due to accumulation of physical, psychological, and social changes in a human being over time. Ageing is one of the risk factors for most human diseases. Approximately two thirds of the 150,000 of total deaths occurring globally per day is due to age related factors. Aging is characterized by a progressive, generalized impairment of function, resulting in an increasing vulnerability to environmental challenge and a growing risk of disease and death. Ageing and mortality started with evolution of sexual reproduction and emergence of the fungal/animal kingdoms approximately a billion years ago. Normal human cells die after about 50 cell divisions known as Hayflick Limit. There are several theories postulated for the cellular mechanism of ageing. They are broadly divided into two main categories: Programmed and Damage-related. Cellular senescence has been attributed to the shortening of telomeres at each cell division. DNA damage theory forms the common basis of both cancer and ageing. Intrinsic causes of DNA damage are the most important drivers of ageing. According to Free radical theory oxidative reaction leads to the formation of molecular species with unpaired electrons which makes them highly reactive known as Free radicals. Ageing affects the various systems of our body. Prevention and delay of ageing can be done by lifestyle modification. The amount of sleep has great impact on mortality. Physical exercises may also increase life expectancy. Avoidance of chronic stress slows loss of telomeres and decreases cortisol levels. Caloric restriction also delays ageing.

Keywords: Ageing; Hayflick Limit; Telomere; Free Radicals; Caloric Restriction.

Introduction

Aging Occurs due to accumulation of physical, psychological, and social changes in a human being over time [1]. Ageing is one of the risk factors for most human diseases. Approximately two thirds of the 150,000 of total deaths occurring globally per day is due to age related factors [2]. Aging is characterized by a progressive, generalized impairment of function, resulting in an increasing vulnerability to environmental challenge and a growing risk of disease and death [3]. Ageing and mortality started with evolution of sexual reproduction and emergence of the fungal/animal kingdoms approximately a billion years ago [4]. Normal human cells die after about 50 cell divisions known as Hayflick Limit [5].

Biological Basis of Ageing

There are several theories postulated for the cellular mechanism of ageing. They are broadly divided into two main categories: Programmed and Damage-related [6]. Programmed factors follow a biological timetable, perhaps that might be a continuation of the one that regulates childhood growth and development. This regulation would depend on changes in gene expression that affect the systems responsible for maintenance, repair and defence responses [7].

Damage-related factors include internal and environmental assaults to living organisms that induce cumulative damage at various levels [7].

Three main metabolic pathways influence the rate of ageing [8]:

1. The Forkhead box O3 (FOXO3)/Sirtuin pathway.
2. Growth hormone/Insulin-like growth factor-1 (IGF-1) signalling pathway.
3. Electron transport chain in mitochondria.

Most of these pathways affect ageing separately. Targeting them simultaneously leads to additive increases in lifespan [9].

Programmed Theories

1. DNA methylation theory
2. Telomere theory
3. Variation in the gene FOXO3
4. Mechanistic Target of Rapamycin (mTOR) theory
5. Growth hormone/Insulin-like Growth Factor 1 signalling theory
6. Evolutionary theories of ageing
7. Reproductive-cell cycle theory
8. Autoimmunity theory
9. Energy homeostasis theory

Horvath hypothesised that DNA methylation age measures the cumulative effect of an epigenetic maintenance system.Prematurely aged mice can be rejuvenated and their lives extended by 30% by partially "resetting" the methylation pattern in their cells by activating the four DNA transcription factors – Sox2, Oct4, Klf4 and c-Myc [10].

Cellular senescence has been attributed to the shortening of telomeres at each cell division. When telomeres become too short, the cells senesce and die or cease multiplying. The length of telomeres is therefore the "molecular clock". The telomeres are protected by telomerase enzyme. Oxidative stress, has an bigger effect onthe rate of telomere loss and telomere shortening [11,12].

Variation in the Forkhead box O_3 ($FOXO_3$) gene has a positive effect on the life expectancy of humans and found in people living to 100 and beyond. Acts on the sirtuin (SIRT) family of genes which also have a significant effect on lifespan. Sirtuin in turn inhibits Mechanistic Target of Rapamycin (mTOR) [13].

Mechanistic Target of Rapamycin (mTOR) is a protein that inhibits autophagy has been linked to ageing through the insulin signalling pathway. When organisms restrict their diet, mTOR activity is reduced, which allows an increased level of autophagy. This recycles old or damaged cell parts, which increases longevity. mTOR inhibition and autophagy reduce the effects of reactive oxygen species on the body [14].

The studies showed that decreasedGrowth hormone/Insulin-like Growth Factor 1 signalling theory increased longevity [14].

Evolutionary theories of ageing states that antagonistic pleiotropy gene has a double function – promoting growth and development early in life to achieve reproduction, but becoming dysregulated later in life, driving senescence. Ageing is regulated by reproductive hormones that act in an antagonistic pleiotropic manner via cell cycle signalling [15].

