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A Comparison between Traditional and Modified Case Based Method for Learning Physiology in First MBBS Students

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ABSTRACT

Background: Teaching methodology is largely didactic lecture based. Active forms of learning such as Problem based learning (PBL) and Case based learning (CBL) have been gaining ground to facilitate self directed learning. Studies have shown that Active learning forms assist the students better to apply concepts of basic medical science such as Physiology & Biochemistry into clinical settings.

Aims and Objectives: In this study we inclined to evaluate the impact of Novel method of teaching –Case based learning (CBL) on learning Physiology.

Materials and Methods: Present study was carried out on 115 first year MBBS students who attended scheduled physiology theory classes, by traditional method (Pre-Test CBL) and then by novel method (Test CBL). It is Modified CBL since it was conducted in a large study group. Pre-Test CBL and Post-Test CBL evaluation was done at the end of both the methods. Likert scale was used to evaluate students' perception about the teaching methods.

Results: In our study CBL had a positive impact ($p<0.05$) on marks obtained in Post-Test CBL evaluation. Girls performed better than boys in Post-Test CBL evaluation.($p<0.5$). 72% of the students agreed that overall, CBLwas a better method of learning for them.

Conclusion: Our study concluded that students were receptive to the introduction of CBL and it had positive impact on the understanding of the topic.

Keywords: *Teaching methodology, Modified Case based learning (CBL), Physiology, Medical students*

INTRODUCTION

Understanding of Physiological concepts is highly relevant, important and foundational to future understanding of Clinical subjects. Present methodology of teaching is largely in didactic lectureformat. These days, the education system is changing to a student centered active form of learning process with the use of various innovative teaching methods such as Problem based Learning (PBL). Vision 2015 document of Medical council of India (MCI) emphasizes the introduction of case scenarios for classroom discussion[2] .Case based learning (CBL) is a method closely related to the more commonly used Problem based learning (PBL). Both have unique characteristics but common goal. In problem based learning, the problem drives the learning. In problem based learning (PBL) students use"triggers" from an open ended problem case to build knowledge.

The CBL format requires students to recall previously covered material to solve structured clinical cases. The case includes a real life or hypothetical situation in which there is incorporation of clinical signs and relevant investigations. Case based learning was first used in law schools and business schools as early as the late 1800's. The pathology professor at the University of Edinburgh, James Lorrain Smith, introduced the 'case

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method of teaching pathology' in 1912[1]. Isolated facts are more difficult to integrate within memories than facts taught in a realistic context .Case based learning is now promoted in many universities because it teaches important concepts and facts within the context of real life situations. It also motivates self directed learning behavior, encourages critical self evaluation and bridges the gap between theory and practice. In various studies, Teachers found that CBL helped in developing students' problemsolving and decision making skills.Motivated by the above facts, this study was designed to compare the traditional method with this novel method for teaching Physiology to first MBBS students[13].

MATERIALS AND METHODS

It is a comparative study done on first year MBBS students of Pacific Institute of Medical Sciences; Udaipur (Rajasthan).The study initiated after the approval of Institutional ethical committee and informed consent was omitted from the study suggested by Ethics committee. All the students are in age group between 17-20 yrs.The students were taught Physiology as per the MCI laid curriculum for MBBS.The study method can besystematically divided into following headings:

1. **Pre-TestCBL:** As per the MCI prescribed curriculum in the preclinical subject of Physiology, the scheduled theory lecture on topic "Cerebral cortex" was taught by the traditional method for 50 minutes and in the last 10 minutes , structured MCQ and True/False questions were given(MM=5) for evaluation.
2. **TestCBL:** After few days in another lecture hour the Modified Case based method was introduced on topic "Basal ganglia". A well constructed case on topic" Parkinson's disease" was projected before the beginning of lecture, and specific learning objective was given to students. After which the scheduled lecture was started. Learning objectives were:
    1. Identification of the clinical condition in the case study and area of brain involved.
    2. Application of Physiology for understanding Clinical signs and symptoms
    3. Treatment of the case

    We called this Modified CBL since it was conducted in a large study group.
3. **Post-Test CBL:** At end of lecture, same case was projected again and then structured MCQ and True/False questions (MM=5) were given for evaluation in last 10 minutes of class. Pre and Post Test CBL format for evaluation was same.

To test the effectiveness of CBL, perception of the students was assessed on the cognitive domain. We used Likert scale to assess the students' perception about Case based method versus Traditional method, based on rating on three response scale: 1= Agree, 2=Disagree and 3=Neutral. Five statements (Table-3) to test the acceptance for CBL were given which students were asked to rate. This feedback was collected along with Post- Test CBL answer sheet. The answer sheets were checked and the marks and ratings obtained were analyzed.

Statistical Analysis: The Data of Students marks and feedback opinion on statements was analyzed for mean and standard deviation.. The Standard normal distribution (SND) test was calculated for comparison. The tabled value of SND (z value) at 5%($p<0.05$) level of significance is 1.96. Therefore, calculated value more than tabled value of 1.96 was considered as statistically significant.

RESULTS

The annual intake of first year MBBS students at Pacific Institute of Medical Sciences, Udaipur is 150 on which this study was conducted. The study was done on two scheduled separate lecture hours. For the purpose of comparison, only those students who were present in both the classes were taken i.e. n=115.

Pre and Post-Test CBL marks: Standard Normal Distribution(SND) test was applied for the comparison between Pre and Post Test CBL marks.

Table 1: Mean marks ±SD obtained in evaluationof both the methods (n=115)

	Traditional Method (Pre-Test CBL)	Novel Method (Post-Test CBL)
Mean Scores & SD	3.147±0.948	3.486±0.831

- Calculated value of SND was 2.76 while the tabled value of SND at 5 %($p<0.05$) level of significance is 1.96. Therefore there was a statistically significant impact of CBL on test marks.

Table 2: Genderwise Mean marks ±SD

	Traditional Method (Pre-Test CBL)	Novel Method (Post-Test CBL)
Boys (n=83)	2.92±0.851	3.31±0.913
Girls (n=32)	3.71±0.894	3.93±0.731

- Calculated SND Value for comparison between Test scores of girlsand boys was 3.42 which is statistically significant ($p<0.05$).

Students' Perception of CBL: The acceptance for novel method was positive in student perspective in all the statements. Statement 5 shows that Overall 72% of students agreed on the Likert scale that CBL was a better method of learning for them.

Table 3: Statements and Likert response rating scale

S. No.	Statement	Agree (%)	Disagree (%)	Neutral (%)
1.	It stimulated my interest in the topic and helped in understanding the topic	72	4	24
2.	It helped me to think logically and develop clinical reasoning.	60	15	25
3.	It was up to the level of my knowledge	65	13	22
4.	It was more interactive than traditional theory lecture.	58	22	20
5.	Overall, it is a better method of learning for me.	72	12	16

DISCUSSION

In our study introduction of CBL had a positive impact on the test marks as compared to traditional method. This implies that the understanding of the topic increased with CBL method.

Clinical condition taught in applied aspect of topic was used as a real case to convert conventional class into CBL class. This method of teaching helps in integrating the basic sciences subjects such as Physiology and Biochemistry in both horizontal and vertical manner. It creates inner motivation in the student to learn and become responsible to learn on their own.. Inert knowledge is learned information that is difficult or impossible to apply to realistic situations. Isolated facts are more difficult to integrate within memories than facts taught in a realistic context. Case based learning reduces the potential for "inert" knowledge. Studies done by Rodriguez et al has shown that case based discussion in Physiology teaching, improved the integrated understanding of human body[13].Study done by Ertmer et al showed that in problem oriented learning some students actually became motivated by their lack of knowledge. It is like a "kid with a new video game"[14]. Pearson et al found CBL to be an effective adjunct to the traditional lecture format[3]. Previous studies have shown that CBL made the learning more enjoyable and improved the interacting ability of students[3].

But, Each method has its own pros and cons and no method is ideal. Importance of Didactic lectures cannot also be underestimated. Study done by Kassebaum et al[8] has shown that students have felt that a lecture format was far superior in preparing for a written exam compared to a CBL format. In our setup examination format is also largely in subjective written format.

Students perception: Results of our study are in agreement with studies done previously which has shown that students enjoyed CBL and this method increased their understanding[16]. Tayem reported that CBL improved self reported analytical and communication skill, confidence , satisfaction , motivation and engagement[15].

Gender and CBL: Females performed better than males in Post test CBL evaluation. This is in agreement with the study done by Peplow et al[9].

CONCLUSION

Our study rejects the null hypothesis that there is no difference between the traditional lecture based learning and Case base method of learning.We conclude that the innovative CBL paradigmappears to be an effective, superior and studentcentered alternative to the traditional lecture format. It is an active learning methodology which should be inculcated more in medical curriculum for teaching Physiology. Applied clinical cases related to the topic of lecture can be structured to convert the conventional class into CBL class. E.g. Parkinson disease and Basal ganglia in our case. Small group in tutorial classes is more favorable for interaction and some tutorial classes can also be converted into CBL classes.

Limitation of study: Impact of CBL versus Traditional method on subjective written examination format was not done**.** Faculty satisfaction survey on CBL methodology was not done since students' perception can be different from Teachers'. Test CBL was not conducted in small group which could have generated more interaction between faculty and students.

Conflict of interest: Nil

Source of funding: Nil

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Cardiovascular Autonomic Milieu and Its Association with Academic Performance in Young Healthy Medical Students

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ABSTRACT

Background: Autonomic nervous system is involved in the learning behavior of animals. High sympathetic activation favors arousal, attention, memory and learning. However in humans evidence exists for increased sympathetic conditions impairing cognitive performance as well as poor sympathetic activation in diseases affecting cognition. This conflicting observation in literature warrants for further scientific study. Therefore the present study attempts to observe the association between the state of autonomic nervous system and cognitive ability. This is accomplished by observing the association between heart rate variability (HRV) which reflects the autonomic nervous system state and academic performance as a measurand of cognitive ability.

Material & Methods: Cross sectional observational type of study with sample size of 102 healthy young subjects in which 34 are boys and 68 girls between 18 -22 years were included in the study by convenient sampling after carefully assessing for the inclusion and exclusion criteria. Heart Rate Variability is computed under standard conditions as per Task Force Recommendations in time and frequency domains. The academic performance is assessed by university examination marks at the end of first year. The association between HRV parameters are academic performance is assessed by spearman correlation and type I error allowance fixed at 5%.

Results & Interpretation: Resting heart rates showed significant positive correlation with academic performance. All time domain indices of HRV showed significant negative correlation with academic performance. Frequency domain parameters indicated a positive correlation between percentage and normalized low frequency powers with parameters of academic performance and negative correlation between percentage and normalized high frequency powers with parameters of academic performance. However frequency domain parameters did not associate in a statistically significant manner with parameters of academic performance.

Conclusion: Results reflect high resting sympathetic tone in better academic performance and study concludes that increased sympathetic tone is associated with better cognitive ability.

Keywords: *HRV, Cognition, Sympathetic, Academic, Medical, Students*

INTRODUCTION

The state of autonomic nervous system is pivotal in the learning behavior of animals[1]. Heightened sympathetic activity increases alertness, sensory association, memory recall and favors learning[2, 3]. The temporal association between emotional state and conditioning are documented in animals[4, 5]. A basal level of arousal is required for any newer conditioning as its evident that conditions that affect cognitive ability, sympathetic activation is impaired[6]. It is noted that higher levels of anxiety and stress decrease cognitive performance[7]. In highly evolved mammals like humans, cognition and learning is much affected by a number of factors. These include but not limited to state of arousal, motivation, physical health, prior priming of information and understanding, favorable external environment etc. Studies associating the state of

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autonomic activity and learning behavior in humans are few and there exists a considerable lacunae in literature. Also in the present challenging educational scenario factors affecting academics are explored to improve the same. Factors affecting learning behavior of humans are multifactorial but this study attempts to find if there is any association between the state of autonomic activity and academic performance in students for reasons mentioned above. The study disclaims the cause - effect relationship between ANS and academic performance, it just aims to study if there is any observable association between them.

Technically, HRV is an excellent tool to find out the state of autonomic nervous system[8]. The frequency domain measurements of HRV subserve as the tool to measure the basal parasympathetic and sympathetic tone[8, 9]. Electrocardiogram is easier to record as compared to the technically difficult muscle sympathetic nerve activity, baroreceptor afferent ramp frequency etc. The present day software tools make it easy to measure the RR intervals at high speed, accuracy and compute HRV in time and frequency domains. Thus the state of ANS is easily elucidated.

Summative assessments are best decisive tools for academic performance. Ranking or ordering are usually made with summative assessments. University examinations at the end of the course are best summative assessments. Therefore the present study aims to study the ANS state by HRV and academic performance by university marks.

MATERIAL AND METHOD

Study Design: Cross sectional type of observational study

Study Setting: Electrophysiology Laboratory, Department of Physiology, Aarupadai Veedu Medical College, Puducherry.

Study Period: July 2015 to July 2017 (2 years)

Sampling Frame: All MBBS students belonging to third, fourth and fifth semesters**.**

Sampling Method: Convenient Sampling type

Sampling Size: A total of 100 samples were planned in the protocol with equal distribution in gender. However the study is now presented with data from 102 samples with 34 boys and 68 girls.

Inclusion Criteria:

1. Volunteer MBBS students belonging to third, fourth and fifth semesters.
2. Age: 18 -22 years
3. Students who have cleared first year subjects in the first attempt.

Exclusion Criteria:

1. Volunteers with any known case of any chronic conditions or on any medications
2. Volunteers who are found to have any physiological abnormalities in clinical examinations before including in study
3. Subjects whose ECG was found to abnormal during the study.
4. Sports persons or athletes.
5. Volunteers with any acute infection/illness.
6. No volunteer from first year MBBS are included. To avoid autonomy issue in consenting for the study.

Methods of Collection of Data: Students were intimated regarding the study orally and interested volunteers were included in the study after getting their informed consent in writing. On the previous day of recording they underwent basic clinical examination to rule out any preexisting abnormality and included in the study based on the inclusion and exclusion criteria.

Anthropometric parameters like height, weight, body fat percentage and skinfold measurements were taken. Height is measured by a wall mounted stadiometer to the nearest millimeter. Weight was measured by digital weighing balance to the nearest 0.1 kg. The body fat percentage was measured by Citizen Body Fat Analyser BM100, Citizen systems Japan Co LTD, by bioimpedance method to the nearest 0.1%. The triceps skinfold was measured by ABS Slimguide calipers to the nearest millimeter.

To maintain uniformity all recordings were done between 4.00 p.m and 5.00 pm after class hours. The subjects are doubly checked for consumption of any neuro stimulant foods in the preceding three hours. The subject is allowed to take supine rest in a dim lighted room with comfortable ventilation for five minutes.

This is followed by a six minute recoding of lead two ECG at the rate of 256 samples per second and at 10 bit resolution by four channel digital polygraph PG4, INCO, Haryana, India communicating through RS232 port to a windows based user interface software Niviqure V56 by Niviqure Meditech Pvt Ltd, Bangalore, India. At the end of the recording resting heart rate and brachial blood pressure in the right arm is measured oscillometrically by Rossmax MJ701, Rossmax Swiss GmbH, Switzerland automated blood pressure monitor in duplicate. All ECG recordings used limb electrodes and in case of girl student recordings, lady teaching faculty was present throughout the recording.

Post recording, the discrete voltage data points of ECG is exported in ASCII format and converted to PCM wave file by Goldwave software. PCM wave file is read by Audacity software where beat detector function labels R wave position and values exported in ASCII text file. RR intervals are then computed in Microsoft Excel and saved as text file.

This text file is opened by HRV analysis software HRV v1.0, Biosignal Analysis Group, Kuopio, Finland[12] and the Heart Rate Variability (HRV) in time and frequency domains are note from 300 seconds data.

The recordings are done after the university examination. All students of the same semester are recorded within a month time to avoid heterogeneity. Recordings are stopped one day prior and after a scheduled class test.

Parameters Recorded:

Basic Details: Name, age, gender, physical activity and medical history**.**

Anthropometric Measurements: Height, Weight, Body Mass Index, Body fat Percentage, Triceps skin fold thickness**.**

Heart Rate Variability Measurements:

Heart Rate Variability Measurements:

Time Domain Parameters: MRR, SDNN, RMSSD, NN50, pNN50.

Geometric indices: RRTI and TINN.

Frequency Domain Parameters: VLF, LF, HF, VLFPP, LFPP, HFPP, LF n.u, HF n.u & LF/HF ratio

Academic Performance Parameters: Three first year MBBS subjects are chosen. Anatomy, Biochemistry and Physiology. In each subject Internal Assessment Practical, Internal Assessment Theory, Record Marks, University Viva Voce, University Theory marks, University Practical Marks and Total Marks are taken for analysis. Absolute marks in mark sheet are used and not percentage.

Analysis of Data: Data analaysis done in SPSS V20. Descriptive details of data presented as both mean ± SD as well as median, inter quartile range. Correlation between autonomic indices and academic parameters are done by spearman correlation. The allowed type I error is fixed at less than 5% to reject the null hypothesis. Due to the high variance of HRV parameters, correlation coefficients with p value between 0.05 and 0.1 are also discussed with due mention.

Ethical Clearance: Ethical clearance obtained from Institute Ethics Committee, AVMC, Puducherry.

RESULTS

Table 1: Descriptive data of general parameters of subjects

Parameter	Age (Days)	BMI (Kg/m^2)	BFP (%)	TSFT (mm)	RHR (BPM)	RSP (mmHg)	RDP (mmHg)	RMP (No Unit)
Mean ± SD n = 102	7375 ± 354	23.56 ± 4.4	26.23 ± 10.21	20.27 ± 8.0	79.05 ± 12.45	105.4 ± 12.44	66.21 ± 8.93	79.28 ± 9.34
Median, Interquartile range n = 102	7385, (7110 -7585)	22.71, (20.28 - 26.33)	28.1, (19.2-33.7)	20, (15 - 25)	79, (69 - 88)	102.25, (97.38 - 112)	65.25, (60.5 -71.13)	77.92, (72.92 - 84.67)

Table 2: Descriptive data of time domain & Geometric Indices - HRV of subjects

Parameter	MRR (s)	SDNN (ms)	RMSSD (ms)	NN50 (count)	pNN50 (%)	RRTI	TINN (ms)
Mean ± SD n = 102	0.8063 ± 0.1509	47.83 ± 2.60	47.81 ± 35.36	82.6 ± 68.5	23.56 ± 20.33	0.10335 ± 0.116784	227.78 ± 97.09
Median, Interquartile range n = 102	0.8035, (0.7172 - 0.8730)	43.00, (30 - 60)	41.95, (23.2-62)	74.5, (15-137)	20.55, (3.88 - 38.65)	0.084, (0.064 - 0.107)	215.5, (150-291.25)

Table 3: Descriptive data of frequency domain parameters - HRV of subjects

Parameter	VLFP (ms^2)	LFP (ms^2)	HFP (ms^2)	VLFPP (%)	LFPP (%)	HFPP (%)	LF n.u (no unit)	HF n.u (no unit)	LF HF ratio
Mean ± SD n = 102	119.2 ± 108.2	297.89 ± 259.58	392.15 ± 588.55	19.61 ± 10.91	40.09 ± 12.94	40.57 ± 16.94	54.13 ± 36.02	48.58 ± 17.23	1.485 ± 1.731
Median, Interquartile range n = 102	84,(56.5 - 142.5)	215.5, (121.5 - 408.75)	231, (86.5-491)	18.4, (10.95-25.32)	39.15, (32-53 -48.10)	38.5, (28.22-53.5)	51.75, (38.62 - 63.8)	48.25, (36.15-61.38)	1.051, (0.614 - 1.718)

Table 4: Descriptive data of marks in anatomy

Parameter	IA_Pr_Anat	IA_Th_Anat	Rec_Anat	Viva_Anat	Pr_Anat	Th_anat	Tot_Anat
Mean ± SD n = 102	17.75 ± 1.938	25.88 ± 2.467	9.77 ± .643	16.69 ± 1.813	50.46 ± 5.677	105.28 ± 13.212	225.83 ± 21.534
Median, Interquartile range n = 102	18.00, (17-19)	26.00,(24-28)	10.00, (10-10)	17.00, (15.75-18)	51.00, (47-55)	106.50, (94-116)	229.00, (208.25-244)

Table 5: Descriptive data of marks in biochemistry

Parameter	IA_Pr_Bio	IA_Th_ Bio	Rec_ Bio	Viva_ Bio	Pr_ Bio	Th_ Bio	Tot_ Bio
Mean ± SD n = 102	13.75 ± 2.468	18.24 ± 3.084	7.17 ± 1.170	14.06 ± 2.424	46.82 ± 5.959	93.22 ± 13.445	192.90 ± 23.679
Median, Interquartile range n = 102	14.00, (12-16)	17.00, (15-21)	7.00, (6-8)	14.00, (12-16)	48.00, (43-51)	94.50, (80-102)	194.50, (175-209)

Table 6: Descriptive data of marks in physiology

Parameter	IA_Pr_Phy	IA_Th_ Phy	Rec_ Phy	Viva_ Phy	Pr_ Phy	Th_ Phy	Tot_ Phy
Mean ± SD n = 102	15.94 ± 2.536	23.80 ± 4.590	9.15 ± 1.189	13.84 ± 2.628	40.56 ± 4.960	107.23 ± 32.005	207.62 ± 21.821
Median, Interquartile range n = 102	16.50, (15-18)	25.00, (20-28)	10.00, (8.75-10)	14.00, (20-28)	40.50, (37-44)	105.00, (95-113)	209.50 (191.75-223)

Table.7: Correlation of time domain parameters and performance in anatomy

S. No.	Parameters	IA_Pr _Anat r_s	IA_Th_Anat r_s	Rec_Anat r_s	Viva_Anat r_s	Pr_Anat r_s	Th_Anat r_s	Tot_Anat r_s
1.	RHR	.227*	.290**	.311**	.181	.118	.242*	.273**
2.	MRR	.118	-.168	-.268**	-.232*	-.063	-.137	-.147
3.	SDNN	-.044	-.165	-.118	-.130	-.003	.046	-.011
4.	RMSSD	-.059	-.188 (0.058)	-.192	-.154	-.041	-.059	-.100
5.	NN50	-.094	-.144	-.172 (0.084)	-.098	-.032	-.057	-.090
6.	PNN50	-.073	-.186	-.206*	-.157	-.070	-.091	-.131
7.	RRTI	-.101	-.180	-.115	-.080	-.016	-.067	-.082
8.	TINN	-.055	-.269**	-.141	-.144	-.069	-.081	-.125

** p < 0.01

*p <0.05

Values within paraentheses indicate exact p value

Table 8: Correlation of time domain parameters and performance in biochemistry

S. No.	Parameters	IA_Pr _Bio r_s	IA_Th_Bio r_s	Rec_Bio r_s	Viva_Bio r_s	Pr_Bio r_s	Th_Bio r_s	Tot_Bio r_s
1.	RHR	.069	.249*	.241*	.279**	.330**	.231*	.284**
2.	MRR	.125	-.242*	.127	.031	-.137	-.254**	-.162
3.	SDNN	.120	-.050	.004	-.033	.013	-.130	-.026
4.	RMSSD	.041	-.136	-.038	-.064	-.107	-.198*	-.118
5.	NN50	.025	-.109	-.109	-.113	-.070	-.204*	-.120
6.	PNN50	.055	-.164	-.070	-.112	-.112	-.256**	-.162
7.	RRTI	-.017	-.123	-.081	-.144	-.117	-.149	-.104
8.	TINN	.078	-.213*	-.007	-.084	-.104	-.232*	-.148

** p < 0.01

*p <0.05

Values within paraentheses indicate exact p value

Table 9: Correlation of time domain parameters and performance in physiology

S. No.	Parameters	IA_Pr _Phy r_s	IA_Th_Phy r_s	Rec_Phy r_s	Viva_Phy r_s	Pr_Phy r_s	Th_Phy r_s	Tot_Phy r_s
1.	RHR	.243*	.338**	.275**	.121	.184	.174	.254**
2.	MRR	-.005	-.142	-.103	.134	-.013	-.058	-.059
3.	SDNN	-.070	-.148	-.174	-.016	-.150	-.019	-.077
4.	RMSSD	-.141	-.240*	-.176	-.074	-.144	-.079	-.154
5.	NN50	-.178	-.252*	-.181	-.134	-.152	-.089	-.178
6.	PNN50	-.168	-.269**	-.191	-.119	-.151	-.107	-.192
7.	RRTI	-.095	-.181	-.265**	-.192	-.166	-.104	-.160
8.	TINN	-.096	-.231*	-.223*	-.150	-.168	-.083	-.171

** p < 0.01

*p <0.05

Values within paraentheses indicate exact p value

Table 10: Correlation of frequency domain parameters and performance in anatomy

S. No.	Parameters	IA_Pr _Anat r_s	IA_Th_Anat r_s	Rec_Anat r_s	Viva_Anat r_s	Pr_Anat r_s	Th_Anat r_s	Tot_Anat r_s
1.	FFT_VLFP	-.149	-.307**	-.064	-.076	-.110	-.167	-.199*
2.	FFT_LFP	.028	-.174	-.120	-.146	-.012	.014	-.036
3.	FFT_HFP	.004	-.194	-.149	-.101	.016	-.008	-.042
4.	FFT_VLFPP	-.150	-.071	.122	.090	-.107	-.135	-.122
5	FFT_LFPP	.035	.123	.034	-.052	-.020	.062	.048
6.	FFT_HFPP	.014	-.109	-.141	-.027	.035	-.029	-.031
7.	FFT_LFNU	-.024	.149	.134	-.039	-.046	.070	.047
8.	FFT_HFNU	-.050	-.105	-.137	.041	-.010	-.047	-.052
9.	FFT_LF_ HF_RATIO	.004	.110	.119	-.016	-.011	.055	.049

** p < 0.01
*p <0.05
Values within paraentheses indicate exact p value

Table 11: Correlation of frequency domain parameters and performance in Biochemistry

S. No.	Parameters	IA_Pr _Bio r_s	IA_Th_Bio r_s	Rec_Bio r_s	Viva_Bio r_s	Pr_Bio r_s	Th_Bio r_s	Tot_Bio r_s
1.	FFT_VLFP	-.169	-.280**	-.153	-.207*	-.102	-.219*	-.214*
2.	FFT_LFP	.110	-.131	.024	-.017	-.068	-.160	-.066
3.	FFT_HFP	.083	-.130	-.011	-.034	-.057	-.222*	-.098
4.	FFT_VLFPP	-.281**	-.128	-.128	-.139	-.040	.014	-.119
5.	FFT_LFPP	.044	.063	.101	.064	-.013	.089	.054
6.	FFT_HFPP	.082	-.064	-.025	-.016	-.051	-.176	-.072
7.	FFT_LFNU	-.095	.073	.028	-.031	-.019	.139	.031
8.	FFT_HFNU	.027	-.067	-.085	.003	.012	-.126	-.040
9.	FFT_LF_ HF_RATIO	.554	.533	.631	.971	.870	.139	.593

** p < 0.01
*p <0.05
Values within paraentheses indicate exact p value

Table 12: Correlation of frequency domain parameters and performance in Physiology

S. No.	Parameters	IA_Pr _Phy r_s	IA_Th_Phy r_s	Rec_Phy r_s	Viva_Phy r_s	Pr_Phy r_s	Th_Phy r_s	Tot_Phy r_s
1.	FFT_VLFP	-.224*	-.292**	-.250*	-.235*	-.181	-.172	-.245*
2.	FFT_LFP	-.015	-.130	-.194 (0.051)	-.030	-.115	-.043	-.097
3.	FFT_HFP	-.090	-.216*	-.196*	-.058	-.123	-.104	-.148
4.	FFT_VLFPP	-.160	-.076	.031	-.146	-.009	-.046	-.054
5.	FFT_LFPP	.138	.220*	.020	.134	.076	.129	.132
6.	FFT_HFPP	-.084	-.170 (0.087)	-.094	-.075	-.087	-.141	-.144

Conted…

7.	FFT_LFNU	.050	.188 (0.059)	.031	.053	.083	.125	.118
8.	FFT_HFNU	-.101	-.190 (0.055)	-.071	-.102	-.095	-.185 (0.062)	-.171
9.	FFT_LF_HF_ RATIO	.102	.194	.040	.090	.075	.149	.142

** p < 0.01

*p <0.05

Values within paraentheses indicate exact p value

DISCUSSION

In the time domain parameters, the RHR is positively correlated with the academic performance. The correlation is statistically significant with most of the academic parameters. In case of anatomy (Table 7) significant correlations were found between mean heart rate and theory and practical internal assessments, record marks, theory marks and total anatomy marks. In biochemistry (Table 8), mean heart rates are in statistically significant positive correlations with theory internal assessment, record mark, university viva voce, practical marks, theory marks and total marks. In concordance, statistically significant positive relations were found between mean heart rate with internal assessment theory and practical, record marks and total marks in physiology examination (Table 9). Thus the higher marks in examinations are associated with higher mean heart rates. Increased heart rate can be corroborated for high level of sympathetic tone in autonomic control of heart. Therefore higher sympathetic tone is seen in better performers.

MRR values negatively correlated with most parameters of academic performance. In anatomy (table 7) statistically significant negative correlations with MRR are seen in record marks and university viva voce. In biochemistry (table 8) such significant correlation is seen with internal assessment theory and theory marks of university. In physiology (table 9) though such negative correlations are seen they are not statistically significant. RR values are inversely related to heart rates. Therefore lower RR values signify higher sympathetic tone and therefore reflect high sympathetic activity in better academic performance.

RMSSD values negatively correlated with academic performance. Significant negative correlations were seen with theory marks in biochemistry and internal assessment theory marks in physiology (table 8 & table 9). In case of anatomy, internal assessment theory marks negatively correlated with RMSSD however p value is 0.058. Thus in general negative correlations are seen between RMSSD and academic performance. RMSSD reflects overall short term heart rate variability[10]. One plausible reason for this observation is higher sympathetic tone increases resting heart rates and reduces overall HRV. Therefore again higher sympathetic tone is observed in better academic performers.

The results of NN50 were similar to that of RMSSD. The same parameters as seen in RMSSD were negatively correlated with NN50 with significance (table 8 & 9). Record marks in anatomy (table 7) were negatively correlated with NN50 but not statistically significant (p value 0.084). pNN50 showed negative correlations with academic performance. Statistically significant negative correlations seen with record marks anatomy, theory marks biochemistry and theory internal assessment marks in physiology.

In case of geometric indices, RR triangular index is negatively correlated with academic performance but statistical significant only in physiology record marks (table 9). TINN has statistically significant negative correlations with anatomy theory internal assessment, biochemistry theory internal assessment, biochemistry theory marks, physiology theory internal assessment marks, and record marks in physiology. Thus in general time domain parameters of HRV were negatively correlated with academic performance. This is consistent with higher sympathetic discharge during resting conditions in better academic performers.

In case of frequency domain parameters the following is observed. Absolute powers in very low frequency band

were negatively correlated with academic performance. Significance in correlations were observed in anatomy with internal assessment theory and total anatomy marks (table 10). In biochemistry (table 11), theory internal assessment, viva voce, theory and total marks were found to be significantly negatively correlated. In in the subject of physiology VLF power was significantly and negatively correlated with practical and theory internal marks, viva voce, record marks and total marks. VLF signifies renin angiotensin axis[13] and it is better not commented in a short term recordings. If allowed then one may say higher renin angiotensin activity is negatively correlates with academic performance. However glaring significance in analysis compels for plausible explanation and further studies.

Absolute powers of LF were also negatively correlated with academic performance but without statistical significance. However in physiology record marks the correlation has a p value is 0.051 (table 12). Absolute powers of HF negatively correlated with academic performance. Significance in correlation was observed in theory biochemistry (table 11), theory internal assessment physiology and physiology record marks (table 12). It may be noted that higher LF and HF absolute powers are both negatively correlated with academic performance

VLF power percentage negatively correlated with academic performance. However significance is observed only in Biochemistry practical internal assessment. LF power percentage was positively correlated with parameters however statistical significance is seen only in physiology theory internal assessment.

HF power percentage though negatively correlated with academic performance parameters there was no statistical significance in the correlation. In physiology theory internal assessment the p value is 0.087.

Differential expression of relation was observed between LF and HF power percentages with parameters of academic performance. LF power percentage values we positively correlated but HF power percentage values were negatively correlated. This reveals that higher sympathetic tone and lower parasympathetic basal tone is seen higher academic performance.

LF normalized unit did not show significant correlation. In general it shows positive correlations with academic performance. However in Physiology theory internal assessment the LF nu has a p value of 0.059. HF numerical units correlations also did not show any significant correlation. In general they have negative correlations with academic performance. However in physiology theory internal assessment the HF nu has a p value of 0.055. LF nu values which reflect the sympathetic activity[14] are positively correlated and HF nu values which reflect the parasympathetic activity are negatively correlated with academic performance. The authors are well aware of the increasing evidence that LF is not fully contributed by cardiovascular sympathetic oscillations but still sympathetic contribution to LF is not refuted[15]. Thus if allowed to say, considering a type I error allowed at 10%, then high sympathetic predominance is very consistent with better academic performance.

LF HF ratio which is a measure of sympathovagal balance[16] was positively correlated with academic performance parameters but did not show any statistical significance.

CONCLUSION

Resting heart rates were high in better academic performance. Time domain parameters all were reduced with increasing academic performance. In case of frequency domain parameters absolute powers of all frequency bands were negatively correlated with academic performance, LF power percentage values showed positive correlation and negative correlation observed between HF power percentage and academic performance. However normalized values of LF, HF and LF HF ratio showed no significant correlation with academic performance.

Results of this study are consistent with conclusion that higher resting sympathetic predominance is associated with better academic performance.

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List of abbreviations used:

HRV- Heart Rate Variability

RHR- Resting Heart Rate

MRR- Mean RR Interval

SDNN- Standard deviation of normal to normal intervals

RMSSD- Root Mean Square of Successive Standard Deviations

NN50- No of instances where consecutive RR intervals differed by more than 50ms

pNN50- Percentage of NN50 divided by total number of RR intervals

RRTI- RR Triangular Index

TINN- Triangular Interpolation of Normal to Normal Intervals

FFT - Fast Fourier Transform

VLF - Very Low Frequency

VLFP - VLF Power;

VLFPP - VLF Power Percentage

LF - Low Frequency

LFP - LF Power

LFPP- LF Power Percentage

LF n.u - LF Normalized

HF - High Frequency

HFP - HF Power

HFPP - HF Power Percentage

HF n.u - HF Power Normalized

IA - Internal Assessment

Pr - Practical

Th - Theory

Anat - Anatomy

Bio - Biochemistry

Phy - Physiology

Rec - Record

Tot- Total

r_s - Spearman rho

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Serum Lipid Profile in Chronic Smokers and Non Smokers

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ABSTRACT

Background: Smoking is an increasing health problem in developing countries like India. Cigarette smoking is an important risk factor for peripheral, coronary and cerebral atherosclerosis. Hence an attempt is made in this study to know possible effect of cigratte smoking on lipid profile.

Objective: To compare the lipid profiles between chronic smokers and non smokers and to relate lipid profile with smoking pack years.

Materials & Methods: 25 active male smokers considering exclusion criteria in age group of 30-55yrs and age, BMI matched male healthy control subjects (25) were assessed for clinical details, dietary habits and smoking.Standard methods were adopted to check the lipid levels. Total cholestrol/ HDL ratio is also calculated. The data was analyzed statistically.

Results: The total cholestrol (213.96±40.81,p<0.001), VLDL (45.44±19.43,p=0.017), LDL(126.12±39.81,p=0.001), Triglycerides (242.88±95.04,p=0.016) and total cholestrol/HDL ratio (6.96±1.78,p<0.001) were found to be signifcantly higher in smokers when compared to non smokers. Total cholestrol(244.91±37.58,p<0.001) and LDL(142.55±46.79,p=0.066) were significantly higher among smokers with >10 pack years compared to smokers with ≤10 pack years.

Conclusion: There was significantly abnormal lipid profile in smokers when compared to non smokers. The total cholesterol/ HDL ratio can be used to predict ischemic heart disorders. Number of pack years was directly proportional to abnormal lipid profile.

Keywords: *Smoking, serum lipid profiles, chronic smokers, coronary and cerebral atherosclerosis, Ischemic heart disorders*

INTRODUCTION

Smoking is an increasing health problem in developing countries like India. Cigarette smoking is an important risk factor for peripheral, coronary and cerebral atherosclerosis causing premature death in developing countries[1,2]. According to World Health Organization, that by the year 2020, coronary heart disease and stroke would occupy the first and fourth places as the leading causes of disability and mortality[3]. Gaseous phase of tobacco contains carbon monoxide, carbon dioxide, nitric oxide, nitrogen dioxide, dinitro trioside, ammonia, hydrogen cyanide, volatile sulphur containing compounds, volatile aldehydes like formaldehyde, acetaldehyde and acrolein, alcohols and ketones, whereas nicotine and various particulate matters (collectively known as "tar") constitute the major particulate phase components of cigarette smoke[3,4]. Tobacco smoke also contains various types of nitrosamines. These nitrosamines are potential carcinogenic substances and they are capable of alkylating the DNA.

Tobacco is patho-genetically a cholesterol dependent risk factor and it acts synergistically with other risk

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factors for the causation of coronary heart disease. Thus, a strong synergistic interaction exists between hypercholesterolemia and tobacco consumption in the genesis of coronary heart disease[3]. Several possible explanations have been offered for this association, including altered blood coagulation, impaired integrity of the arterial wall, and changes in blood lipid and lipoprotein concentrations[5,6,7].

Smoking is one of the modifiable risk factor[8,9]. There is also dose response relationship between the number of cigarettes smoked and cardiovascular morbidity and mortality[10,11]. Irrespective of known risk many people are becoming prey for cigarette smoking. Hence, an attempt is made to compare the lipid profiles between chronic smokers and non smokers and also to relate lipid profile alteration with smoking pack years.

MATERIALS AND METHOD

A comparative parallel study was conducted in Bengaluru, among 50 smoking and non smoking males with age group 30-55 years and who had BMI of <25 kg/ m2 belonging to different socio-economic strata of the society. Each group contained 25 subjects.

Subjects with Diabetes mellitus , hypertension, obesity, renal diseases, lipid metabolism disorders, coronary diseases ,other systemic illness and subjects on medications corticosteroids, hormones or oral contraceptives, beta blockers, diuretics, isotretinoin, antiepileptics, vitamin/mineral supplements/herbal/ native medicines etc were excluded.

After taking written consent, categorization of smokers was done by eliciting smoking history, Smoking pack years was calculated{(Number of cigarettes smoked per day × Number of years smoked)/20}. Later classified based on the number of pack years as <= 10 and >10 respectively.

The blood samples are collected after an overnight fasting for about 12 hours. 5 ml. of whole blood was collected from each subject and estimation of serum lipid profile was done at Central Research Laboratory, Victoria Hospital campus, Bangalore Medical College and Research Institute (BMCRI), Bangalore by using Beckman coulter automated machine.

Total cholesterol/ HDL was calculated, as it is a useful and simple index of IHD risk in smoking individuals. It is proposed that the ability of this ratio to predict risk is explained by the fact that it is a relevant cumulative marker of the cluster of metabolic abnormalities found in individuals with high TG–low HDL-C dyslipidemia[12].

Statistical method: The data was analyzed using SPSS 15 software and Descriptive statistical analysis were carried out and the results were presented in Mean ± SD, Student t test with P value < 0.05 –was taken as significant and the results were expressed in tables using Microsoft word and Excel.

FINDINGS

Present study is a comparative study consisting of 25 smokers (Study group) and 25 non smokers (control group). Subjects in both the groups were well matched with respect to age (p=0.193) and BMI (p=0.421). 44% of smokers had smoking pack year of >10 and 56% of them had ≤ 10.

Table 1: Age distribution of samples studied

Age in years	Smokers		Non smokers	
	No	%	No	%
30-40	14	56.0	20	80.0
41-50	9	36.0	3	12.0
51-60	2	8.0	2	8.0
Total	25	100.0	25	100.0

Samples are age matched with P=0.19

Table 2: Comparison of BMI(kg/m²)

BMI (kg/m²)	Smokers		Non smokers	
	No	%	No	%
<18.5	1	4.0	0	0.0
18.5-23	8	32.0	13	52.0
23-25	13	52.0	11	44.0
>25	3	12.0	1	4.0
Total	25	100.0	25	100.0
Mean ± SD	23.18 ±1.89		22.76±1.83	

BMI is statistically similar in two groups with P=0.421

Table 3: Comparison of Lipids profile in smokers and non smokers

Lipids Profiles	Smokers	Non smokers	P value
Total cholesterol	213.96±40.81	158.12±27.61	<0.001**
VLDL	45.44±19.43	33.28±14.88	0.017*
LDL	126.12±39.81	93.76±24.34	0.001**
HDL	32.12±7.73	33.80±5.85	0.390
TGL	242.88±95.04	179.16±84.16	0.016*
Cholesterol/HDL	6.96±1.78	4.76±0.91	<0.001**

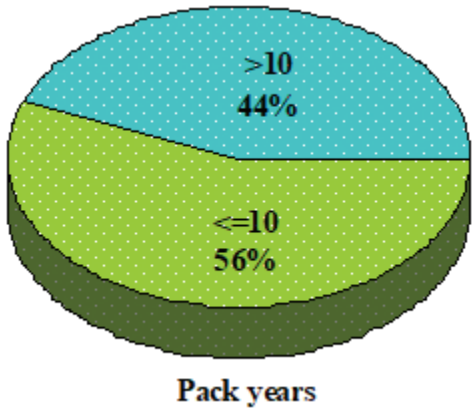

Fig. 1: Distribution of Smoking pack years

Table 4: Comparison of Lipid profile among smokers

Pack years	Number of patients	Total cholesterol	VLDL	LDL	TGL	Cholesterol/ HDL
≤10	14	189.64±23.26	43.57±17.3	113.21±28.88	236.86±89.84	6.82±1.72
>10	11	244.91±37.58	47.82±22.5	142.55±46.79	250.55±105.21	7.14±1.92
Total	25	213.96±40.81	45.44±19.43	126.12±39.81	242.88±95.04	6.96±1.78
P value	-	<0.001**	0.598	0.066	0.729	0.665

DISCUSSION

Age and BMI are matched between smokers and non smokers. It is revealed that TC,VLDL-C, LDL-C, triglycerides were significantly higher in smokers as compared to non-smokers similar to other studies[1,2,3]. Cholesterol/HDL was also significantly higher in smokers thereby revealing a direct dose response relationship similar to other works[10,11]. The serum total cholesterol in non-smokers was 158.12 ± 27.61 mg/dl while it was significantly higher in smokers, i.e., 213.96 ± 40.81 mg/dl. These observations are in tune with the findings of other works instead of workers. Cigarette smoking substantially increases the risk of coronary heart disease and ischemic stroke[14-17]. The total cholesterol values in subjects with pack year ≤10 was 189.64 ± 23.26 mg/dl and those >10 was 244.91 ± 37.58 mg/dl. The serum triglycerides levels in smokers and non smokers were 242.88 ± 95.04 mg/dl and 179.16 ± 84.16 mg/dl respectively. These findings are similar to those observed by Wynder et al[8] and Rustogi et al[12]. The values of serum triglycerides and total cholesterol were higher in those subjects with pack year >10 when compared with ≤10. The VLDL-C and LDL-C values in nonsmokers were 33.28± 14.88 mg/dl and 93.76 ± 24.34 mg/dl respectively. But these values were higher in subjects with pack year >10 as compared to those with pack year ≤10.The mean HDL-C in smokers was 32.12 ± 7.73 and 33.8 ± 5.85 in nonsmokers respectively. Further, the subjects with pack year >10 shows high Total cholesterol/ HDL-C (7.14 ±1.92) as compared to those with pack year ≤10 (6.82±1.72). These findings suggest that smoking alters the lipid profile adversely causing dyslipidemia in smokers and the changes become more marked with increasing smoking pack years.

Several mechanisms were proposed to explain the deleterious effect of tobacco leading to abnormal serum lipid profile they are (a) nicotine stimulates sympathetic adrenal system leading to increased catecholamines resulting in increased lipolysis and increased concentration of plasma free fatty acids which further results in increased Free fatty acids's and hepatic triglycerides along with VLDL in blood stream (b) fall in estrogen level which further lead to decrease in HDL and (c) presence of hyperinsulinemia in smokers lead to increased cholesterol, LDL, VLDL and TG due to decreased activity of lipoprotein lipase[4,5,14].

It is a known fact that smokers have a higher risk of vascular disease including coronary heart disease and cerebrovascular disease than non smokers. Tobacco exerts its deleterious effects through multiple mechanisms. Endothelial dysfunction, increased oxidative stress, and altered blood coagulability, decreased fibrinolysis and changes in serum lipids profiles[6,7]. Also, cigarette smoking is a risk factor for many cancers like oral, naso oropharengeal, larynx, gastrointestinal and urogenital malignancies. It is also responsible for chronic obstructive pulmonary disorders and is detrimental to maternal and infant health[5].

CONCLUSION

Lipid profile abnormalities are directly correlated with smoking and duration of smoking pack years in this study. Smoking, or if we say more carefully, tobacco, has a very bad influence on the total health system of the human beings, not only effecting the arteries or the lung but almost all the functional systems of the body. The total cholesterol/ HDL ratio can be a useful index to prevent atherosclerosis in smokers. Cigarette smoking is not only harmful to person who smokes but also to the innocent bystander who unfortunately happens to share the same air as the smoker. Hence, law makers should amend a stringent law to prohibit smoking in the public places. Intense education program about adverse health events of smoking and promote healthful lifestyles through an ongoing campaign involving community leaders should be under taken through all means of audio-visual media to the public and to students through their curriculum.