According to autoimmune theory ageing results from an increase in auto-antibodies that attack the body's tissues. A number of diseases are associated with ageing, such as atrophic gastritis and Hashimoto's thyroiditis [16].

Energy homeostasis theory states that the imbalance between cellular energy generation and consumption promotes ageing process. Thus tight regulation of balance between cellular energy generation and consumption is required to delay ageing. It was demonstrated that acetylation levels of AMP-activated protein kinase slows ageing [17].

Damage related theories

1. DNA damage theory
2. Genetic theory
3. Accumulation of waste theory
4. Wear and tear theory
5. Mitochondrial theory
6. Free radical theory

DNA damage theory forms the common basis of both cancer and ageing. Intrinsic causes of DNA damage are the most important drivers of ageing such as Genetic damage (aberrant structural alterations of the DNA), Mutations (changes in the DNA sequence), and Epimutations (methylation of gene promoter regions) [18,19,20]. These cause abnormal gene expression. DNA damage causes the cells to stop dividing [21].

Genetic theory states that rate of aging varies between species but not much within species due to difference in genetic programming.Aging cannot

be prevented even under best of circumstances. Gradual impairment of function is genetically programmed [22].

Accumulation of waste theory suggests that buildup of waste products in cells interferes with metabolism. A waste product called lipofuscin is formed by a complex reaction in cells that binds fat to proteins. Lipofuscin accumulates in the cells as small granules, which increase in size as a person ages [23]. Autophagy enhance clearance of toxic intracellular waste thus improving lifespan [24,25].

Wear and tear theory is concerned with the changes associated with ageing are the result of chance damage that accumulates over time.Ageing also results from chance events that escape proof reading mechanisms, which gradually damages the genetic code [26].

In Mitochondrial theory, mtDNA mutations lead to respiratory-chain-deficient cells and thence to apoptosis and cell loss leading to increased generation of reactive oxygen species (ROS) [27].

According to Free radical theory oxidative reaction lead to the formation of molecular species with unpaired electrons which makes them highly reactive known as free radicals- superoxide, hydroxyl radicals [28]. Free radicals damagevital macromolecules such as DNA and Proteins. Membranes of cells and organelles are also damaged by lipid peroxidation.Antioxidants such as Glutathione, Vit. A, C, E can be usedto prevent such effects [29].

Network theory is a newer concept that takes into consideration the interaction and synergism between different theories.Understanding these connections is likely to be important in developing effective interventions against age related cellular deterioration [30].

Age Related Changes

In hematpoietic system marrow is replaced by fatty marrow. Physiological reserve capacity for erythropoieses is reduced. There is decline in immuno- competence thus increased suceptibiltyto infection and also increase in auto- reactivity to autoimmune diseases [31].

There is decline in respiratory function due to structural and functional changes.Alveoli becomes flatter and shallower, wall gets thinner and contains few capillaries leading to reduction in pulmonary diffusing capacity. Total and timed vital capacity decrease and increase in residual volume. Loss of elastic recoil of lungs thus leading to overall impairment of ventilation, diffusion as well as regulation [31].

In Cardiovascular system atherosclerosis is extremely common in elderly. Elasticity of aorta and other large arteries decreases with increasing age, as a result systolic and pulse pressure are increased. Myocardium shows atrophy accompanied by deposition of a brown pigment lipofuscin. Structural changes in the valves are seen. There is reduction in number of pacemaker cells [31].

The alimentary canal: Teeth show attrition. Weakness of pharyngeal musculature causes dysphagia. Stomach and pancreatic secretions are decreased. There is decreased villus height leading to reduced absorptive surface area. Liver shows decrease in number and increase in size of hepatocytes and fibrous tissue leading todecrease in synthetic function of liver [31].

Excretory system is characterised by reduction in number and size of nephrons.There is ten percent reduction in renal plasma flow per decade after the age of 30 years. Both secretory and reabsorptive functions of renal tubule also decrease [31].

Nervous system suffers dementia whichbecomes more common with age. There is mild cognitive impairment. Progression of neurodegenerative diseases such as Alzheimer's disease, cerebrovascular disease and Parkinson's disease increases [32].

In Reproductive systemfemale fertility declines.Menopause typically occurs between 49 and 52 years of age [33].

Prevention and Delay

Lifestyle modification can be done by taking proper amount of sleep as sleep has great impact on mortality [34,35]. Physical exercise may increase life expectancy [36]. Avoidance of chronic stress slows loss of telomeres and decrease cortisol levels [37,38]. Caloric restriction also plays an important role in prolongation of life [39].

Conclusion

Thus aging is accumulation of physical, psychological, and social changes in a human being over time. According to studies phenomenon of aging occur when pro-aging factors are superseded by anti-aging factors. This may be program related

or damage related. Process of aging can be prevented by modification of lifestyle and caloric restriction.

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