Conflict of Interest: None

Source of Funding: Self

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Effect of Meditation on Cardiovascular System

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ABSTRACT

In this study, cardiovascular functions of those practicing Raja Yoga Meditation (Short and Long Term Meditators) were compare with those of non-meditators. Diastolic and systolic blood pressure and heart rate were significantly normal in short term and long term meditators than non-meditators. Moreover long term meditators had significantly lower diastolic and systolic blood pressure than short term meditators.

This shows that Raja Yoga Meditators provides significant improvement in Cardiovascular functions.

Keywords: *Meditation, Raja Yoga, Diastolic Blood Pressure, Systolic Blood Pressure, Heart Rate.*

INTRODUCTION

Meditation is the method of extending our ordinary consciousness and thereby discovering more about ourselves.

Meditation is the technique of turning down the brilliance of the day so that the subtle sources of energy can be perceived within.

The present study is aimed at determining the effect of Raja Yoga, Meditation on Cardiovascular functions.

The study was performed on subjects who did not differ significantly in age, sex distribution and physical activity.

MATERIALS AND METHOD

The present study was conducted in the Department of Physiology, Kakatiya Medical College, Warangal.

The study was undertaken to analyze the effect of Anapanasati Meditation on Cardiovascular parameters among short term and long term meditators and to compare with that on non-meditators.

Inclusion Criteria:

- Healthy males and females in the age group of 40 to 45 years.
- Short term meditators were those who had been practicing meditation from 6 months to 5 years.
- Long term meditators were those who had been practicing meditators for more than 5 years.
- Age and sex matched healthy individuals not exposed to any meditation or relaxation techniques were included as controls.

Exclusion Criteria:

- Age below 40 years and above 45 years.
- Presence of obesity, hypertension diabetes mellitus, ischemic heart disease, congestive heart disease.
- Asthma, COPD, gross vertebral column or thoracic cage anomalies.

METHOD

Presently study was conducted on 75 healthy subjects of either sex in the age group of 40 to 45 years.

This group was divided into 25 short term meditators, 25 long term meditators and 25 non-meditators.

They practice meditation regularly for 1 hr/day i.e. 6-7 A.M.

Table 1: Mean values of Systolic and diastolic B.P and Heart rate of Non-meditators,Short term meditators,and Long term meditators.

Variables	Non-Meditators	Short Term Meditators	Long Term Meditators	p Value
Systolic BP (mmHg) Mean ± SD	135 ± 4.45	126 ± 4.45	114 ± 6.53	0.0001
Diastolic BP (mmHg) Mean ± SD	92 ± 7.09	84.8 ± 4.44	74.2 ± 6.72	0.0001
Heart Rate (Min) Mean ± SD	86 ± 5.52	91.2 ± 1.96	73.4 ± 4.27	0.0001

The results were expressed as mean ± standard deviations for continuous data and number and percentage for discrete data.

One way ANOVA was used for simultaneous multiple group comparison followed by Post-hoc Tukey's Test for group wise comparisons.

Categorical data was analysed by Chi Square Test.

STSS version 16 software was used for analysis.

1. p value >0.05 is taken as 'not significant'.
2. p value <0.05 is taken as 'significant'.
3. p value <0.001 is taken as 'highly significant'.

DISCUSSION

The mean values of heart rate systolic blood pressure and diastolic blood pressure are highly significant reduction after 6 months of yoga practice.

Reduction in heart rate and blood pressure indicate a shift in the balancing components of automatic nervous system towards the parasympathetic activity.

This modulation of autonomic nervous system activity might have been brought about through the conditioning effect of yoga on autonomic functions and mediated through the limbic system and higher areas of CNS. Regular practice of yoga increases the baroreflex sensitivity and decreases the sympathetic tone, thereby restoring blood pressure and heart rate to normal levels.

The present study also revealed significant responses in subjects of same age group, who are practicing yoga compared to the subjects who are not practicing yoga.

This may suggest that yoga is more effective in reducing basal heart rate and blood pressure.

Improvements in cardiovascular parameters seen in the meditators in our study are similar to other studies done on meditation (1, 2,3) and yoga (4,5). Meditation by modifying the state of anxiety reduces stress induced sympathetic over activity resulting in a lowering of DBP and HR. It makes the subject undergo relaxation and thereby decreases arterial tone and peripheral resistance (6, 7).

CONCLUSIONS

Non-pharmacological methods like yoga, meditation and life style modification should be encouraged to control the modifiable risk factors. The cardiovascular parameters alter with age, but these alterations are slower in persons aging with regular yoga practice.

It can be thus concluded that these results and their explanations would justify the incorporation of yoga as part of our life style in prevention of age related complications.

"In a tension filled society, yoga pranayama, meditation alone will bring solace from all problems and hence they are the essence of life".

Conflict of Interest: NIL

Source of Funding: Self

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Gender Issue in Oxidativestress in Undialyzed Chronic Renal Failure Patients

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ABSTRACT

Oxidative stress is at play in progression of chronic renal failure which negatively affects human health and longevity. Over production of oxidants or inability to balance the oxidant level by the antioxidants could be the cause of systemic oxidative stress. Available reports regarding oxidative stress in undialyzed chronic renal failure (CRF) patients are inconclusive. Therefore, the aim of the present study was to evaluate the level of oxidative stress and gender influence in undialyzed CRF patients against that of healthy individuals. However, gender specific susceptibility influencing oxidative stress was never reported in undialyzed chronic renal failure patients. The study group was consisted of 80 volunteers including 40 undialyzed chronic renal failure patients and 40 age matched healthy volunteers. Changes in serum malondialdehyde (MDA) levels, catalase and superoxide dismutase (SOD) activities in undialyzed chronic renal failure patients were measured spectrophotometrically and compared with healthy control groups. Overall values indicate upsurge in oxidative stress in CRF patients in comparison to healthy volunteers through raised levels of MDA along with increased SOD activities in serum. Interestingly, obvious differences were observed in between genders within the CRF patients, which is signified by statistical tests only in case of serum MDA level. This is the first report of gender issue in terms of oxidative stress in CRF patients. On the basis of observations reported here, it can be summarized that the gender linked inconsistency in oxidative stress in CRF patients may be due to differential responses of oxidant handling enzymes in male and female CRF patients.

Keywords: *Oxidative Stress, Undialyzed Chronic Renal Failure, Malondialdehyde, Catalse and Superoxide Dismutase*

INTRODUCTION

Kidneys play a vital role in body homeostasis. One of the imperative kidney functions is to filter waste products from the blood stream[1]. Chronic Renal Failure (CRF) is well recognized as worldwide public health problem[2]. CRF is insidious and gradual may progress to end stage renal disease[3]. Additionally, CRF patients have a high risk of death from stroke or heart attack, if remain unnoticed or unchecked[4]. In view of the high degree of mortality, morbidity and financial burden, efforts have been made to preempt the injury from causative factors such as diabetes mellitus, hypertension and those which complicate the condition such as oxidative stress and nephrotoxins[5]. Oxidative stress is defined as imbalance between production of Reactive Oxygen Species (ROS) and antioxidant potential level[6,7]. Oxidative stress has negative consequences, on cell cycle regulation (mitochondrial dysfunction) of host organism, in particular at sites of inflammation in CRF patients[8,9].On the other hand, oxidative stress promotes the progression of long term systemic complications like atherosclerosis, amyloidosis, hypertension, diabetes, renal ischemia and cardiovascular disease[10,11,12]. Series of reports over recent years have used *in vivo* circulating biomarkers to assess the burden of oxidative stress in CRF patients[13] .Uremia, dialysis associated factors (dialyzer membrane and trace amount of endotoxin in dialysate) and even intravenous iron supplementation, may contribute to increase oxidative stress of dialyzing CRF patients[8,9]. However little is known about the same in undialyzed CRF patients. Additionally, data from *in vitro* study indicates free radicals contribute oxidative stress in CRF patients[14,15,16]. CRF is more common in males[17], nevertheless, the literature describing alterations in antioxidant enzyme levels are somewhat controversial.

Sangita et al reported decreased SOD levels in CRF patients[18], whereas Baud et al reported that increased SOD levels in CRF patients[19], Martin – Mateo et al found decreased catalase levels in CRF patients[20], while Piez et al reported increased levels of catalase in CRF patients[21]. Then, the current study was aimed to evaluate the level of oxidative stress in undialyzed CRF patients. Additionally, study of correlation between levels of oxidative parameters and creatinine in serum is also carried out to identify the importance of each studied oxidative stress parameters in the context of oxidative stress induced damage in CRF. Whether gender is influencing oxidative stress in CRF or not is unclear. Therefore, inclusion of study of gender influence in oxidative stress parameters in CRF is also considered worthwhile.

MATERIALS AND METHOD

The study was conducted on 40 undialyzed CRF patients as evidenced by serum creatinine level above 2.0mg/dL who have visited the Nephrology Department, NRI Medical College during June 2013 to May 2015. 40 healthy controls (having serum creatinine level within normal range) have been included in the study. Informed consent was taken from all subjects involved in the study and the study was approved by the Institutional Ethics Committee.

None of the study groups received any form of antioxidant as medication during the study period. The undialyzed CRF patients were on renal diet (50gms protein and 5gms salt/day). The healthy controls were not on any kind of prescribed medication or dietary restrictions. The blood samples were collected and serum was stored to carry out the biochemical tests.

Serum levels of MDA and SOD activity were assayed as mentioned by Dasari et al[22].

Activity of catalase enzyme can be tracked by decomposition of hydrogen peroxide. The assay system contained 1.90mL of 0.05M sodium phosphate buffer (pH 7.0), 0.10ml serum sample and 1.0mL of 0.05M hydrogen peroxide in phosphate buffer. The change in absorbance was read at 240nm for a minute. The specific activity of catalase enzyme was calculated using molar extinction coefficient as 43.6 for hydrogen peroxide decomposed/mL.

Collected data are processed by two-way ANOVA test considering the level of significance at $p < 0.05$.

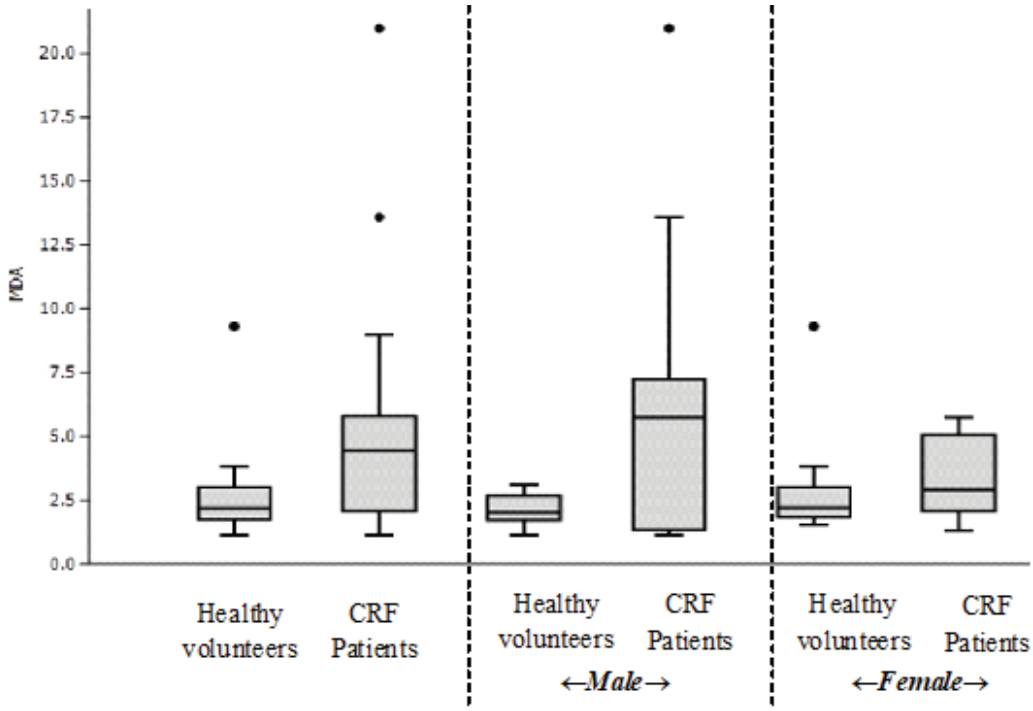

Figure - 1. Box and whisker plot of collected data of serum malonaldehyde (MDA) levels (nmole/dL) of included patients and volunteers indicating median value (as cross line inside the box), 1st to 3rd quartile of values (as rectangular box), maximum and minimum (range) values (as line outside the box with cap) and outliers (as dark dots),

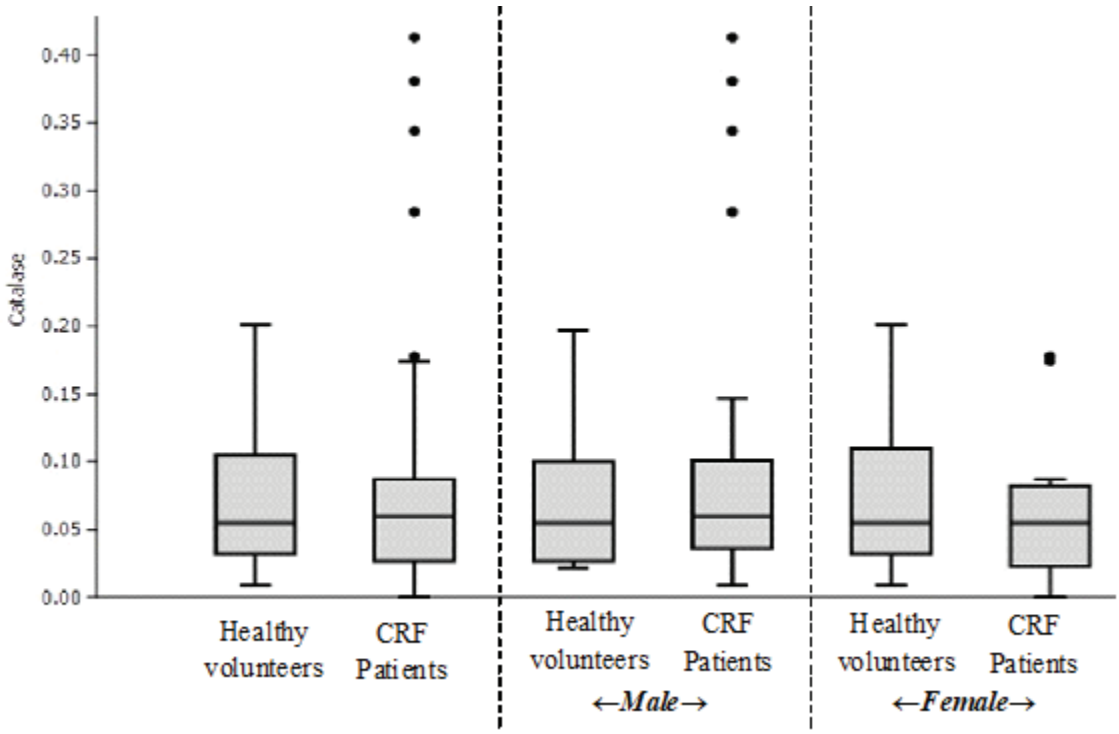

Figure - 2. Box and whisker plot of collected data of serum levels of catalase activity (Unit / mL) of included patients and volunteers indicating median value (as cross line inside the box), 1st to 3rd quartile of values (as rectangular box), maximum and minimum (range) values (as line outside the box with cap) and outliers (as dark dots).

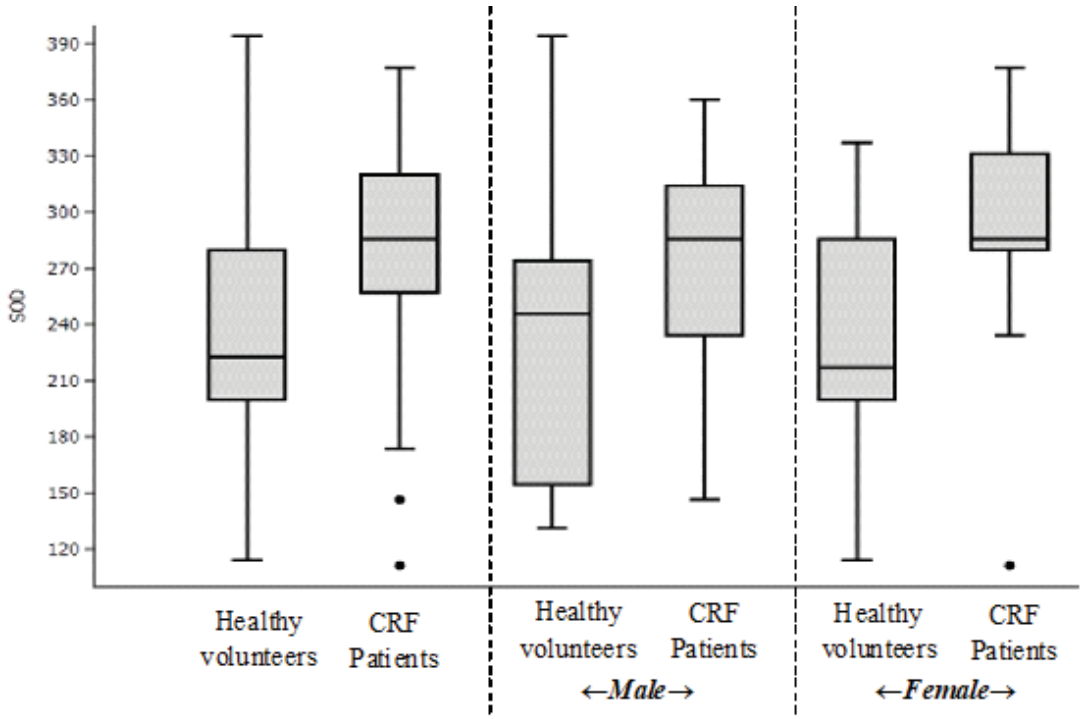

Figure - 3. Box and whisker plot of collected data of serum levels of SOD activity (unit / mL) of included patients and volunteers indicating median value (as cross line inside the box), 1st to 3rd quartile of values (as rectangular box), maximum and minimum (range) values (as line outside the box with cap) and outliers (as dark dots).

RESULTS

Serum MDA levels were measured as an indicator of lipid peroxidation.From figure-1, increased levels of serum MDA were observed in CRF patientsin comparison to their respective controls. Two-way ANOVA test indicated significant contribution of kidney status ($F = 12.77$; $p = 0.0006147$), gender ($F = 7.016$; $p = 0.009823$) as well as interaction of both of them ($F = 6.107$; $p = 0.0157$). The average serum MDA levelwas found to be increased by29% in female CRF patients and 195% in male CRF patients. Figure-2shows that 43% increase in catalase level in male CRF patients while the same is only 14% in female CRF patients in comparison to their respective control counterparts.Two-way ANOVA test indicated only insignificant contribution of both kidney status ($F= 0.06$; $p = 0.8005$),gender ($F = 0.011$; $p = 0.9157$) as well as their interactions ($F = 1.606$; $p =0.20$) in alterations of serum catalase activities.

From figure-3median SOD activities of CRF patients were found to be higher in comparison to their respective control groups. From two-way ANOVA test the SOD activities were found to be significantly influenced by the kidney status ($F=13.1$; $p =0.0005308$), however, not by the gender or their interaction. Even though,a higher augmentation in SOD activities were recorded in the female CRF patients is28% as compared to 15% in male CRF patients in comparison to their respective control counterparts.

DISCUSSION

In recent years the incidence of chronic kidney disease is on the rise21.Number of studies was directed at assessing the magnitude of the problem and the factors complicating CRF.Reduction in nephron number is known to result in impaired functions by the kidneys in CRF patients17.For long, it is known that imbalance in oxidants and antioxidantsis a noteworthy complication of CRF by Ichikawa et al23.

As such, enhanced oxidative stress was well established in uremia,a consequence of chronic renal damage as described by Witko-sarsa et al24. Reactive oxygen species in excess quantity are implicated in damage of cellular macromolecules and thereby increasing systemic risks in chronic renal failure7.Even though, the very short half life of oxidant molecules make their estimation extremely difficult, effects of those oxidants on cellular macromolecules are often appreciated by biochemical estimation. The results of the current study revealed increased serum levels of MDA, frequently used as biochemical marker for the level of oxidative stress in CRF patientswere significantly higher compared to that of healthy volunteers. Male CRF patients showed relatively greater rise in MDA levels compared with female CRF patients (Figure -1). Kemidillaiah et al showed an increased MDA level in CRF patients25.

At the same time, reduction in the activities of antioxidants enzymes like catalase and superoxide dismutase etc also enhance oxidative stress.Either way,oxidative stress pose an increased risk of developing adverse effects like cardiovascular disease in CRF patients as well as expecting deterioration of renal functions as mentioned by Locatelli et al7.Literature describing the results of biomarkers for oxidative stress in undialyzed CRF patients is somewhat controversial. In general, there is concurrence of opinion on increased oxidative stress reflected by the elevated serum levels of products of lipid peroxidation and with the nonuniform results ofantioxidant levels in serum by various investigators. Thus, the direction of tilt of oxidant and antioxidant balance in undialyzed patients with chronic renal impairment remains an unresolved enigma as per Prajapati et al26. In view of this,the present study investigated the oxidant and antioxidant imbalance by estimating serum levels of MDA on one hand and that of antioxidants like catalase and SOD on the other.

Whereas catalase activity in CRF patients showed only insignificant but marginal rise compared with healthy volunteers(figure-2). Martin – Mateo et al found decreased catalase levels in CRFpatients20. On the other side Piez et al reported increased levels of catalase in CRF patients21.In the current study male CRF patients showed marginal rise in catalase activity compared with female CRFpatients.

Concurrently, there was significant increase in SOD activity in CRF patients compared with healthy counterparts. This is accordance with the earlier report of higher SOD levels in CRF patients15. However, Sawant et al reported decreased SOD levels in CRFpatients18. It wasalso observed from the current study that female CRF patients showed relatively greater rise in SOD

activity compared with male CRF patients; however, no significant influence of gender on the CRF-related alteration in SOD activities was found. Observe subtle difference in SOD activities in between genders warrants further study with greater number of participants. On the other hand, wide variations in serum SOD activities in healthy participants also could be reason for blunting the differences between male and female CRF patients, as contrasted with minimum variations in female CRF patients (Figure-3). However, as there is no study reported difference between the male and female CRF patients in terms of serum SOD activities, the current study is indicating some insight about it..

In essence,the study supported existence of greater oxidative stress based on the results of significant increase in serum MDA.An increased level of SOD signifies increased generation of another harmful product H2O2 from ROS.Insignificant rise in catalase in patients with renal damage yet cause toxic to the cells.Although catalase level itself was not decreased,the balance was obviously in favor of increase in oxidant stress with some minor contribution from compromised antioxidant activity.However,this aspect may open up new avenues in the management of chronic renal disease with promise of slowing the deterioration and morbidity.

CONCLUSION

There is no earlier report of gender variation in oxidative stress in CRF patients. However, the present investigation clearly demonstrates that gender is significantly influencing the oxidative stress in CRF patients. In terms of most important antioxidant parameters, the oxidant handling enzymes – SOD and Catalase, the gender issue was obvious, as presented in the box and whiskers plots. Nevertheless, the statistical tests used here did not find significant influences of gender in the current study. Even though, the number of patients studied in this study are sufficient as per the statistical requirements, with more number of patients and stricter inclusion criteria may provide a better understanding of the oxidant handling by the undailyzed CRF patients.

Conflict of Interest: Nil

Source of funding: Self

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Psychological Morbidity, Sources and Gender Correlation of Stress in First Year Medical Students

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ABSTRACT

Medical students are exposed to many stressors and if stress is perceived negatively or becomes excessive can affect academic performance and health adversely. The objective of this study was to assess stress, predominant stressor and its gender correlation among the first year medical students in our college. It was conducted to understand better the factors influencing student perception.

We chose 100 medical students for this study, they were asked to self-rate the tailored Medical Student Stress Questionnaire. After statistical analysis it was found that, academic related stress level was high (2.18) among the students. And the intrapersonal and interpersonal related stressors (IRS), teaching and learning-related stressors (TLRS), social related stressors (SRS), drive and desire related stressors (DRS), and group activities related stressors (GARS) scored 1.73,1.85,1.58,1.03,1.36 respectively.i.e. stress level was moderate all these categories. Better techniques to cope up the stress were taught to the students later through music and yoga.

Keywords: *Stress, Academic Related , Teaching and Learning-Related , Social Related , Drive and Desire Related , Group Activities Related*

INTRODUCTION

Everybody experiences stress in life. Despite the fact that stress is one of the most common human experiences, it is surprisingly difficult to define. Stress is defined as inability to cope with perceived(real or imagined) threat to one's mental, physical, emotional, or spiritual well-being, which results in series of physiological responses and adaptations[(1)] College is a transitional period when young people undergo new experiences, meet new people face challenges and get opportunities that may add stress in their life. For students the pressures of maintaining a balance between interpersonal relationships, academic demands, one's own expectations, and family and peer expectations further aggravate the stress. While assessing factors of stress it is important to examine psycho-social variables in addition to demographic and other related variables because it has been found that individuals with high self-esteem are associated with low academic and life stress [(2, 3).]

Medical courses in India are very demanding for students, which involves emotional aspect as well, sometimes making career in medical education very stressful [(4).] Studies have proved that compared to general population medical students are more stressed of the students [(5)] and has led to suicide and suicidal attempts by them [(6).] The stress stems from fear of failure, academic pressure, perfectionist standards, enormous content that has to be mastered in small time frame, higher expectation from parents & peers, and exhaustive work schedules in addition to the frequent assessment and examination[(7)] & compulsion for educational program that may not be their first choice[(8).]

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MATERIALS & METHOD

The study was conducted at department of Physiology. After getting clearance from institutional ethical committee of the college, first year MBBS students (n=100) were invited to participate in the study. Following informed , written consent the volunteers were asked to self-rate the tailored Medical Student Stress Questionnaire. Data collection was done in February in middle of academic term.

To investigate the sources of stress the questionnaire was tailored from the Medical student stress Questionnaire (MSSQ) [9] which consisted of a set of 40 questions on several domains of stress perceived by them. All the 40 questions had 5 responses on Liker scale and the sum of responses of domain were normalized and scaled as mild (0-1), moderate (1.01-2); high (2.01-3) & severe (3.01-4). The questions were addressed to six domains of stress which included, Academic related: involving examination, learning context, competition, falling behind in schedule etc; Intrapersonal & interpersonal: verbal/physical abuse, conflicts with peers and teachers, health problems etc; teaching related: inadequate study material, lack of guidance, teaching skills, feedback from teachers etc; Social related: interruption by peers, lack of time for friends and families; Drive related: parental wish, unwillingness; Group activities related: peer pressure, performance and discussion. Demographic information (age, genderetic) was obtained within the same questionnaire. Identities of the volunteers were kept hidden by randomly allocating IDs to recruiting volunteers. They were allowed to fill the questionnaire, seal the envelops and drop it in a drop box.

OBSERVATION AND RESULTS

Statistical analysis was done by descriptive stastistics methods. Following observations were made.

Mean age for this study was 18 years. Out of 100 students 53 were females, 47 were males.

Table No.1: Scoring of type of stress

Sources of Stress	Scores
ARS(academic related)	2.18
IRS(interpersonal related stress)	1.73
TLRS(teaching learning related stress)	1.85
SRS(social related stress)	1.58
DRS(desire related stress)	1.03
GARS(group activity related stress)	1.36

When we analyzed the overall students, academic related stress level was high (2.18) among the students. And the intrapersonal and interpersonal related stressors (IRS), teaching and learning-related stressors (TLRS), social related stressors (SRS), drive and desire related stressors (DRS), and group activities related stressors (GARS) scored 1.73,1.85,1.58,1.03,1.36 respectively.i.e. stress level was moderate in all these categories.

Table No.2: Gender correlation of types of stress

Sources	Score in Males	Score in Females
ARS	2.08	2.23
IRS	1.43	1.93
TLRS	1.65	1.96
SRS	1.52	1.63
DRS	0.96	1.06
GARS	1.52	1.47

When scoring was compared in both gender, all the stress related scoring was more in female compared to male except group activity related stress.

DISCUSSION

Stress has been described as a double-edged sword that can either stimulate and motivate the students to peak performance or reduce the students to ineffectiveness[10].

The study confirmed the general impression that medical students in this institute have considerable stress which is consistent with similar studies [7].Academic factors are the predominant stressor for students. Extensive syllabus, multiple examinations and viva-voce examinations, attending lectures and demonstrations and results in examination add up to stress faced by students along with hostel accommodation, peer and senior interaction and other emotional aspects.

Our study showed that many students reported high stress levels related to the academic that included frequent examinations & assessment methods, grading methods, academic schedule and lack of time for review. The same was observed as the greatest source of stress in Malaysian study (24%) [11], by Chandra sheker et al [9] in Indian students at a medical college at Nepal and

in studies at Saudi Arabia (25%) [11]. More than 50% of medical students at Pakistan medical college reported academic stress in higher quartile (Mean >28) in the study by Shah et al [4]. Study of Abraham et al on Indian first year students of MMC also observed a higher % of students (52.5% to 91.2%) having sources of stress from academic category regarding information overload and frequency of summative examination [12]. Stress associated with examinations was reported across all the years of BDS by Acharya [13] but not observed by Westerman et al [14]. Supe A N in his study found that 73% of first year medical students perceived stress with academic factors as a greater perceived cause of stress in MBBS medical students [4]. First year students in India have to undertake repetitive summative examination of the three subjects. With 8 hrs of teaching in a day they hardly have spare time for de-stressing.

Results of the present study showed that overall females perceived more stress than male students, which was in non agreement with Acharya [13] and Kumar et al [15]

CONCLUSION

1. Academic related stress was high among the students.
2. Males have comparatively less stress levels than the females.

This study suggests that there is a need to sensitize students about adverse effects of stress and intervention programs like counseling and stress relaxation programs to be provided to excessively stressed students to decrease depression.

Source of funding: Self

Conflict of interest/Limitations: This cross-sectional study was based on self-reported information provided by students. Therefore, there is some potential for reporting bias which may have occurred because of the respondents' interpretation of the questions or desire to report their emotions in a certain way or simply because of inaccuracies of responses. Another longitudinal study could be carried out with a cohort of students to investigate the levels of stress among students in all the five years of undergraduate medical years and the associated factors.

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Cardiovagal Balance during Different Phases of Menstrual Cycle

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ABSTRACT

Introduction and Aim: Cyclical changes in female sex hormones during menstrual cycle not only have its role in reproductive function of women but also have its effect on womens' psychology and cardiovascular system via its influence over autonomic nervous system. Hormonal imbalance affects autonomic regulation of the heart resulting in heart diseases. Vagus nerve was known to have a cardioprotective role. Cardiovagal balance is mainly measured by parasympathetic function tests. Since there were lot of conflicts between the authors on cardiovagal balance in different phases of menstrual cycle, this study was chosen. Our aim is to compare the cardiovagal balance during follicular and luteal phases of menstrual cycle.

Materials and Methods: After getting institutional ethical committee clearance, this observational study was undertaken in the department of Physiology. Fifty young women volunteers aged between 20-30 years with normal BMI (18- 24 kg/m^2) and regular menstrual cycle were selected. Parasympathetic function tests like postural index (30:15), Deep breathing test and Valsalva ratio were done during follicular phase (6th -7th day) and Luteal phase (24th- 25th day) of menstrual cycle. Statistical analysis was done using SPSS 17 version.

Results: All the three parasympathetic parameters were significantly increased in the follicular phase compared to the luteal phase.

Conclusion: Cardio protective role of female sex hormones (by influencing the autonomic nervous system) was found to be higher during follicular phase of menstrual cycle.

Keywords: *Deep Breathing test, Follicular Phase, Luteal Phase, Postural Index, Valsalva ratio*

INTRODUCTION

The reproductive life of women is associated with cyclical changes in the sex hormones. Female sex hormones are known to have its effect on cardiovascular system directly and indirectly via autonomic nervous system. The behavioral and psychological changes in response to hormonal imbalance during premenstrual phase, pregnancy and menopause involve limbic system and hypothalamus. Hormonal imbalance affects not only physical health but also psychological health, manifesting as problems ranging from depression to panic disorders[1]. The physiological background for these changes is the altered autonomic function. Reduced autonomic regulation of the heart is one of the risk factors for heart disease.

Female sex hormones by gene transcription and translation and protein synthesis, helps in decreasing the LDL and increase the HDL cholesterol. Thus preventing the atherosclerotic changes in the vessel walls by acting as an antioxidant. It also helps in vasodilatation by releasing NO, prostacyclin and inhibits nor-adrenalin release presynaptically[2]. Indirectly, parasympathetic nervous system helps in protecting the cardiovascular system as well as psycho neural co-ordination in

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females. Cardio vagal balance is mainly evaluated by parasympathetic function tests in which heart rate is measured during different manoeuvres like valsalva, deep breathing since the heart rate is mainly determined by the vagus nerve. This study was carried out mainly to find out whether vagal activity remains the same or it differs along the phases of menstrual cycle among healthy young females in our locality as there remain controversies between the authors.

AIM

To study the cardio vagal balance in young adult women during different phases of menstrual cycle.

OBJECTIVES

1. To study the cardio vagal balance during early follicular phase.
2. To study the cardio vagal balance during late luteal phase.
3. To compare the vagal activity between both the phases of menstrual cycle.

MATERIALS AND METHOD

After getting institutional ethical committee clearance, this observational study was undertaken in the department of Physiology Sri Venkateshwaraa Medical College Hospital and Research Centre, Puducherry. Written consent was obtained from all participants. Fifty young women volunteers aging between 20-30 years with normal BMI (18- 24 kg/m^2) , regular menstrual cycle and normal BP, Heart rate were included.

Females with irregular menstrual history, anemia, chronic medical or surgical illnesses, endocrine abnormalities like diabetes mellitus, thyroid disorders, hypertension and those who were on chronic medications and hormonal pills were excluded.

General examination and history collection were done for all participants. Parasympathetic function tests were carried out during the two phases [Follicular phase (6^{th} -7^{th} day), Luteal phase (24^{th}- 25^{th} day) of the menstrual cycle] for all the 50 subjects.

Their basal heart rate and Blood pressure was found to be within normal limit. ECG analysis was done by using PHYSIOPAC PP4 MEDICAID system CHANDIGARH in the department of Physiology. Limb leads were used to record ECG. Recordings were done in the morning between 9.00 am to 11.00 am in the Autonomic Function Test lab ensuring that the participants didn't have morning breakfast or coffee 2 hours before the test. Instructions were given to all the participants before each test and their doubts were clarified. The following parasympathetic tests were done.

Postural Index (30:15): The test was conducted after 10 minutes of supine rest. Immediate heart rate response to standing from a supine position is called as postural index[3]. It is also called as orthostatic test. Only limb leads of the ECG were attached to the subject and the subject was asked to stand up with her feet within a period of 3 seconds. Continuous ECG recording was taken from supine rest for 30 seconds to the time the subject started getting up to a few seconds after standing still. In normal subjects there was characteristic immediate shortening of the R-R interval that is maximum around the 15th beat after standing followed by a relative lengthening that reaches a maximum around the 30th beat after standing thus giving a ratio of 30:15

$$30:15 = \frac{\text{longest R-R interval after standing}}{\text{Shortest R-R interval after standing}}$$

Deep breathing test: The subject was asked to do deep breathing by following the hand signal of the investigator to maintain the rate and time of breathing. For 6 cycles per minute, the inspiration was done for 5 seconds and expiration for 5 seconds. ECG recording was done during this procedure after taking baseline ECG for 30 seconds. Expiration and inspiration ratio (E: I) was calculated using longest R-R interval and shortest R-R interval.

$$E:I = \frac{\text{maximum R-R interval during expiration}}{\text{minimum R-R interval during inspiration}}$$

Valsalva Ratio: The subject was asked to blow into the mouth piece attached to the sphygmomanometer. The expiratory pressure is kept at 40 mm Hg for 15 seconds and nose was closed with nose clip. At the end of 15 seconds the pressure was released. ECG readings were done during valsalva maneuver. Valsalva ratio was calculated using longest R-R interval and shortest R-R interval.

$$\text{Valsalva ratio} = \frac{\text{Maximum R-R interval during relax}}{\text{Minimum R-R interval during strain}}$$

It is a measure of the change of heart rate that takes place during a brief period of forced expiration against a closed glottis or mouthpiece.

FINDINGS

The values were shown in Mean±SD. The data was analysed by student's paired t test by using SPSS 17 version.

Table 1: Parasympathetic function test during different phases of menstrual cycle

Parameters	Luteal phase	Follicular phase	P value
30:15 ratio	1.399±0.157	1.483±0.166	0.0053*
E:I ratio	1.408±0.16	1.479±0.15	<0.0001*
Valsalva ratio	1.438±0.186	1.589±0.202	<0.0001*

*P < 0.05 was considered to be statistically significant

Table 1 shows that all the three parameters were significantly increased in the follicular phase compared to the luteal phase of the menstrual cycle.

DISCUSSION

Deep breathing tests shows that the E:I ratio is significantly increased in the follicular phase compared to luteal phase. Increase in heart rate during inspiration results from decreased vagal activity. During inspiration impulses from vagal stretch receptors in lungs inhibit cardio inhibitory area in the medulla[4]. Rama Choudhury et al. reported that there was a negative correlation between progesterone level and heart rate response to DBT[5]. According to Saleh et al. estrogen in the follicular phase increase the density as well as the function of presynaptic α_2 adrenoreceptors, which in turn decrease the norepinephrine induced responses[6]. This results in increased parasympathetic activity in the follicular phase of the menstrual cycle with estrogen dominance[7,8]. Wellman et al. further suggested that estrogen stimulates the opening of calcium activated potassium channels by NO thus causing smooth muscle relaxation in the blood vessels[9]. Estrogen also stimulates the opening of calcium activated potassium channels via cyclic guanosine monophosphate dependent pathway[10]. Constantini et al. reported that estradiol might be associated with acetylcholine concentration[11]. Thus estrogen was found to have a facilitating effect over the cardiovagal function.

When various studies found that estrogen was associated with increase in parasympathetic activity in the follicular phase, some other studies revealed the reason behind the decreased parasympathetic activity in the premenstrual phase. According to the study done by Kondo et al. decreased parasympathetic activity in the luteal phase was associated with increase in the level of progesterone[12]. Thus progesterone inhibits the influence of estrogen on cardiovagal activity. Progesterone may increase the cardiac excitability by its opposing effect on estrogen[11]. Sato reported that estradiol increases the number and sensitivity of progesterone receptors thus increases the action of progesterone hormone during the premenstrual phase[7]. Thus progesterone exerts inhibitory effect on cardiovagal responses.

In contrast to the above findings Kamal Chand et al. and Ashwini et al. found increased parasympathetic function in the premenstrual phase compared to the proliferative phase[1,13]. Sumana Panja et al. found that parasympathetic activity decreased progressively as the gestational age increased. This could be due to increase in progesterone level as the pregnancy advances and their level is higher when compared to the estrogen. Thus the decrease in parasympathetic activity as the pregnancy advances could be due to increased progesterone level[14]. Our results are similar to those obtained by Christina et al. where the parasympathetic function tests were within normal limits across the menstrual cycle[15]. In the same way Sarita Kanojia et al. have reported increased parasympathetic activity in the postmenstrual phase compared to the premenstrual phase in normally menstruating females[16]. Anjali Nadir et al. found altered sympathetic and parasympathetic activity in postmenopausal women which could be due to the decrease in the level of estrogen[17]. This was further supported by Freedman et al. who found that estrogen replacement in postmenopausal women stabilises the cardiac autonomic function[18].

Similar to DBT other parasympathetic function tests like valsalva ratio and postural index also showed significant increase in the follicular phase compared to the luteal phase. Similar to our results Ashwini, Kamal Chand and kavitha et al. also found increase in the valsalva ratio and 30:15 in the follicular phase compared to the premenstrual phase indicating increased parasympathetic activity in the follicular phase[1,13,19]. Various other studies also found a significant change in the 30:15 ratio in the premenopausal and postmenopausal women[17]. Latha Devi et al. found that the postural index and Valsalva ratio were decreased both in perimenopausal and postmenopausal women indicating the decrease in the parasympathetic activity. This revealed the importance of estrogen in menopausal women and perimenopausal women[20]. Rama Choudhury et al. measured estrogen and progesterone along the different phases of the menstrual cycle. They found that estrogen peaks in the follicular phase and the progesterone peaks in the luteal phase of the menstrual cycle[5].

In this study, all the parasympathetic tests have shown significant increase in the follicular phase when compared to the luteal phase. This could be due to increase in estrogen in the proliferative phase or increase in progesterone in the premenstrual phase of menstrual cycle.

Estrogen receptors, present in the heart, vascular smooth muscle and autonomic brain stem centers suggest that ovarian hormones have a control over cardiovascular system directly and indirectly via autonomic nervous system. Estrogen was also found to have a profound anti-apoptotic effect in the cardiac myocytes and the vascular endothelium[2]. It was found that estrogen can increase the density and affinity of muscarinic receptors and suppressed the sympathetic activity in the brain of the male and female ovariectomized rats[22]. As oestrogen has a cardioprotective role incidence of cardiovascular morbidity is more common in men compared to premenopausal women. But the incidence of cardiovascular morbidity is same for both the sexes after menopause[1]. Injection of estrogen in brain stem nuclei associated with central autonomic cardiovascular control increase the vagal tone and decrease the sympathetic nerve traffic at rest[24].

CONCLUSION

Thus from this study we conclude that the parasympathetic activity was significantly higher in the follicular phase compared to the luteal phase which might be due to the estrogen dominance. The reduced parasympathetic in the luteal phase might be due to progesterone hormone antagonizing the action of estrogen.

IMPLICATIONS

This study will help the young women to understand the changes taking place in their body due to the cyclical change in the female sex hormones and its impact on cardiac vagal activity. Since the parasympathetic activity decrease in the luteal phase they are more prone for environmental stressors during that particular period of menstrual cycle.

Conflicts of Interest: none

Source of funding: nil

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Stress, Cognition and Sleep Quality in Pre Hypertensive Women

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ABSTRACT

Objective: The present study was undertaken to evaluate stress, cognition and sleep quality in women with pre-hypertension.

Materials and methods: Thirty cases of pre-hypertensive women between the age of 25-50 years and thirty age matched non pre-hypertensive were included in the study after obtaining written informed consent. Stress levels were assessed by using perceived stress scale and serum cortisol.

Results: Perceived stress and serum cortisol levels were significantly higher in pre-hypertensive women. Spatial, verbal memories, MMSE were significantly decreased in pre-hypertensive women. Sleep Quality was significantly low in pre-hypertensive women. Cognitive functions are assessed by spatial and verbal memory test and Mini Mental State Examination scores (MMSE). Sleep quality was assessed by using Pittsburgh sleep quality index and Epworth sleepiness scale.

Conclusion: In the present study we have observed significantly high stress, decreased sleep quality and cognitive functions in pre-hypertensive women. It is the need of time to increase awareness about pre-hypertension and preventive methods to improve quality and quantity of life.

Keywords: *Pre-hypertension, Stress, cognition, sleep quality.*

INTRODUCTION

Cardiovascular diseases are known as the first cause of mortality in the developed countries and it is growing rapidly in the developing countries too. Hypertension is considered as an important issue in public health and the risk of death all over the world. Today, in developed countries, 1 in every 3 adults has hypertension [1-3]. The Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and treatment of High Blood Pressure (JNC-7) included "prehypertension" as a category that was formerly covered by both the "normal" and "borderline" groups. Individuals with a systolic BP of 120 to 139 mm Hg or a diastolic BP of 80 to 89 mm Hg should be considered as pre-hypertensive. Prehypertension is a designation chosen to identify individuals at high risk of developing hypertension. Prevalence of prehypertension was found to be high in females when compared to males. Individuals with prehypertension are not candidates for drug therapy based on their level of BP and should be firmly and unambiguously advised to practice lifestyle modification in order to reduce their risk of developing hypertension in the future [2]. The present study was undertaken to evaluate stress, cognition and sleep quality in women with pre-hypertension.

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METHODS AND MATERIALS

The present study was conducted at Little Flower Hospital and Research Centre, Angamaly, in collaboration with Saveetha Medical College, Saveetha University, Chennai. Thirty cases of pre-hypertensive women between the age of 25-50 years and thirty age matched non pre-hypertensive were included in the study after obtaining written informed consent. The following criteria were followed while selecting the cases.

Inclusion criteria: Individuals with a systolic BP of 120 to 139 mm Hg or a diastolic BP of 80 to 89 mm Hg, not suffering from any other disease, under no medication and not practicing any stress management techniques were included in the study.

Exclusion criteria: Pregnancy or postpartum <3 months and Body mass index (BMI) >40 kg/m² were excluded from the study. All the participants were advised to continue their routine habits and diet throughout the study.

The effective variable on BP was controlled as much as possible however, individual differences, incidents and daily stress and also the way individuals adapted themselves with life affairs were uncontrollable variables of the study.

Assessment of stress levels: Stress levels were assessed by using perceived stress scale and serum cortisol[4,5].

Assessment of cognitive functions: Cognitive functions are assessed by spatial and verbal memory test and Mini Mental State Examination scores (MMSE)[6].

Assessment of sleep quality: Sleep quality was assessed by using Pitts burgh sleep quality index and Epworth sleepiness scale[7,8].

Data analysis: Data was analyzed by SPSS 20.0. Student t test was used to observe significant of difference between the groups. P<0.05 was considered as significant.

Results: Demographic data was presented in table no 1**.** Perceived stress and serum cortisol levels were significantly higher in pre-hypertensive women (table no 2). Spatial, verbal memory, MMSE were significantly decreased in pre-hypertensive women (table no 2). Sleep Quality was significantly low in pre-hypertensive women (table no 3).

Table No. 1: Demographic data of cases and controls.

Parameter	Control (n=30)	Pre-hypertensive (n=30)	P value
Age (years)	33.33±7.48	34.23±6.51	0.6209
Height (cm)	159.70±4.27	158.83±3.47	0.3920
Weight (kg)	55.70±4.81	56.83±7.15	0.4743
BMI (kg/m²)	21.89±2.0	22.51±2.70	0.3120

Data was presented as Mean ± SD. *P<0.05,**P<0.01, ***P<0.001.

Table No. 2: Perceived Stress, serum cortisol, MMSE, spatial and verbal memory scores of cases and controls

Parameter	Control (n=30)	Pre-hypertensive (n=30)	P value
Perceived stress Score	15.67±3.97	19.1±3.28	0.0006***
Serum Cortisol	6.6±2.04	9.33±1.98	0.0001***
MMSE	24.43±1.5	23.07±1.64	0.0013**
Spatial Memory	6.87±1.14	5.63±1.25	0.0002***
Verbal Memory	4.63±1.07	3.77±0.94	0.0014**

Data was presented as Mean ± SD. *P<0.05,**P<0.01, ***P<0.001. (MMSE- Mini Mental state examination)

Table No. 3: sleep quality and day time sleepiness in cases and controls

Parameter	Control (n=30)	Pre-hypertensive (n=30)	P value
Global PSQI score	3.9±1.27	5.33±1.63	0.0003***
Day time sleepiness	8.07±3.43	9.5±2.93	0.0874

Data was presented as Mean ± SD. *P<0.05,**P<0.01, ***P<0.001. (PSQI- Pittsburgh Sleep Quality Index)

DISCUSSION

Hypertension (HTN) is the common and leading cause of world's mortality and morbidity. It is one of the common causes for cardiovascular disease (CVD) affecting about 20% of adult population and a major risk factor for stroke, kidney and heart disease [9]. A study done by sunandha et al; stated that there the incidence of prehypertension in males is significantly higher than females. The study had also stated that sleep quality, increase in body weight or obesity, diet and sedentary life styles are the modifiable risk factors of hypertension [10-13]. In the present study we learnt that poor sleep quality, increased stress and decreased cognition are the major risk factors and had noticed all these conditions in pre-hypertensive women. Change in the life style, regular exercise, mediation could be the appropriate measures to improvise the condition and to prevent hypertension in an individual. The various risk factors listed above when clustered together may lead to CVD, stroke and many other health complications. Our present study emphasizes that the sedentary and instrumental life without any physical activity may stimulate stress and may show a greater impact on health leading to hypertension. Awareness and proper measure may decrease the incidence of hypertension thus, preventing from CVD and other complications.

CONCLUSION

In the present study we have observed significantly high stress, decreased sleep quality and cognitive functions in pre-hypertensive women. It is the need of time to increase awareness about prehypertension and preventive methods to improve quality and quantity of life.

Limitations: Limitations of the present includes the subjects represented by this study were women from Angamaly, Kerala, India, thus, the results cannot be generalized to other cities, cultures.

Ethical clearance: The current study was approved by institutional ethical committee of Little Flower Hospital and Research Centre, Angamaly on 27-01-2016.

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Effect of Vestibular Stimulation on Negative Affectivity and Social Inhibition in Relation to Stress

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ABSTRACT

Objective: The present study aimed to observe the effectiveness of vestibular stimulation on negative affectivity and social inhibition in healthy males and females in relation to stress.

Materials and methods: 240 healthy college students were randomly assigned into four groups (control male (MC) and female group (FC) and vestibular male (MV) and female (FV) groups) with 60 participants in each group. Vestibular stimulation was administered by making the participants to swing on a swing in back to front direction, according to their comfort. After recording base line values, vestibular stimulation was administered to the intervention groups and post intervention values were collected during regular classes and during pre-examination period. DS14 questionnaire was used to assess Negative affectivity and Social inhibition.

Results: Vestibular stimulation significantly reduced negative affectivity and social inhibition and limited stress induced changes in males and females.

Conclusion: We recommend incorporation of vestibular stimulation by using swing in our routine life style. Vestibular stimulation thus can be used as a simple intervention to greatly reduce the negative affectivity and social inhibition in both male and female.

Keywords: *Swing, Vestibular stimulation, Personality traits, Social inhibition, Negative affectivity, College students.*

INTRODUCTION

Individuals with high negative affectivity and social inhibition are identified as type D personality[1], having higher levels of depression, anxiety and stress and decreased quality of life. [2- 5]. Reported prevalence of type D personality in general population is 21% and 18-53% in cardiac patients [6,7]. Negative affectivity and social inhibition are associated with increased cortisol reactivity to stress and depression, which increases the risk of coronary heart diseases [8], [9].

Vestibular system is the balance organ present in the inner ear. Otoliths are the most primitive part of vestibular system which develops before any other sensory system had developed and provide information about gravitational vertical [10]. Earlier studies reported that vestibular dysfunction was associated with development of anxiety disorders in humans [11] Earlier

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studies reported that vestibular impairment causes changes in cognition, emotion and personality [12, 13, 14].

It was reported that cold caloric vestibular stimulation of left ear reduced unrealistic optimism in healthy right-handed adults [15]. Vestibular stimulation modulates cognitive functions through its connections with temporal–parietal cortex, anterior cingulate cortex, and insular cortex. Provisional evidence has been provided for successful application of vestibular stimulation for treatment of conversion disorder [16]. Recently study has documented the beneficial use of vestibular stimulation in the reduction of pain and somatic delusion in a central post-stroke pain patient by behavioral and imaging data [17]. Both animal and human studies reported that vestibular stimulation relieves stress effectively [18, 19], 20]. The present study aimed to observe the effectiveness of linear vestibular stimulation on negative affectivity and social inhibition in healthy males and females in relation to stress.

METHODOLOGY

Participants: 240 healthy college students of the age group of 18-24 of either sex were a part of this research after obtaining written consent from them. Participants involved in drug/alcohol abuse, and those taking any kind of medication or suffering from any somatic or mental disorders, participants with a history of use of corticosteroids in the past year, students with a history of antidepressant medication, and students on hormone supplements including oral contraceptives and ear infections or any vestibular disturbances, those with cardio-respiratory disorders were excluded. Selected participants were randomly assigned to four groups.

Group MC (n=60): Control male group (No vestibular stimulation was administered).

Group FC (n=60): Control female group (No vestibular stimulation was administered).

Group MV (n=60): Intervention male group (Vestibular stimulation was administered for 268± 5 days)

Group FV (n=60): Intervention female group (Vestibular stimulation was administered for 268 ± 6 days)

Design: This was a longitudinal follow-up study in which, participants spatial and verbal memory were assessed three times. The first assessment was performed during regular classes (with no examination in preceding two weeks and coming two weeks), these are base line values. Second assessment was performed after intervention and during regular classes and third assessment was performed in stressed state (one week before University theory examinations). After recording base line values, vestibular stimulation was administered to the intervention groups and post intervention values were collected during regular classes (duration of intervention was 146 ± 5.6 days in males and 147 ± 6 days in females) and during pre-examination period (duration of intervention was 268± 5 days in males and 268 ± 6 days in females) followed by vestibular stimulation. Vestibular stimulation was not administered to the control group. However, values were recorded at the corresponding points in time.

Setting: The present study was performed at Little Flower Medical Research centre and Little Flower Institute of Medical Sciences and Research, Angamaly, Kerala.

MATERIALS AND APPARATUS

Vestibular stimulation: Vestibular stimulation was administered by making the participants swing on a swing, according to their comfort (Back to front direction) once in a day, for five days in a week at their leisure time (8:30-9:30am, 11:00-12:00 am, 1:00-2:00 pm, and 4:00 -5:00 pm in four groups) as described earlier[21].

Assessment of Negative affectivity and social inhibition: DS14 questionnaire was used to assess negative affectivity and social inhibition[6].

Ethical consideration: The study was approved by Institutional Ethics Committee. The study was performed in accordance with the "Ethical Guidelines for Biomedical Research on Human Participants, 2006" by the Indian Council of Medical Research and the Declaration of Helsinki, 2008.

DATA ANALYSIS

Statistical analysis was performed by using SPSS 20.0 version. Mean and standard deviations of all the observations were calculated. Comparison between the groups was performed by two way ANOVA and post-hoc by Bonferroni post test. Significance was accepted at P<0.05.

RESULTS

Significant decrease (P<0.001) in the negative affectivity and social inhibition scores was observed followed by vestibular stimulation in both male and female intervention groups. (Fig: 1 & 2). Stress induced increase in the scores of negative affectivity and social inhibition was effectively prevented by vestibular stimulation in both male and female intervention groups (Fig 1 & 2).

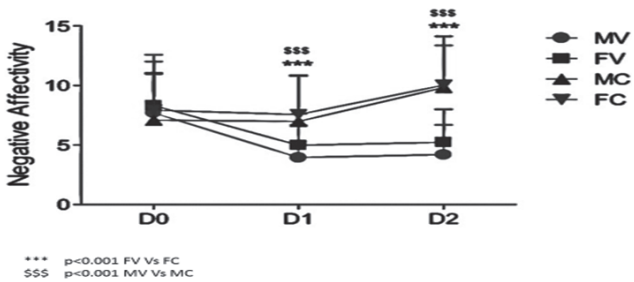

Figure 1: Negative affectivity in the participants before and after vestibular stimulation

Data was presented as Mean ± SD. MV- Vestibular males, FV- Vestibular females, MC- control males, FC- Control females. D0- pre intervention score (during regular classes), D1- post intervention score (during regular classes), D2- post intervention scores (during pre-examination period)

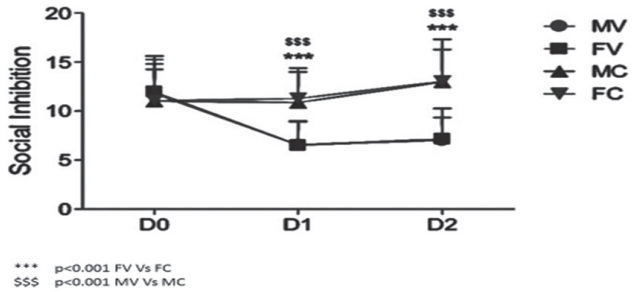

Figure 2: Social inhibition in the participants before and after vestibular stimulation

Data was presented as Mean ± SD. MV- Vestibular males, FV- Vestibular females, MC- control males, FC- Control females. D0- pre intervention score (during regular classes), D1- post intervention score (during regular classes), D2- post intervention scores (during pre-examination period)

DISCUSSION

It was reported that stress modulates neural dynamics and precipitates disorders that shape personality traits involving negative affectivity[22] and personality modulates stress response in many ways[23], [24]. Interestingly, stress response was reported to vary from individual to individual [25]. Changes in personality have been reported in frontal lobe disorders based on involvement of prefrontal cortex or subcortical structures[26]. The prefrontal cortex, which regulates our thoughts, emotions and actions, is the most sensitive to stress. In fact mild form of stress may cause brisk and pronounced functional loss of prefrontal cortex [27]. Vestibular stimulation was reported to relieve stress both by direct and indirect pathways [28]. In contrast, vestibular dysfunction activates stress axis and increases stress and anxiety [29]. Earlier studies demonstrated that functional network of vestibular system was distributed throughout thalamic, limbic, and particularly primary sensory cortical areas, frontal regions, including infralimbic and cingulate cortices [30,31]. Vestibular stimulation was reported to influence decision making through insular cortex [32]. Hence, vestibular stimulation was considered as a non-invasive means for neuro-modulation of functional brain networks [33].Further, decrease in the volumes of hippocampus was observed in borderline personality disorder and posttraumatic stress disorder [34] Vestibular stimulation stimulates hippocampal formation and modulates hippocampal place cell activity [35] and bilateral vestibular loss leads to significant selective atrophy of the hippocampus [36], [37] reported that vestibular stimulation modulates mood, based on side of stimulation. Our results further support earlier studies as we have observed significant decrease in the scores of negative affectivity and social inhibition followed by vestibular stimulation in both male and female intervention groups (P<0.001). Further, stress induced changes in negative affectivity and social inhibition was effectively limited in both male and female intervention groups (P<0.001), proving the positive effects of vestibular stimulations.

LIMITATIONS

Limitations of the present includes the subjects represented by this study were only college students in Kerala, India, thus, the results cannot be generalized to other levels of education, cities, cultures and other universities.

CONCLUSION

Vestibular stimulation significantly reduced negative affectivity and social inhibition and limited stress induced changes in males and females. We recommend incorporation of vestibular stimulation by using swing in our routine life style. Vestibular stimulation thus can be used as a simple intervention to greatly reduce the negative affectivity and social inhibition in both male and female.

Conflicts of interest: None declared

Source of funding: self

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A Study of Visual Evoked Potential in Nocturnal Mobile Phone Users

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ABSTRACT

Smart phones, a demand of the modern–days have made man addicted to its usage to extent of disrupting his normal sleep wake cycles and make compromises with his biological clock. The overuse of these radiations-emitting devices has proved deleterious to both physical and mental health. As inferences of macular degeneration and ocular inflammation have been reported among the cell phone overuse, this study has been designed to evaluate the visual evoked potential in the nocturnal cell phone users to infer the degree of neuronal impairment in them. This observational study was carried out in the research lab, involving 60 volunteers who were segregated into 4 groups depending upon the duration of cell phone usage overnight and the VEP was recorded in all the 4 groups. The VEP revealed a significant prolongation of N145 wave latency in both eyes of the group that used cell phones more at night. From the observation it could be concluded that overuse of smart phones increases the hazardous outcomes of electromagnetic radiations and blue light emission exposure could have rendered pathological visual processing.

Keywords: *Electromagnetic radiation, Mobile phones, Visual evoked Potential, Blue light, Wave latency.*

INTRODUCTION

The mobile phone and smart phone ownership among teens has grown substantially since 2011. Fully 95 % of teens are online, a percentage that has been consistent since 2006. In many ways, teens represent the leading edge of mobile connectivity and the patterns of their technology use often signal future changes in the adult population. The total users of mobile phone are estimated to be increased to about 4.77 billion in 2017. According to vision council the smaller devices which are to be held at 8 – 12 inches from the eyes foster the conditions for digital eye strain, characterized by blurred vision, eye fatigue, head neck and back pain. The various studies indicate that there may be relationship between daytime sleepiness and nocturnal mobile phone usage. The blue light from personal electronic devices has also been linked to serious physical and mental health problems. The direct exposure to blue light can cause damage to the retina. Light Emitting Diode (LED) is the basic lighting component in screens of phones, television sets and computers. LED decreases the cellular viability by 75%-99%, increases cellular apoptosis by 66%- 89%[1]. The American Macular Degeneration Foundation warns that retinal damage caused by blue light may lead to macular degeneration which causes the loss of central vision. Some statistical evidence shows that mobile phone usage can lead to blurring of vision, secretions from eye, inflammation and lacrimation of eyes. Also there is decreased sperm count and testicular weight in rats which was exposed to electromagnetic radiations from 3G mobile phones[2]. Various studies are going on related to the cell phone addiction. It has become an indispensible part of the human life but this has crossed the point of necessity to the point of addiction. Few studies suggest that cell phone usage is a risk factor for gliomas and neuroma[3]. It can also cause earlier cataract formation. The microwave radiations from the smart phones can literally

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cook the eye tissue. These radiations are directly delivered into our eye tissues. Holding bright light close to eyes can cause shortsightedness in young age.

The exposure to diffuse blue light for 3-6 hrs resulted in cell apoptosis which leads to early macular degeneration in rats[4]. The Visual Evoked Potential (VEP) is the measure of functional integrity of the visual pathway from the retina via optic nerve to visual cortex[5]. Any abnormality that affects the visual pathway to visual cortex in the brain can affect the VEP. They are recorded from the occipital scalp overlying the calcarine fissure[6]. Therefore the present study is aimed to assess the cognitive functions and visual evoked potential in nocturnal mobile phone users.

MATERIAL AND METHOD

An observational study was conducted among 60 volunteers aged between 18 and 23 years in the department of Physiology at Sri Venkateshwaraa Medical College Hospital and Research Centre in Puducherry, after obtaining Instituitional Ethical Committee (IEC) clearance before commencement of the study. After obtaining the prior consent from the subjects, they were divided into 4 groups. Group 1: Non mobile phone users at night. Group 2: Nocturnal mobile phone users (< 1 hr per day). Group 3: Nocturnal mobile phone users (1 – 2 hrs per day). Group 4: Nocturnal mobile phone users (> 2 hrs per day). The subjects were selected by convenient sampling method and the selection was based on the following criteria. The subjects with history of prolonged hospitalization likely to reduce attention span and visual abnormality were excluded. Informed written consent was obtained from all the subjects prior to the study. An ID code was assigned for the subjects to maintain confidentiality of the data obtained.

Visual Evoked Potential (VEP): The visual evoked potential was recorded in the research lab, in the morning times in an ambient temperature of 20-25°C by using the PHYSIOPAC PP4, Medicaid Systems, Chandigarh. Prior to VEP recording, the visual acuity and field of vision of all subjects were checked. Each subject was seated at distance of 1 meter from the pattern generator screen in dark air-conditioned room and was asked to look at the central spot on screen with one eye, other being patched. The scalp electrodes were placed according to the 10-20 International system of electrode placement. The active electrode was placed at Oz, which is the highest point on the occiput. The reference electrode was placed at Fpz, which is 12 cm above the inion. The VEPs were picked up as the difference between active electrode (Oz) and reference electrode (Fpz). The ground electrode was fixed at wrist. The shift pattern test stimulus on the TV monitor is white and black checks (15x15mm size). The electrode impedance was kept below 5 Kilo ohms, with automatic artifact rejection. The recording was done in each eye separately, till the end of 2000 waves. The commonly seen wave forms in VEP are N75, P100, and N145 are a result of electrical stimulation of the area 17,19 and 18 of the occipital cortex respectively. The latencies of all these waves were analyzed by the computer software[7].

Statistical Analysis: Data were presented as mean ± standard deviation. One way ANOVA test was performed to find whether scores of different groups differ significantly. To test inter group significant difference, by keeping group 1 as control, multivariate ANOVA test was performed. The correlation between cognitive functions and VEP was done by Pearson's correlation test and the data were analyzed by using SPSS 17 software. Statistical probability of $P<0.05$ was considered to be significant.

RESULTS

Table 1: VEP in right eye of nocturnal mobile phone users

GROUPS	N 75	P 100	N 145
1	73.05 ± 4.66	114.68 ±24.04	158.06 ±21.54
2	72.95 ±3.6	101.12 ±25.37	165.41 ±16.93
3	72.76 ±4.19	116.96 ±25.06	171.85 ±17.02
4	68.95 ±13.32	113.30 ± 18.48	177.15 ± 14.33
F Test (P value)	0.602	0.265	0.034*
Multivariate ANOVA (P value)			
1vs 2	0.978	0.121	0.074
1vs 3	0.937	0.79	0.414
1vs 4	0.254	0.872	0.006*

In Table 1, the N 145 latency has been increased significantly ($P< 0.02$) between groups 1 vs 4.

Table 2: VEP in left eye of nocturnal mobile phone users

GROUPS	N 75	P 100	N 145
1	78.85±3.05	107.5±4.70	176.01±14.03
2	73.36±4.68	107.28±7.15	168.51±18.40
3	70.86±17.50	118.05±25.09	166.98±21.48
4	75.05±10.63	111.68±18.09	161.81±19.43
F Test (P value)	0.745	0.230	0.224
Multivariate ANOVA (P value)			
1vs 2	0.901	0.971	0.273
1vs 3	0.445	0.077	0.188
1vs 4	0.758	0.478	0.040*

In Table 2, N 145 wave latency has been significantly increased (P< 0.03) between groups 1 vs 4.

DISCUSSION

The blue light from personal electronic devices has also been linked to serious physical and mental health problems. The night time exposure to blue light emitted by smart phones, tablets, laptops and other LED screens may be damaging our vision. The VEP is used primarily to measure the functional integrity of the visual pathways from retina via the optic nerves to the visual cortex of the brain. The VEPs better quantify functional integrity of the optic pathways than scanning techniques such as Magnetic Resonance Imaging. In both the eyes, N145 wave latency had been significantly increased in group 4, compared to group 1 and there was a significant negative correlation of N75 wave latency with cognitive test scores. This is a pilot study, since there is no literature available on the correlation of VEP parameters and the cognitive function tests in nocturnal mobile phone users.

On the contrary, a study reported by Ahlers et al[8], showed that radio frequency electromagnetic fields exposure at three mobile phone frequencies (GSM – 900, GSM-1800, Universal mobile Telecommunication system) has no acute efforts on mouse retinal ganglion cell responses under constant temperature condition. The contrary finding was also reported by by Demirel et al[9] on effects of third generation mobile phone – emitted electromagnetic radiation on oxidative stress parameters in eye tissue and blood of rats, 3G mobile phone radiation does not lead to harmful effects on eye tissue and blood in rats. The recently developed figures of merit for circadian luminous efficacy of radiation (CER) and circadian illuminance (CIL) related to human health and circadian rhythm were measured to compare 3 kinds of smartphone displays. The CIL values for social network service messenger screens from all 3 displays were higher than 41.3 biolux in a dark room at night. The highest CIL values (50.9 biolux) correspond to melatonin suppression values[10].

CONCLUSION

Thus we conclude from this study that nocturnal usage of mobile phones have negative influence on the variation in VEP latencies thus increasing eye strain. Thus the study has thrown light on deleterious effects of nocturnal mobile phone usage which was not given much importance previously. The student community needs to be aware of harmful effects of nocturnal mobile usage, as this has been found to be one of the major factors to increase eye strain which in future may emerge as a risk factor for reduction in cognitive function, blindness and also several related carcinomas.

Conflict of interest: Nil.

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Analysis of Heart Rate Variability in Women with Polycystic Ovary Syndrome (PCOS)

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ABSTRACT

Background: PCOS is a growing health problem of young adolescent girls and women in reproductive age group.Metabolic and cardiovascular disorders commonly seen in PCOS suggests that autonomic imbalance might have a role in the pathogenesis of PCOS. Increased anxiety and depression due to the reproductive and metabolic disorders seen in PCOS further worsen the quality of life.The variation of the heart rate from beat to beat known as the heart rate variability(HRV) has been used to determine the balance between sympathetic and vagal nerve activities in the heart.

Aim and Objectives: To evaluate the autonomic activity in women with PCOS by assessing the resting heart rate variability and comparing with that of normal controls.

Methods: Thirty women with PCOS diagnosed as per the Rotterdam's criteria, of age group between 20-35 years, attending an infertility clinic were selected as cases and thirty age matched apparently healthy women from the community were selected as controls for the study. Resting HRV was analysed using Niviqure ambulatory digital ECG recorder (INCO). Mean RR, Mean HR, SDNN,RMSSD, pNN50,Total power, low frequency (LF), High frequency (HF) and LF/HF were estimated. Independent student t test was employed as the Test of Significance at 95% confidence interval. p value <0.05 was considered as significant.

Results: Resting HRV analysis showed a significant change in frequency domain measures with increase in LFnu, (48.83±13.2 vs 38.27±9.9),LF/HF ratio (1.16±0.57 vs 0.70±0.28) and decrease in HFnu,(50.78±12.7vs 57.21±10.9)in women with PCOS compared to the controls respectively. All time domain measures except pNN50 was reduced but none of them was significant.

Conclusion: Resting HRV analysis indicate that there is a definite sympathovagal imbalance in women with PCOS in the form of sympathetic overactivity and parasympathetic withdrawal. Approaches targeting sympathetic nervous system might have a therapeutic role in PCOS.

Keywords: *Polycystic Ovary Syndrome, heart rate variability, sympathetic overactivity,Autonomic dysfunction.*

INTRODUCTION

PCOS is a growing health problem of young adolescents affecting the quality of life in terms of infertility, metabolic syndrome and adverse cardiovascular events.An increasing prevalence of obesity and sedentary lifestyle among the adolescent girls predisposes them to this disorder.

A prevalence of 9.13% is reported by Nidhi, et al among the the Indian adolescents[1].The phenotype varies widely depending on the age, lifestyle and body weight. Increased anxiety and depression due to the reproductive and metabolic disorders seen in PCOS further worsens the quality of life. Metabolic and cardiovascular disorders commonly seen in PCOS suggests that autonomic imbalance might have a role in the pathogenesis of PCOS.Hyperandrogenism,obesity and insulin resistance seen in PCOS might be due to sympathetic overactivity[2].

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The heart rate is being constantly influenced by external and internal stimuli and regulated by the autonomic nervous system. This variation of the heart rate from beat to beat is known as the heart rate variability(HRV).The analysis HRV has been used to determine the balance between sympathetic and vagal nerve activities in the heart[3].

Therefore, in this study, we aim to evaluate the autonomic activity in patients with PCOS by assessing the resting heart rate variability and comparing with that of normal controls

METHODOLOGY

The cross sectional study was conducted in a group of 30 age matched cases of PCOS and 30 controls over a period of 6 months in the Institute of Physiology and Experimental Medicine, Madras medical college, Chennai, after obtaining the Institutional Ethical Committee clearance.

Selection of cases: Thirty females in the age group of 20 to 35 years, with PCOS diagnosed as per the Rotterdam's criteria(2003)[4], were selected from the patients attending the outpatient department of infertility clinic in the Institute of Obstetrics and Gynaecology, Egmore, Chennai-8.

Inclusion criteria

- Age group 20 – 35 years
- Transabdominal ultrasound evidence of polycystic ovaries (at least 12 follicles, 2–9 mm); and/or increased ovarian volume (>10 ml) revealed by two-dimensional ultrasound examinations in one or both ovaries)
- Menstrual irregularities- oligomenorrhoea(<6 menstrual periods/year) with intermenstrual interval >35 days or amenorrhoea.
- And /or Clinical features of hyperandrogenism-hirsutism, acne or androgenic alopecia.

Exclusion criteria:

- Pregnancy
- Use of oral contraceptives,ovulation induction agents,antidiabetic, antihypertensive, antiobesity drugs, glucocorticoids, antiandrogens, or other hormonal drugs within the previous 6 months
- Subjects with neoplastic, hepatic, respiratory and any cardiovascular disorder or other medical illness
- Conditions that mimic PCOS like Ovarian hyperthecosis, Congenital adrenal hyperplasia, Hypothyroidism,Idiopathic hirsutism

Selection of controls: Thirty women with normal ovulatory cycles and without any features of hyperandrogenism from the general population,were selected and assigned as the control group.

An informed consent was obtained from both the study and the control group. A detailed history and a thorough general and systemic examination was performed. The subjects were made comfortable and relaxed in a quiet room with controlled temperature ranging from 25-28 degree Celsius for 30 minutes before the procedure. They were asked to lie down in the supine position without moving the limbs and to be awake throughout.Electrodes were placed in the following position after cleaning the site with sprit.

Electrode	Position
Exploring Electrode	Left Shoulder
Exploring Electrode	Left Subcostal
Exploring Electrode	Right Shoulder
Reference Electrode	Right Subcostal

Resting HRV was recorded for a minimum of 10 minutes using Niviqure Ambulatory Digital ECG Recorder.After screening for the artefact and editing, continuous recording for five minutes (320 seconds) which is needed for short term ECG analysis was fed to Kubios HRV analysis software. The analogue to the digital conversion of the resting ECG signal was done using AD converter with sampling frequency of 1024/ sec. Power spectral analysis of the converted ECG signal was done using Fast Fourier Transformation. Time Domain measures, Mean RR, Mean HR, SDNN,RMSSD, pNN50 and Frequency domain measures,Total power, low frequency (LF), High frequency (HF) and LF/HF were estimated.

RESULTS

The statistical analysis of the data obtained were done using the Statistical Package for the Social Sciences(SPSS) software. The Mean and Standard deviation of the variables were determined for the two

groups . Independent student t test was employed as the Test of significance at 95% confidence interval. P value <0.05 was considered as significant.

The mean age of the control group was 29.03±4.51 and that of PCOS was 27.30±4.17.The difference in age among the groups was not significant.

Table 1: Time Domain Measures

Variables	Mean±SD		p Value
	Controls	PCOS	
MEAN HR	76.91±6.49	78.30±8.64	0.483
MEAN RR	0.773±.07	0.795±.10	0.347
RMSSD	39.65±14.22	47.51±26.70	0.162
pNN50	23.87±13.47	18.71±22.40	0.285
TRIANGULAR INDEX	0.099±.08	0.115±.08	0.455

Table 1shows the values of the Time domain measures between both the groups.All the time domain variables except pNN50 were increased in the PCOS group but none of them was significant.

Table 2:Frequency Domain Measures

Variables	Mean±SD		p Value
	Controls	PCOS	
LFms²	110.69±81.5	185.70±173.8	0.000**
HFms²	221.87±226.9	238.23±305.5	0.814
LFnu	38.27±9.9	48.83±13.2	0.000**
HFnu	57.21±10.9	50.78±12.7	0.037*
LF/HF RATIO	0.70±0.28	1.16±0.57	0.000**

* - Significant ** - Highly significant

Table 2 shows the values of the frequency domain measures between both the groups. The LF values which is an indicator of sympathetic tone was higher in PCOS group in both ms² units as well as normalised units (nu) and was highly significant. The HF values in normalised units (nu) which is an indicator of parasympathetic tone was found to be significantly lower in PCOS group. The LF/HF ratio, an indicator of sympathovagal balance was significantly higher in PCOS group suggesting an autonomic imbalance with sympathetic overactivity in the PCOS group.

DISCUSSION

The mean HR of the PCOS group was a little higher than the control group but was not statistically significant. Zachurzok-Buczynska A et al[5] have stated that the mean resting heart rate in PCOS is higher than the controls and might indicate cardiovascular risk at an earlier stage.The increase in heart rate might be due to a decreased baroreceptor sensitivity and decreased afferents to the centre. This in turn leads to an increased cardiac and vascular sympathetic activity resulting in an increased heart rate and peripheral resistance. Moreover obesity and increased adipose tissue in PCOS requires an increased blood flow leading to tachycardia and increased stroke volume.

Our findings were in accordance to Kristhiane et al[6] who showed that the resting time domain measures did not vary significantly in PCOS. De sa JC et al[7] have reported contradictory results showing a significant reduction in RMSSD and SDNN values in PCOS at rest and have suggested weight gain as the cause of this variability. RMSSD and pNN50 are considered as sensitive indicators of parasympathetic function and thereby a low value indicates reduced vagal action[3].

A significant variation in the frequency domain variables was observed between both the groups. The LF values which is an indicator of sympathetic tone was higher in PCOS group in both ms² units as well as normalised units(nu) and was highly significant. The HF values in normalised units(nu) which is an indicator of parasympathetic tone was found to be significantly lower in the PCOS group. The LF/HF ratio, an indicator of sympathovagal balance was significantly higher in the PCOS group suggesting an increased sympathetic activity in PCOS.

Yildirir A et al[8] and Saranya et al[9] have reported similar observations in young women with significant higher LFnu and LF/HF ratio and significant lower HFnu in PCOS stating an increased sympathetic and a decreased parasympathetic activity in PCOS. The analysis of frequency domain variables suggest autonomic modulation in the form of vagal withdrawal and sympathetic overactivity in women with PCOS.

Sympathetic outflow to an organ is regulated regionally without any change in another. Animal studies have shown that increased ovarian sympathetic outflow leads to an increased intra-ovarian synthesis of nerve growth factor (NGF)[10]. This might be a cause for the initiation of ovarian pathology in PCOS. Earlier studies have proved that women with PCOS have increased muscle sympathetic nerve activity (MSNA), and altered heart rate variability suggesting generalized increase in sympathetic nerve activity[10]. Testosterone and cholesterol are identified as independent predictors of sympathetic activity. Increased androgen concentration is a common feature of PCOS and is directly proportional to the severity of PCOS[11]. This further suggests that sympathetic overactivity might have a role in the pathogenesis of PCOS. Women with PCOS are more anxious and stressed out which further stimulates the adrenal gland and increases the the testosterone levels, worsening the condition[12].

CONCLUSION

This study on the heart rate variability of women with PCOS shows a significant autonomic imbalance in the form of sympathetic overactivity. Autonomic dysfunction might have a role in the iteopathogenesis of PCOS. Approaches targeting sympathetic nervous system might have a therapeutic role in PCOS. There is limited data on the sympathetic and parasympathetic activity in women with PCOS. Further studies with larger sample size and assessment of androgen levels in PCOS might throw light on the iteology of this disorder.

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A Study on Effect of Body Mass Index on Median Motor Nerve Conduction among the Young Adults and Variance in the Dominant Hands

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ABSTRACT

Background and Aim: In the recent years obesity is commonly seen in young adults, making them more prone to many diseases like hypertension, diabetes mellitus, heart diseases and musculoskeletal diseases. Obesity also affects nerves due to compression by adipose tissues. Nerve conduction study is an important test to diagnose nerve damage, demyelination and conduction blocks. This study aims to compare median motor nerve conduction between Non- obese and obese subjects and also the differences between dominant and non – dominant hand of the subjects.

Methods: Subjects were chosen based on inclusion and exclusion criteria. 60 young volunteers were chosen and were divided into two groups, controls-30 non-obese subjects and study- 30 obese subjects. Motor nerve conduction test was performed in the median nerve of both hands in all the subjects.

Results: Comparison of nerve conduction parameters in the right (dominant hand) and in left hands(non-dominant hand) between obese and non-obese shows highly significant increase in latency, decrease in amplitude and reduction in nerve conduction velocities. Comparison of the parameters between the right and left hands within the groups had no difference in nerve conduction velocity.

Conclusions: The results of our study make us infer that there exists a negative correlation between body weight and nerve conduction parameters thus making us to conclude that obesity affects neuronal functions.

Keywords: *Body mass index, Dominant hands, Median nerve, Motor nerve conduction.*

INTRODUCTION

Approximately one - third of world's populations are either obese or overweight. India and China together represent 15% of the world's obese population. India has reached a third obese population in the world. India has reported in morbid obesity affecting 5% of the country's population. Obesity causes many adverse effects on wellness, and poses a danger gene for many disease example, high blood pressure, diabetes mellitus ischemic heart disease and stroke. In obesity research, a strong association was detected between SNPs located 188 kilobases (kb) downstream from the melanocortin 4 receptor gene (*MC4R*) and BMI.[1] In overweight and physically inactive people the conduction velocity gets reduced due to compression of the nerve which causes pain, numbness, tingling sensations or weakness of hand with loss of fine motor skill and fundamental motor activity. Hence this study has been designed to measure the effect of BMI on median motor nerve conduction. Nerve Conduction velocity test is the measurement of the speed of conduction of an electrical impulse through a nerve. Nerve Conduction Study is used in the diagnosis of nerve damage or nerve dysfunction. In motor nerve conduction studies, motor nerves are stimulated and the compound muscle action potential from the muscle is recorded. This corresponds to the integrity of the motor

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unit. Nerve conduction parameters can be affected, by any process that damages the anterior horn cell body or axon, Schwann cells, the neuromuscular junction, or the muscle cell itself. Studies have tried to assess the neuronal impairment by the assessment of the size, shape, and morphology of the compound muscle action potential to determine the state of myelination, the number of functioning muscle fibers, and the neuromuscular junction. Since the cell body of motor nerves is located in the anterior horn of the spinal cord, the motor nerve conduction is abnormal in both preganglionic and postganglionic injuries.[2]

AIMS &OBJECTIVES

To compare median motor nerve conduction between Non- obese subjects and obese subject and also variances in the dominant and non – dominant hands of the subjects

METHODS AND MATERIALS

A total of 60 young adults were selected for this study and they were categorized into study group- 30 obese subjects and controls- 30 non – obese subjects. This study was conducted in Sri Venkateshwaraa Medical College Hospital and Research Centre and participants were selected among the college students, general population visiting outpatient department & staff working in this institution.

Inclusion criteria: 30 obese with BMI above 30 kg/m^2 and the 30 Non – obese subjects with BMI 18.5 to 24.9 kg/ m^2 the age between 18-25 years

Exclusion criteria: Compliant of pain, tingling, numbness, weakness of upper Limb, any other chronic disease like diabetes mellitus, thyroid disease, liver disease, hypertension, alcoholics, smokers, athletes and pregnant women were excluded from this study.

The study was undertaken after obtaining the institutional ethical committee clearance. Subjects were recruited based on the inclusion and exclusion criteria. A written informed consent was obtained from all the subjects. After explaining the procedure, motor nerve conduction study was done in physiology department.

Anthropometric measurements (height and weight) were taken by using scales on bare foot to calculate Body Mass Index (BMI). Motor nerve conduction study of median nerve was performed on both sides of the body in an environment with room temperature ranging from 23°C to 25°C using NEUROSTIM, MEDICAID SYSTEMS, Chandigarh using surface electrodes. With the help of stimulating electrodes supramaximal stimulation was given first at the wrist then at elbow to obtain Compound Muscle Action Potential (CMAP). The distance between the wrist and elbow was measured. The recording (active) electrode was placed close to the motor point of Abductor Pollicis Brevis muscle and the reference electrode was placed 3 cm distal to the active electrode at the first metacarpophalangeal joint. Ground electrode was placed between stimulating and recording electrodes. Motor Distal Latency (MDL), Amplitude (Amp) and Conduction Velocity (CV) were measured[3].

Statistical analysis: Data were presented as Mean ± Standard Deviation. Analysis was done by using SPSS 20. Unpaired t test was used to compare the parameters between obese and non obese and also used to analyse of both right and left hands of subjects

RESULTS

Table No: 1. Comparison of Anthropometric measurements between control groups and obese groups

Parameters	Age	Height	Weight	BMI
Non- obese (30)	18.9 ± 2.7	172.1 ± 8.1	61.4 ± 1.9	20.6 ± 3.2
Obese (30)	19.9 ± 2.9	161.5 ± 6.8	82.3 ± 6.7	31.6 ± 2.9
p. value	0.17	0.0001**	0.0001**	0.0001**

**p<0.001; highly significant

Table 1 shows there was significant difference in the physical parameters in height, weight and BMI between the groups.

Table No. 2: Comparison between Right Dominant hands of Non – obese subjects and Right Dominant hands of obese subjects (Median motor nerve conduction)

Dominant hand – right median nerve (60)	Latency (ms)	Amplitude (mV)	Conduction velocity (m/s)
Non – obese (30)	2.93 ± 0.53	10.93 ± 1.49	56.14 ± 2.02
Obese (30)	3.59 ± 0.62	8.85 ± 3.11	52.8 ± 2.47
p. value	0.0001**	0.002 **	0.0001**

*p<0.05; significant, **p<0.001; highly significant. SD: Standard deviation

Table 2 compares the motor nerve conduction parameters of right (dominant) hand between the groups and it is observed that the study group had increased latency, and decreased Amplitude and slow nerve conduction velocity as compared with non- obese subjects. All Nerve conduction parameters are statistically highly significant.

Table No. 3: Comparison between Left Non–Dominant hands of Non–obese subjects and Left Non-Dominant hands of obese subjects (Median motor nerve conduction)

Non–dominant hand left Median nerve	Latency (ms)	Amplitude (mV)	Conduction velocity (m/s)
Non – obese (30)	2.62 ± 0.34	10.11 ± 1.72	55.5 ± 1.72
Obese (30)	3.39 ± 0.55	8.79 ± 2.38	51.9 ± 2.1
p. value	0.0001**	0.016*	0.0001*

*p<0.05; significant, **p<0.001; highly significant. SD: Standard deviation

Table 3 compares the motor nerve conduction parameters of left (non-dominant) hand between the groups and it is observed that there was a prolongation of latency and decreased amplitude with reduced nerve conduction velocity in obese when compared to non - obese subjects. There was significant difference in nerve conduction parameters.

Table No. 4: Comparison of right Dominant hands and left Non–Dominant hands of non–obese and obese subjects (median motor nerve conduction)

	Right dominant hands	Left non -dominant hands	p. value
Non – obese Conduction velocity (m/s)	56.14 ± 2.02	55.5 ± 1.72	0.19
obese Conduction velocity (m/s)	52.8 ± 2.47	51.9 ± 2.11	0.13

*p<0.05; significant, **p<0.001; highly significant. SD: Standard deviation

Here the analysis of nerve conduction velocity between the right and left hands of Non–obese subjects and also obese subjects shows that there was no significant difference between right dominant hands and left non–dominant hands of non - obese and obese subjects. But there was reduction in nerve conduction velocity.

DISSCUSION

Nerve conduction studies can determine nerve damage and destruction. Motor nerve conduction studies involve analysis of specific parameters, including latency, Amplitude, and conduction velocity. The latency of compound muscle action potential (CMAP) indicates the speed of conduction in nerves, whereas the amplitude of CMAP refers to the density of nerve fibers and the muscle mass activated by stimulation of the motor nerve.[4] Nerve Conduction velocity is determined by conduction velocity of the faster fibers. Velocity is calculated by dividing the difference in the latencies, by the distance between the two stimulation.

In our study the groups differed significantly in

their physical parameters like height, weight and BMI and statistically significant changes in the median motor nerve conduction parameters were observed between the groups. The obese groups had prolonged latency, reduced amplitude and slow nerve conduction velocity in right (dominant) hand when compared to non obese. (Table no: 2). Radecki et al,[5] found that prolongation of median latency and slowing of conduction was associated with increased BMI. Awang MS [6] et al, also observed slowing of nerve conduction velocity with increasing BMI in median nerve. Previous studies. by Shubhangi Deshmane et al. [7] and Basanta et al.[8] had the observations of statistically significant prolonged latencies, reduction in amplitude and non statistically significant decrease in conduction velocity. Werner et al.[9] observed that obese individuals have slowed conduction in median nerve across the wrist. Parul agarwal et.al. [10] studies reported that obese individuals have slowed conduction in median nerve across the wrist but do not directly suggest that excess body weight can result in symptoms. In this study statistical significance in nerve conduction velocity between the groups could be attributed to direct physical effect of the adiposity compressing over the underlying structures like vasculature, kidney and nerve. The compression effect of subcutaneous fat over the underlying nerve causes compression followed by neuropathy. This external pressure reduces flow in the vessels supplying the nerve with blood .This causes local ischaemia, which has an immediate effect on the ability of the nerve axons to transmit action potentials. As the compression becomes more severe over time, focal demyelination occurs, followed by axonal damage occurs.[11]

Comparison between left non-dominants hands of non-obese subjects and left non-dominants hands of obese subjects found that increases latency, decreased amplitude and reduction in conduction velocity in obese shows significant changes (Table no: 3). Similar observation was made by Sunil K. Rayan etal.[12] who concluded that weight and BMI can affect the conduction velocities. They observed reduction in conduction velocities of the median nerve in right handed and left handed subjects with respect to body mass index. Maini et al.[13] found that the conduction velocity to be faster on the right side in the majority of right handed subjects and on the left side in left handed subjects.

Though the conduction velocity differed not significantly between the dominant and non-dominant hands within the subjects there is a mild reduction in conduction velocity in left when compared to right hand. (Table no: 4). Tayad, Latti [14] also found some variation between left and right handed individuals. Bhorania et. al [15] found, there was no significant difference in velocity between the dominant and non dominant limbs of same individuals in relation to motor nerve conduction velocity, but nerve conduction velocity in the right handed subjects was more as compared to their counterpart.

Harinder J. Singh et.al [16] found limb dominance did not have any significant effect on the motor nerve conduction velocity of the upper limbs. Study done by Sathiamoorthy A.[17] found a significant correlation between "handedness" and motor nerve conduction especially in median nerve. The comparison of conduction velocity between the hands, within the groups had no statistical reduction in conduction velocity though mild decreases in its value are present.

Obese people have poorer motor skills and less activities of daily living. There was an inverse relationship of BMI with fine motor precision, balance, running speed, quick and strength. Adiposity is related to muscle quality ratio that is associated with motor conduction velocity and finger tapping speed. Lateralization of hemispheres is proposed as main factor for the difference in nerve conduction. In 2007,researchers discovered that specific alleles of at least one of three single polynucleotide polymorphism upstream of the already known LRRTM gene were linked to left-handedness[18].This gene may be responsible for the difference in nerve conduction. Study of effect of peripheral factors on handedness was studied widely by various researchers. Apart from genetic factors, some peripheral factors (biological [19] and environmental[20]) may be involved. Tan U [21] and Bromberg MB [22] noted asymmetry in dominants hands of nerve conduction velocity in their studies

CONCLUSION

Therefore, we conclude that significantly increased latency, decreased amplitude and reduction in nerve conduction velocity exist in obese when compared to non–obese. Thus it coultd be observed that obesity impairs neuronal activity which can derange the motor functions in the obese population. Hence measures to improve the quality of life like regular exercises and modifications in dietary pattern and measures to lose weight can be advised to improve health.

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Comparative Study of Short Term Memory among Athletic and Non-athletic School Children

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ABSTRACT

Aim: To investigate the influence of Athletics on short term memory in school going students

Objectives: To establish if there is any specific effect of Athletics on Auditory and Visual memory

Methods: 30 Athletes of both the genders between 8-16 years of age were selected as study group and 30 Non athletes of both the genders with age and BMI matched were selected as control group.The study was conducted in ZPTC school,vikarabad. Visual memory was assessed in three trials by flashing 20 numbers,20 words and showing 20 objects each for 1 min.The subjects were asked to write down immediately on a paper what they remembered within 2 mins.Auditory (Verbal) memory was assessed by reading aloud 20 numbers within 1 min and the subjects were asked to write down immediately on a paper the numbers they remembered within 2 mins.

Results: The data obtained was analyzed using sigma stat software using unpaired t test.Short term memory was better in Athletes compared to Non-Athletes.

Conclusion: Physical activity has positive impact on short term memory.

Keywords: *short term memory, Visual memory*

INTRODUCTION

Memory is one of the most important cognitive domains with respect to everyday function and is the process of storing, encoding, and retrieving information. Different forms of memory are recognized,including sensory, short-term, long-term, and working memory[1].

Short-term memory, also known as primary or active memory, is the information we are currently aware of or thinking about. In Freudian psychology, this memory would be referred to as the conscious mind. The information found in short term memory comes from paying attention to sensory memories. Most of the information kept in short-term memory will be stored for approximately 20 to 30 seconds, but it can be just seconds if rehearsal or active maintenance of the information is prevented. While many of our short-term memories are quickly forgotten, attending to this information allows it to continue on the next stage - long-term memory[2]. Short-term memory resides in the inside (medial) of the temporal lobe called the hippocampus and entorhinal cortex, and lasts a few minutes to a few weeks before being erased. When you try to recall a conversation or a phone number learned a few minutes to a few weeks ago, these brain areas are activated.

Working memory is a short-term memory system that allows concurrent retention and manipulation of information. It is used for thinking about what is already known and for deriving conclusions on the basis of that knowledge; therefore,working memory is fundamental to successful completion of many activities.

Rolls described four types of brain systems that are involved in different types of memory. These systems

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are based on the use of functional magnetic resonance imaging to study neuronal operations in various parts of the brain. One system involves the primate orbit frontal cortex and amygdala, which represents the learning stimulus-reinforce associations and is involved in motivation and emotion. The second system is in the temporal cortical visual areas. This is involved in learning representations of objects that don't change with respect to size or view. A third system in the hippocampus is implicated in remembering specific events (i.e., episodic memory). In the fourth area, brain systems in the frontal and temporal cortices are involved in short term memory[3].

Findings have suggested that adult brain continues to generate new neurons in response to exercise in the hippocampus[4,5]. Hippocampus receives information from each of the sensory modalities and projects widely throughout the brain[6]. This area is best known for its role in learning and memory[7]. Exercise has also been shown to enhance hippocampus cholinergic functioning[8].

Research has shown that 60 minutes moderate-to-vigorous physical activity (MVPA) per day is the minimum amount to benefit health in youth[9]. MVPA is defined as activity above three age-adjusted metabolic equivalents (METs), which are for example jogging, swimming or playing soccer[10].

MATERIALS AND METHODS

The study was carried out in ZPTC high school, Vikarabad

Study group: 30 Athletes of both the genders between 8-16 years of age were selected as study group who were actively involved in sports activities in school.

Control group: 30 Non athletes of both the genders with age and BMI matched were selected as control group.

Inclusion criteria for study group:

1. students regularly involved in sports activities
2. students between the age 8-16 years

Inclusion criteria for control group:

1. Students not involved in sports activities

Exclusion criteria:

1. Any systemic illness
2. any central nervous system disorder

All the students were explained about the tests and an informed consent were taken from school authorities

Short term memory testing:

Visual Memory: It was assessed in three trials by flashing 20 numbers,20 words and showing 20 objects each for 1 min.The subjects were asked to write down immediately on a paper what they remembered within 2 mins

Auditory Memory: It was assessed by reading aloud 20 numbers within 1 min and the subjects were asked to write down immediately on a paper the numbers they remembered within 2 mins.

Statistical analysis: Statistical analysis was done using unpaired t test and Microsoft excel were used.

P value <0.05 was considered as statistical significant.

The results were expressed as Mean ± Standard Deviation.

FINDINGS

Table No.1: Auditory Memory

Group	N	Mean	SD	SD Mean
Athletes	30	39.1065	14.169	2.5868
Non-Athletes	30	32.1548	11.901	2.1729

The Variation of recalling capacity between Athletes and Non-athletes was statistically significant with P-Value 0.04.

Visual Memory: assessed in three trails

Table No. 2: Flashing 20 numbers

Group	N	Mean	SD	SD Mean
Athletes	30	18.9032	8.8482	1.6154
Non-Athletes	30	13.1935	10.4161	1.9017

The Variation of the recalling capacity for visual memory assessed by flashing numbers was statistically significant with P value 0.02

Table No. 3: Flashing 20 words

Group	N	Mean	SD	SD Mean
Athletes	30	56.4516	21.0631	3.7831
Non-Athletes	30	39.6774	19.5762	3.5160

The variation of the recalling capacity for visual memory assessed by flashing words was statictically significant with P value 0.002

Table No. 4: Flashing 20 objects

Group	N	Mean	SD	SD Mean
Athletes	30	69.0323	15.1338	2.7181
Non-Athletes	30	59.0323	11.6490	2.0922

The variation of the recalling capacity for visual memory assessed by flashing objects was statistically significant with P value 0.0001.

CONCLUSION

Physical activity has positive effect on short term memory.

DISCUSSION

The present study addressed the relationship between Physical activity and neurocognitive functioning.Results showed that there is a positive impact of physical activity on short term memory.

Our findings receive support from previous studies that observed enhanced working memory after single bouts[11] and regular sessions of physical exercise[12]. It has been previously reported that running enhances neurogenesis, levels of brain–derived neurotrophic factor (BDNF) and other growth factors and neurotransmitters especially in the hippocampus[13].

Students should be encouraged to participate in sports activities as it has a positive impact on short term memory and it helps in academic achievement.

Further research: we emphasize the need for further research on the relationship between sports and neurocognitive functioning and moderators such as MVPA and, cardiovascular fitness. Other possible moderating factors such as improved motor skills (needed in many neurocognitive tasks) or motivational aspects, may play a role as well in the relationship between sports participation and neurocognitive functioning.

Source of Funding: Self

Ethical Clearance: Taken from Scientific Ethical committee,Mahavir Institute of Medical Sciences,Vikarabad,Telangana.

Conflict of Interest: Nil

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Comparison of Respiratory Functions in Rural Vs. Urban Population

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ABSTRACT

Aims: To study and compare the effects of air pollution on respiratory function in urban and rural areas.

Materials and Method: The patients attending the general medicine OPD in the age group of 18-45 were included. FVC, PEFR and FEV1were measured. The results from urban and rural patients were compared and statistically analyzed.

Results: Mean PEFR of urban vs. rural in males was 401 ± 98.23 and 502 ± 95.43 while in females was 399 ± 95.24 and 498 ± 96.42 respectively. Mean FVC of urban vs. rural in males was 65 ± 5.89 and 75 ± 5.67 while in females was 64 ± 5.73and 73 ± 5.85 respectively. Mean FEV1 of urban vs. rural in males was 76 ± 5.74 and 87 ± 5.28 while in females was 74 ± 4.97and 85 ± 5.34 respectively.

Conclusion: Urban population has greater risk of developing respiratory disorders as compared to rural population.

Keywords: *air pollution, respiratory function, urban ,rural.*

INTRODUCTION

Air pollution has become a serious public health problem which affects health and well being of people leading to morbidity and mortality. Air pollution has increased across the world by 8% over the last 5 years and many cities are showing the air pollution levels 5-10 times higher than WHO recommended levels [1]. India has 8 cities in top 30 polluted cities of the world [2]. Air pollution has been directly correlated with respiratory diseases such as chronic bronchitis, asthma and lung cancer and increased risk of heart disease and stroke [3-19]. But no quantitative data exists for comparing the impact of air pollution in urban areas versus rural areas. Therefore a study was planned to compare the effects of air pollution in urban and rural areas.

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MATERIALS AND METHODS

The present study was conducted in accordance with the declaration of Helsinki and informed consent was obtained from the patients after proper explanation. It was conducted at Geetanjali Medical College and Hospital from January 2016 to June 2016. All the patients attending the outpatient department of general medicine between the ages of 18 to 45 years were included in the study. Detailed history with emphasis on type of occupation and residence whether urban or rural were noted. The patients with history of smoking were excluded .The patients with clinical features of any infective, inflammatory and parenchymal lung diseases were excluded. All the patients underwent general physical examination .Then pulmonary function tests were performed by spirometer (Vitalograph Ltd., Buckingham). Forced vital capacity (FVC), Forced expiratory volume at 1 second (FEV 1) and Peak Expiratory Flow Rate (PEFR) were noted. The data were entered into statistical software and the results were analyzed. Chi square test was conducted to calculate the p value. P value < 0.05 was considered significant.

RESULTS

The total number of patients examined in urban and rural areas was 100 each. Amongst the urban patients 64 were males while in the rural areas 65 were males.

Table 1: Distribution of patients according to age (in years):

	Urban (mean ±2SD)	Rural (mean ±2SD)
Male	39 ± 5.61	38 ± 5.72
Female	37 ± 5.46	36 ± 5.82

Table 2: PEFR (litres/minute) in urban and rural area

	Urban (mean ±2SD)	Rural (mean ±2SD)
Male	401 ± 98.23	502 ± 95.43
Female	399 ± 95.24	498 ± 96.42

Table 3: FVC (in percentage) in urban and rural area

	Urban (mean ± 2SD)	Rural (mean ± 2SD)
Male	65 ± 5.89	75 ± 5.67
Female	64 ± 5.73	73 ± 5.85

Table 4: FEV1 (in percentage) in urban and rural area

	Urban (mean±2SD)	Rural (mean ±2SD)
Male	76 ± 5.74	87 ± 5.28
Female	74 ± 4.97	85 ± 5.34

PEFR, FEV1 and FVC were lesser in urban patients as compared to rural patients and this difference was statistically significant ($p < 0.05$).

DISCUSSION

Various sources of air pollution are burning of fossil fuel, agricultural activities, exhaust from factories and industries and mining operations. But the major source of air pollution in urban areas is vehicular pollution. Exhaust from cars, jeeps, trucks and buses contain harmful chemicals like carbon monoxide, sulfur dioxide and nitrogen oxide. Agricultural activities, more common in rural areas, also release harmful chemicals in air by the use of insecticides and pesticides, although to a small extent.

Higher levels of air pollution lead to inflammation of walls of the respiratory passage [20]. Inflammation can directly affect the respiratory smooth muscle by increasing their tone and consequently narrowing their lumen [21]. Inflammation can also have indirect effect by causing fibrosis of air passage and thereby decreasing the lumen [22]. Inflammation also causes destruction of the alveolar walls and thereby hampering air exchange in the lungs [23]. All these pathological processes deal a final insult to the respiratory system which results in limitation of air flow through the lungs [24].

In our present study we found that the respiratory function tests were decreased as proved by the lower values of PEFR, VC, and FEV1in urban areas. These could be due to higher levels of air pollution in urban areas as compared to rural areas. Due to rapid and massive unplanned urbanization, not only the number of vehicles has increased but also these cities have become congested due to vertical growth of cities. This is in sharp contrast to the villages and rural countryside where not only the vehicles are very low but also there is no congestion as high rise buildings are very rare.

To reduce the untoward complication caused by emission of harmful chemicals in air in urban areas, measures to decrease the levels of air pollution needs to be undertaken. Such measures shall include reducing the number of private vehicles on road, encouraging the use of public transport, use of advanced technology for energy efficient engines and use of hybrid vehicles. Till the time such measures come into force, the urban population should be advised to use air filter masks during outdoor activities.

CONCLUSION

Urban population has greater risk of developing respiratory disorders as compared to rural population. Higher levels of air pollution in urban areas can be the associated risk factor. To lessen the effect on respiratory dysfunction ,measures by urban development authorities to reduce the air pollution and protective measures by the people in urban areas need to be adopted.

Conflict of interest: Nil.

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Study of Correlation of Hand Grip Strength with Height and Weight in Cricket Players

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ABSTRACT

Background: Hand grip strength has been an indicator for determining strength.

Objective : The purpose of study was to found out correlation of hand grip strength with height and weight in cricket players.

Material and Methods: Total 30 healthy cricket players (15-25 years), from district sport academy, regularly practicing from last 3 years at university level and who don't have any abnormality of upper arm or any neurological problem, history of fracture of hand were included. Measurement of hand grip strength with help of Sahens hand grip digital dynamometer was done. Mean of three reading was taken as final reading. Standing height was measured using a scale mounted on a wall, in a barefooted subject in centimeter. Weight was taken using a standardized weighing scale with the subject in minimum sports regular clothing.

Result: It was found that there was positive correlation observed between hand grip strength with height and weight in cricket players**.**

Conclusion: Proper training for maintaining height and weight will increase in hand grip strength. It will further lead to better strength and performance in cricket activities like batting, bowling, throwing, fielding.

Keywords: *Handgrip strength, Anthropometry, Dynamometry.*

INTRODUCTION

A sport is a worldwide phenomenon. Amongst sports, cricket events are more popular as it is a great fun and people of all ages can enjoy it. Hand grip strength has been an indicator for determining strength since 1880. It is referred as the muscular strength and force that they can generate with their hands. It is the result of forceful flexion of all finger joints, thumbs, wrists with maximum voluntary force that the subject is able to exert under normal bio kinetic conditions.[1,2] There are 35 muscles involved in movement of the forearm and hand, with many of these involved in gripping activities. During gripping activities, muscles of the flexor mechanism in the hand and forearm create grip strength while the extensors of the forearm stabilize the wrist.[3] According to German Sports Scientist Weinick J[4] the characteristic structure of the hand is related to its function as a grasping tool. Grasping ability is made possible by the fact that the thumb can be opposed to the fingers. The fingers and the thumb act as a versatile pair of pliers. They need the palm of the hand as a flat base, on which the object grasped can be held. Extensor digitorum increases the joint compression and enhances the joint stability. Muscles of the hypothenar eminence that are Abductor digiti minimi, Opponens digiti minimi, Flexor digiti minimi are responsible in an active cylindrical grip. Power grip is the result of opening of the hand, positioning of fingers,approaching the fingers to the object,and maintaining a static phase that actually constitutes the grip.

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Hand grip strength is a physiological variable that is affected by a number of factors including age, gender, body size, weight, height, muscle strength, fatigue, time of the day, age, nutritional status, restricted motion, and pain. Strong correlations between hand grip strength various anthropometric traits (weight, height, hand length etc.) were reported.[5,6] . Correlation of dominant and non-dominant hand grip strength and height and weight in cricket players were studied. This study offers the opportunity to enhance, update and clarify the understanding of the relationships between isometric hand grip strength and anthropometric dimensions. So that, we can plan training programmes to increase hand grip which will lead to better performance of cricketers.

MATERIAL AND METHOD

Normal healthy cricket players playing cricket from last 3 years still playing at university level, state level or national level with age group between 15- 25 years who were practicing in daily cricket practice for 2-3 hours for 6 days a week were included in the study. Subjects suffering from disease or injury or any treatment and surgery that affect upper extremity strength were excluded. Ambidextrous subject using both hands with equal ease were also excluded from study. The present study was approved by the Ethical Committee. All the statistical calculations were performed using the software SPSS for windows (statistical package for social sciences) version 19.0. Pearson correlation coefficient established a correlation of anthropometric parameter with hand grip strength.

$r > 0.7$ = highly positive correlation.

$0.4 < r < 0.7$ = moderately positive correlation.

$0.4 < r$ = low positive correlation.

The hand grip dynamometry used in study was of the Digital Hand Grip (DHD-3). (Product of SAEHAN Corporation Company, South Korea). It is type of Electronic hand grip dynamometry. Instrument Reliability- Digital handheld dynamometer used for in the study had been proved reliable by Faria in his study.[7] Specifically about Sehan's HGD, good validity and reliability is stated by Reis 2010.[8]

A standard testing position as approved by American Society of Hand Therapist (ASHT) was used (Innes[9] 1999, Mathiowetz[10] 1985). How to use the hand grip dynamometry was demonstrated to all subjects.[9,11,12,13] Measurements were taken for all subjects around midday i.e. 11.00 hours to 12.30 hours, as it is proved to be significantly stronger at these times.[14]

Johanson[15] (1983) found a significant difference between the volume of verbal command and isometric contractions, where increased volume resulted in increased strength. Hence, same tone and volume of instructions were given in this study each time a test was conducted. To get the maximum reliability of data collected, every subject was asked to squeeze the dynamometer for three times. Mean of these three trials were taken as the readings.[16] Innes[9] recommended a 60 seconds rest period between trails on isometric tests. It was recommended that a 3 seconds grip was usually sufficient to register a maximum reading hence 3 seconds is taken for length of contraction time in this study.[17]

Height is defined as the distance from heels to vertex in a subject standing erect with his heels, buttocks and back touching the wall. Standing height was measured using a scale mounted on a wall, in a barefooted subject in cm. Subjects were measured barefoot or only wearing socks in an upright posture looking forwards without raising the head, with their feet placed together and heels against the rod of the stadiometer. The upper limbs were resting at the sides and the head was in the horizontal plane. Upon taking the measurement the subject inhaled deeply and stretched up to the fullest extent. The subjects were encouraged to stand tall, take a deep breath, and relax. The subjects back was kept a straight as possible. Height was measured from the highest point on the head in the median sagittal plane (Vertex) to the soles of the feet with stadiometer . Height was measured in cm to the nearest 0.1 cm., then it was converted to meter. Care was taken to ensure that the heels were not raised. Care was taken to ensure that the heel, the interscapular area and the occipital area was in contact with the stadiometer board during the measurements.

Weight is defined as "The word weight denotes a quantity of the same nature as a force the weight of a body is the product of its mass and the acceleration due to gravity[18] . It is taken in morning time after 1 hour of breakfast. Weight was taken using a standardized weighing scale with the subject in minimum sports regular clothing. All the pockets were emptied and the subject was asked to remove the footwear and heavy garments prior to measurement. Subject instructed

to face forward with both feet solidly on the scale,the weight was evenly distributed between the feet. The balance bar was aligned and thus calibration of weighing scale was done before each measurement and the neutral was maintained at zero. Each time a new person was weighed, the weighing machine was calibrated to zero. Weight was measured in kg to the nearest 0.1 kg.

Photograph 1: weighting machine

Photograph 2: weight measurement

Photograph 3: Stadiometer

Photograph 4: Height measurement

Photograph 5: SAEHAN Digital Hand Grip Dynamometer

Photograph 6: HGS Measurement DM Hand (Front View)

RESULT

Table No. 1: Correlation between height and hand grip strength of Cricket players

	Cricket players	
	Dominant hand	**Non dominant hand**
N (Sample size)	30	30
Correlation coefficient (r)	0.10	0.07

There is positive correlation observed between height & dominant, non dominant hand grip strength in Cricket players

Table No. 2: Correlation between weight and hand grip strength of Cricket players

	Cricket players	
	Dominant hand	**Non dominant hand**
N (Sample size)	30	30
Correlation coefficient (r)	0.36	0.35

There is positive correlation observed between weight and dominant, non dominant hand grip strength in Cricket players

DISSCUSSION

Our results shows that dominant and non dominant hand grip strength (DM and NDM HGS) continued to be increased with increase in height in cricket players. For dominant hands, in cricketers r= 0.10, t= 0.51, (table 1,graph1) For non dominant hands, in cricketers r= 0.07, t= 0.36, (table 1, graph 2).

Similar result with our finding i.e. positive correlation between height and hand grip strength was shown by other authors like Koley S (2009, for rt hand, r= 0.383 and for left hand, r= 0.35) in Indian cricket players,[19] Fallahi AA (2011, r= 0.603),[20] Koley S and Pal AS (2009, r= 0.872) in Indian population,[21] Koley S and Gandhi M (2008),[22] Moy F (2011, r=0.346)[23] in Malaysia population, Innes E (1999),[24] Sampoli S (2007),[25] Neimpoog S (2007),[26] Pietrese S (2002),[27] Samsung M (2000),[28] Chatterjees (1991),[29] Kamarul T (2006),[30] Hanten (1999).[31] More height may lead to more number and more length of muscle fiber. It may lead to more strength in hands when examined for grip. So more heighted players may have more grip strength This may be the reason of positive correlation of height and hand grip strength. Dissimilar result with our finding were shown by Jurimae T[32] (2009). His study shows that there is low negative correlation between height and hand grip strength. Campbell (1980) shows that there is no correlation in between height and hand grip strength.[33] It may be due to variations in height as per different countries which can vary the results.

Also, results shows that dominant and non dominant hand grip strength (DM and NDM HGS) continued to be increased with increase in weight in both cricketers. For dominant hand grip strength, in cricketers r= 0.36, t= 2.03, and (table 2, graph 3) , For non dominant hand grip strength, in cricketers r= 0.35, t= 1.99 (table 2, graph 4)

Similar result with our finding i.e. positive correlation between weight and hand grip strength was shown by other authors like S koley (2009, for rt hand r= 0.498 and for lt hand 0.472)[19] in Indian cricket players, Fallahi AA (2011. r=0.516),[20] Hanten (1999, r= -0.73),[31] Koley (2009, r= 0.853)[21] in Indian population, Moy F (2011, r= 0.298) in Malaysia population.[23] Chatterjee S and Chowdhari BJ (1991),[29] Koley S and M Gandhi (2008),[22] Innes E (1999),[24] Sampoli S (2007),[25] Neimpoog S (2007),[26] Pietrese S (2002),[27] Samsung M (2000),[28] Kamarul T (2006).[30] Christian MG

(2008),[34]Bassy (1993).[35] More weight may lead to more weight of hands. It may exert more force of contraction on dynamometer when testing for hand grip strength. This may be the reason of positive correlation of weight and hand grip strength. Dis-similarity with our result was shown by Campbell (1980)who shows that there is no correlation in between weight and HGS.[33] It may be due to variations in weight as per different countries which can vary the results.

CONCLUSION

All anthropometric parameters like height and weight should be assessed by coach periodically. There is need to improve physical fitness parameter to enhance players performance. Height training should be implemented at junior level to build whole body mass and to counter asymmetric load placed on the body through the nature of game. Hand grip strength training programmes should be planned at various level such as school, college,university, state.

Through this we can give a specific sport prescription to player while selecting a sport. In Japan, they have already implemented this sport prescription method at earlier stages which help person to choose a game. So it should be considered in India as it will be helpful for the performance of the player our purpose of "RIGHT SPORT FOR RIGHT PERSON" should be served.

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Evaluation of Erythrocyte Morphology and Antioxidant Enzymes in Patients of Systemic Lupus Erythematosus

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ABSTRACT

Background: The inflammatory cytokines released in systemic lupus erythematosus (SLE) are suggestive of oxidative stress which can be studied by evaluating the antioxidant enzymes.The oxidative stress is manifested in the circulating RBCs affecting its morphology and antioxidant defenses

Aim: The present study aims at evaluating the RBC morphology by studying the various RBC indices and by evaluating the antioxidant enzymes such as catalase(CAT), superoxide dismutase (SOD) and glutathione peroxidase(GPX) in SLE patients.

Methods: The study consisted of 40 SLE patients in active disease and 40 healthy controls who were evaluated for total RBC count (t-RBC), haemoglobin (Hb) levels, mean corpuscular volume (MCV), mean corpuscular haemoglobin concentration (MCHC) and erythrocyte antioxidant enzyme activities such as catalase (CAT), superoxide dismutase (SOD), and glutathione peroxidase (GPX).

Results: The total RBC count, Hb levels, PCV and MCHC were significantly reduced in SLE patients. The activities of SOD and GPX were significantly lower ($p < 0.001$) in SLE patients, whereas there was no significant difference observed in CAT activity ($p<0.001$) in patient group while comparing with controls.

Conclusions: Along with conventional inflammatory markers like elevated CRP and ESR, the antioxidant enzyme activities of SOD and GPX can be be considered as markers of inflammation and disease activation in patients of SLE.

Keywords: *Systemic lupus erythematosus, superoxide dismutase, catalase, glutathione peroxidase*

INTRODUCTION

Systemic lupus erythematosus (SLE) is a chronic, multisystem, autoimmune connective tissue disorder, with a heterogeneous presentation. The disorder presents as a broad spectrum of clinical presentations involving almost all organs including skin.[1] Skin being the largest organ of the body gets visibly affected. The clinical course of SLE is characterized by periods of remission and relapses.[1] Since SLE is a complex condition involving cutaneous as well as systemic manifestations, the disease activity in SLE can be assessed using composite disease activity indices, such as the SLE Disease Activity Index (SLEDAI) and British Isles Lupus Assessment Group (BILAG).[2] However, these indexes are complex for use in routine clinical practice. Therefore, there is great amount of interest in the identification of biomarkers that can quantify disease activity of SLE. Since SLE is an inflammatory condition, the inflammatory cytokines released are said to cause oxidative stress and there by affect the intracellular antioxidant enzymes.[3] Oxidative stress in a physiological setting is an excessive bioavailability of reactive oxygen species (ROS), which is the net result of an imbalance between production and destruction of free radicals (with the latter being influenced by antioxidant defences.[4] In a normal healthy human body, the generation of pro-oxidants in the form of ROS and RNS are effectively kept in check by the various levels of antioxidant defenses. However, when it gets exposed to adverse physicochemical, environmental

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or pathological agents, this delicately maintained balance is shifted in favour of pro-oxidants resulting in oxidative stress. SLE is often found to be associated with hematological abnormalities.[5] It has been observed that about 50% diagnosed cases are found to be anemic. [5] Since, there are few studies on role of oxidative stress in disease pathology of SLE, the present study was undertaken to study the extent of oxidative stress in SLE by quantifying the intracellular antioxidant enzymes such as erythrocytic catalase, superoxide dismutase and glutathione peroxidase and also, by studying the RBC indices such as total count, Hb concentration, MCC, MCHC in SLE patients and then comparing them with normal subjects of similar age group and gender.

MATERIALS AND METHOD

The study comprised of total 80 female subjects aged 20 to 50 years, out of which 40 were patients diagnosed with SLE in the outpatient Department of Dermatology, Kamineni Institute of Medical Sciences, Hospital, Narketpally over a time period of two years. Patients were evaluated clinically by the dermatologist based on history, systemic and cutaneous examination including site of the lesions, severity of erythema. Forty age matched healthy female controls were enrolled for this study, recruited from healthy volunteers and patients attending skin outpatient department for cosmetic problems like acne and pigmentary disturbances. The study was approved by institutional ethics committee. Informed consent were taken from the patients as well as the controls, before collection of blood sample. About 10 mL of venous blood sample, was collected from the anterior cubital vein of each of the SLE patient and the control subjects for carrying out the following biochemical analysis.

Sample Preparation: Heparinized blood was centrifuged at 1,000 g for 10 min at 4°C; the buffy coat was discarded, and the isolated RBC pellet was hemolyzed in four times its volume of ice-cold high-performance liquid chromatography-grade water and again centrifuged at 4°C. The erythrocyte lysate was, then, used to evaluate the CAT, SOD, and GPX activities.

Catalase Assay: CAT activity was assayed based on the method of Johansson and Borg, [6] using the Cayman kits (item no. 707002; Ann Arbor, MI, US). The method is based on the reaction of the enzyme with methanol in the presence of an optimal concentration of H2O2. The formaldehyde produced was measured colorimetrically with purpald as the chromogen at 340 nm.

Glutathione Peroxidase Activity Assay: The GPx activity was determined with Cayman kits (Item no. 703102; Ann Arbor, MI, US) at 25°C by colorimetry at 340 nm, based on the method of Paglia and Valentine,[7] which requires cumene hydroperoxide as a substrate.

Superoxide Dismutase Activity Assay: The SOD activity was determined with Cayman kits (item no. 706002; Ann Arbor,MI 48108, US) at 25°C by colorimetry at 340 nm, based on the method of Marklund.[8] This method employs xanthine and xanthine oxidase to generate superoxide radicals, which react with 2-(-4-iodophenyl)-3-(4-nitrophenol)-5-phenyl tetrazolium chloride to form red formazan dye. The SOD activity is, then, measured by the degree of inhibition of this reaction.

Study of erythrocyte indices: Whole blood [ethylenediaminetetraacetic acid (EDTA) as anticoagulant] was used for determining RBC count; count, Hb, MCV and MCHC by an automated cell counter (Autocounter AC 970, Lab Life H3D, Mindray).

Body mass index (BMI): The BMI of all the subjects was calculated by the accepted formula: Weight (kg)/ [height (meter)2]

Statistical Analysis: The statistical analysis was performed using the SPSS software, version 19 (SPSS, Chicago, IL). The variables were expressed as mean and standard deviation, and p value <0.05 was considered statistically significant. Unpaired t-test was used to compare the results between the patient and control groups.

RESULT

The baseline data and RBC indices are shown in Table-1. The antioxidant enzyme levels are given in Table-2. While comparing the RBC indices, it was observed that the total RBC count, Hb concentration and MCHC was observed to be significantly lower compared to controls. The antioxidant enzyme levels analysis revealed that the erythrocytic SOD and GPX levels were significantly lower ($p < 0.001$) in SLE patients, whereas no significant difference was observed in CAT activity.

Table 1: RBC indices in SLE patients and controls

Parameters	Patients	Controls	p-value
t RBC(cells/cumm)	2.6±0.45	4.02 ± 0.92	<0.001
Hb (gm%)	11.32±1.5	13.6 ± 1.7	<0.05
PCV	40.11±2.18	43.06 ± 3.16	<0.001
MCV	82.43±12.38	83.26 ± 10.77	NS
MCHC	31.02±1.32	33.34 ± 3.63	<0.001

tRBC-Total RBC count, Hb-Hemoglobin concentration, PCV-Packed cell volume, MCV-Mean corpuscular volume, MCHC-Mean corpuscular hemoglobin concentration

Table 2: Comparison of antioxidant enzymes in SLE patients and controls

Parameters	Patients	Controls	p-value
SOD (IU/g of Hb)	1239.05±138.31	1456.06±282.74	<0.001
GPX (IU/g of Hb)	47.41±9.56	51±10.21	<0.001
CAT (nmol/min/ml)	532±68.32	552.85±77.25	NS

CAT-Catalase, SOD-Superoxide dismutase, GPX-Glutathione peroxidase,NS-not significant

DISCUSSION

Systemic lupus erythematosus is an autoimmune inflammatory disease characterized by the presence of flare of autoantibodies, especially against nuclear components.[1] Although it is believed that the aetiology of SLE is multifactorial, including immune dysfunction, genetic, hormonal and environmental, the molecular mechanisms underlying this systemic autoimmune response remain largely unknown. In the present study, While comparing the RBC indices among the the two groups, we did observe significant reduction in terms of total RBC count, Hb concentration and MCHC ($P < 0.001$) [Table 1] in SLE patients. The activities of SOD and GPX were found to be significantly reduced in SLE patients whereas there was no significant change observed in CAT activity. The pathogenesis of lupus is how intracellular antigens become exposed and targeted by the immune system.[9] In this regard, excessive production of ROS and altered redox state which may cause abnormal activation of apoptosis, are considered as imperative factors involved in production, expansion of antibody flares and various clinical features in SLE.[2]Haematological abnormalities are common in systemic lupus erythematosus. Anaemia is found in about 50% of patients, with anaemia of chronic disease being the most common form. Impaired erythropoietin response and presence of antibodies against erythropoietin may contribute to the pathogenesis of this type of anaemia.[10] The findings of present study are concurrent with Serban et al,. and Kurin and Scofeild et al., who have reported a decreased activity of SOD and formation of auto-antibody against SOD enzyme in SLE patients. [11,4] However, the findings of the present study does not agree with Turgey et al., who have reported decrease in the activities of SOD and GPX with increase in CAT activity in the SLE patients. [12] Therefore, We suggest erythrocytic GPX and SOD to be evaluated as markers of disease progression by the clinician along with conventional hemogram for a better assessment of disease activity in SLE.

LIMITATION

The results of this study are subjected to some limitations. The study was conducted on relatively smaller sample size which have been taken from a limited geographical area. Thus studies on larger scale are warranted to further strengthen the present results.

Conflict of interest: Nil

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Waist Hip Ratio, a Predictor of Cardiovascular Death in Obese Individuals

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ABSTRACT

Objective: To evaluate Waist Hip ratio in obese indiviuals to predict death from cardiovascular disease (CVD) and coronary heart disease (CHD), in parallel with conventional cardiovascular risk factors.

Design, participants and setting: Cross-sectional analysis of an age- and sexstratified sample of 150 adults aged 20–69 years from Kamineni institute of medical sciences , Nalgonda. Blood pressure, fasting serum lipid levels, smoking, history of heart disease or diabetes, and obesity as measured by body mass index (BMI), waist circumference and waist–hip ratio were recorded.

Main outcome measures: Hazard ratios for the risk factors predicting CVD mortality and CHD mortality. Results: Of the modifiable risk factors, obesity, as measured by waist–hip ratio, is a dominant, independent, predictive variable for CVD and CHD deaths in Australian men and women. Self-reported angina/myocardial infarction in both sexes, and cigarette smoking in women, are also independent risk factors.

Conclusions: Obesity assessed by waist–hip ratio is a better predictor of CVD and CHD mortality than waist circumference, which, in turn, is a better predictor than BMI. The recognition of central obesity is clinically important, as lifestyle intervention is likely

Keywords: *Body mass index; Obesity; Blood pressure; Lipid.*

INTRODUCTION

Obesity has become a major worldwide epidemic affecting more than 300 million people. It is an important risk factor for diabetes mellitus, type 2, a chronic disorder of carbohydrate, fat, and protein metabolism. From the clinical perspective, visceral adipose tissue is known to generate diabetogenic substances [(1)] and, as such, may be more informative than total fat for diagnostic evaluation. The standard epidemiologic translation of these important clinical facts uses anthropometric measures. Waist circumference and waist/hip ratio have been used as measures of central obesity (where visceral adipose tissue is stored), and body mass index (kg/m2) has been used as a measure of general obesity [(2).].Clinical evidence suggests that the association of diabetes with central obesity is stronger than the association with general fat. Studies using computed tomography and magnetic resonance imaging have provided further evidence to support that central obesity, visceral adipose tissue, and upper-body nonvisceral fat are the major contributors to the metabolic complications[(6)]. Central obesity has been associated with decreased glucose tolerance, alterations in glucose insulin homeostasis, reduced metabolic clearance of insulin, and decreased insulin-stimulated glucose disposal. In addition, studies that have analyzed the association of anthropometric measures and abdominal visceral fat have found waist circumference to be a better measure of central obesity because it is a better predictor of abdominal visceral fat obtained with computed tomography than is waist/ hipratio, and it can be easily measured and interpreted [(10).]. However, waist circumference cannot distinguish abdominal subcutaneous fat, total abdominal fat, and total body fat, and it is strongly correlated with body mass index. Body mass index has been shown to be a good indicator of general fatness (fat areas in the arm, thigh, and waist using computed tomography scans), muscularity (muscle area in the thigh), and frame size (bone area in thighs)[(10)].

METHOD

Population sample Kamineni institute of medical sciences, Nalgonda conducted the third Risk Factor Prevalence Study . This study involved elderly individuals aged 20–69 years .A systematic probability sample of this population was selected by sex and 5-year age groups. The target was 150 subjects in each catchment area. Subjects were invited to attend a local survey centre after an overnight fast. Complete data on 150 subjects were analysed. Survey methods Participants completed self-administered questionnaires and their fasting status (>12 hours) was confirmed. Respondents were classified as current.Smokers (cigarette smokers, cigar and/or pipe smokers), ex-smokers, or never-smokers. Self-reported coronary heart disease was coded if subjects gave a positive response for a past history of angina or heart attack. Selfreported diabetes was also recorded. Physical measurements, with the participants in socks, stockings or bare feet, and in light street clothing, included height measured to the nearest centimetre, and weight to the nearest 10th of a kilogram (1kg was deducted from the weights recorded as an allowance for clothing). Waist circumference was measured around the narrowest point between ribs and hips when viewed from the front after exhaling. Hip circumference was measured at the point where the buttocks extended the maximum, when viewed from the side.[11,12] .Two consecutive recordings were made for each site to the nearest 1cm using a metal tape on a horizontal plane without compression of skin. The mean of two sets of values was used. Blood pressure levels were obtained using mercury sphygmomanometers on the right arm of seated subjects. Systolic and phase 5 diastolic pressures were taken twice to the nearest 2mmHg and the average recorded.Fasting blood samples collected into EDTA tubes and separated within 3 hours were maintained at 4C until despatched each week to the central laboratory.

Ethical approval: Ethical clearance for the study was provided by ethical committee of Kamineni Institute Of medical Sciences, Nalgonda.

RESULTS

Table 1: shows the baseline characteristics of the cohort

	Male	Female
Number of subjects	75	75
Age (Years)	43±13	42±13
Height (cm)	174±7	160±6
Weight(kg)	78±12	64±13
BMI(Kg/m2)	25±3.6	24±4.8
Waist circumference (cm)	90±1	77±10
Waist-Hip ratio	0.87±0.06	0.75±0.05
Systolic Blood Pressure(mm/Hg)	126±17	122±18
Diastolic Blood Pressure(mm/Hg)	80±11	74±13
Total Cholesterol(mmol/L)	5.5±13	5.5±1
HDL(mmol/L)	1.2±13	1.1±0.7
Triglycerides(mmol/L)	1.2±1.3	1.1±0.7
LDL(mmol/L)	3.7±13	3.5±0.1

Table 2: Corelation coefficients

	Corelation coefficient					
	Body mass index		Waist circumference		Waist-Hip ratio	
Bloodpressure						
Systolic	0.27	0.25	0.25	0.23	0.19	0.15
Diastolic	0.30	0.26	0.29	0.24	0.21	0.15
Cholesterol						
Totalcholesterol	0.17	0.12	0.17	0.15	0.17	0.15
HDL	-0.25	-0.25	-0.25	-0.28	-0.22	-0.23
LDL	0.15	0.16	0.15	0.18	0.14	0.16
Triglycerides	0.33	0.29	0.35	0.38	0.35	0.36

Waist–hip ratio had much stronger predictive power and greater statistical significance than waist circumference, which, in turn, was superior to BMI for assessing risk in this population.

DISCUSSION

Hip circumference is an index of muscle mass[9] and may reflect exercise status and insulin sensitivity. Waist–hip ratio may prove also to be a more appropriate and universal indicator of risk for ethnically diverse

populations, including small-framed Asian and Indian groups and large-framed Polynesians, but more detailed studies are required. All the measures of obesity showed strong statistical correlations with triglyceride levels, HDL cholesterol levels and blood pressure, suggesting that vascular damage may be mediated by these associated factors. But waist–hip ratio proved to be independent of these factors on multivariate analysis, indicating that there may be other mechanisms whereby visceral adipose tissue confers risk.[6]

Blood pressure and lipid levels in predicting cardiovascular end-points, but caution in interpreting our findings is advised. In population studies, a single blood pressure or lipid reading is likely to underestimate the true risk (or hazard ratio) by at least a third, owing to random variation and fluctuation of an individual's blood pressure and lipid levels, causing the well documented phenomenon of regression to the mean. In contrast, single measures of obesity such as BMI are much more stable and reproducible, with negligible regression dilution bias.[8] BMI has been shown to be a significant risk factor for all-cause and cardiovascular mortality, but very large population samples are required to achieve conclusive statistical outcomes.2-4 Hazard ratios for BMI are quite low when compared with those of conventional risk factors. Moreover, exclusion of subjects with confounding conditions, such as past or present cigarette smoking and coexisting chronic disease, is required to sustain the relationship of BMI with mortali Waist circumference has become the preferred measure for abdominal obesity. James advocates that waist measurements provide a simple discriminator of risk, in combination with BMI.[5] He cites unpublished reanalysis of the Gothenburg data that waist circumference performs favourably in comparison with waist–hip ratio, although the original authors disagree.[15] Waist circumference is the best surrogate measure for visceral fat mass, as estimated from computed tomography[5,6] and dualenergy x-ray absorptiometry.[7] The WHO has echoed these principles and supports the measurement of waist circumference. Subsequently, a number of cross-sectional studies have related waist measurement to the prevalence of diabetes6 and cardiovascular risk factors (most recently, the US Third National Health and Nutrition Examination Survey,[8] and the Italian Olivetti Heart Study[9]. But there have been no further prospective studies in relation to cardiovascular end-points. We have used modern statistical methods to confirm that waist–hip ratio is the major obesity-related determinant of CVD and CHD death, and is independent of other modifiable risk factors.

CONCLUSION

Recognition of central obesity by simple standardised means is clearly of clinical importance, as well as being relevant to epidemiological studies. Lifestyle interventions in those at risk are likely to yield significant benefits in preventing cardiovascular disease. There is strong evidence that sustained improvements in physical activity and diet will prevent diabetes.[3] Similar studies should be mounted to determine the influence of such interventions on cardiovascular disease.Hence Waist –Hip ratio is one of the better predictor of cardiovascular death in obese individuals.

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Conflict of Interest: None

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Effect of Moderate Exercise on Ventilatory Functions of Asymptomatic First Degree Relatives of Asthamatics

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ABSTRACT

Exercise induced bronchospasm (EIB) is used to describe transitory increase in airway resistance that follows after moderate exercise among individuals with underlying asthma. The present study was designed to assess ventilatory functions in healthy first degree relatives of asthmatics before and after moderate exercise. In this study thirty healthy first degree relatives of asthmatic patients, attending the OPD of TB & Chest Deptt. Chatrapati Shivaji Subharti Hospital Meerut comprised the-(Study Group)-Group II and thirty healthy individuals age and sex matched from general population with no history asthma, atopy and hay fever were recruited as-(Control Group)-Group-I Various parameters of pulmonary function test FEV_1 (Forced Expiratory Volume in 1 sec.), FVC (Forced Vital Capacity), $FEF_{25-75\%}$ (Forced Expiratory Flow - $_{25-75\%}$), PEFR(Peak Expiratory Flow Rate) were recorded before and after exercise. We observed more than 10 % fall in FVC, FEV I%, FEF25-75%, and PEFR in 6 males and 6 females in Group II while in Group I more than 10% fall was recorded in FVC in 4 females only. We concluded that first degree relatives of asthmatic patients have higher exercises induced bronchial lability as compared to healthy controls with no history of atopy.

Keywords: *Exercise induced bronchospasm, First degree relatives, Pulmonary function test.*

INTRODUCTION

Bronchial asthma is a common chronic inflammatory disease of the airways characterized by variable and recurring symptoms, reversible airflow obstruction and bronchospasm.[1]

It is manifested by lowering of ventilatory function and a decrease in peak expiratory flow rate (PEFR), a low forced expiratory volume (FEV), together with either a reduction in proportion of forced vital capacity (FVC) that can be expired in 1 second (low FEV_1%) or by a prolongation of time for expiration of FVC (forced expiratory time) to more than 4.5 seconds.[2]

For many years asthma is known to run in families but the strength of genetic influence has been difficult to ascertain because of inevitable sharing of environment and genes in family studies. Earlier data of past studies have shown that the close relatives of asthma patients are prone to develop asthma more than the general population and the incidence is greater when both the parents are asthmatics.[3]

In the Laboratory, exercise induced broncho constriction can be demonstrated in the subject who performed steady state exercise for 6 minutes while breathing room air.[4] For the diagnosis of EIB it is necessary to show more than 10% decrease in either PEFR, FEV_1 FVC or a reduction of 35% or $FEF_{25-75\%}$ from the baseline following physical exercise.[5] Signs and symptoms at any age is equally common in adults and children in EIA and do not differ from other forms of asthma except that they are usually of short duration and less severe.[6]

Most of the studies to assess exercise induced bronchospasm are based on the measurement of PEFR. Relatively little information is available concerning the detailed measurement of Pulmonary Function Test to assess the EIB.[7]

The early recognition and appropriate management of EIB can allow children and adolescents to participate fully in physical activities and sport.[8]

The hypothesis of the study was that there will be a decrease in ventilatory status in first degree relatives of asthmatics after exercise.

MATERIAL AND METHOD

It is an observational study conducted in the Department of Physiology, in collaboration with Department of TB and Chest, in Subharti Medical College and associated Chatrapati Shivaji Subharti Hospital Meerut. The period of study was 1 year from July 2014 to January 2016.

Inclusion Criterion:

1. Study Group/Group II consisted of thirty subjects –healthy first degree relatives (as father, mother & children) both males & females of age between 18 to 55 yrs.
2. Healthy controls/Group 1 consisted of thirty controls - age & sex matched with no history of asthma, hay fever, atopy, allergy.

Exclusion Criterion:

1. Cardiovascula respiratory, renal & CNS, disorders spinal & bony abnormalities, anemia and obesity
2. Non cooperation or inability to perform PFT,
3. Subjects on NSAIDs which alters PFT
4. Athletes

General & Anthropometric Examination: Height was measured by stadiometer to nearest 1 cm and weight by weighing machine (Krups) to nearest 1 Kg with subject standing without shoes and wearing light clothes. Body Mass Index (BMI) in kg m^2 was calculated by Quetelet's index. Heart rate (bpm) was recorded by auscultation using stethoscope.

PFT recording: The PFT was carried out using CLARITY-Spirotech machine Version no. 1.1.0.25. The subjects were explained about the PFT procedure. They were made to sit in loose comfortable clothing in a well ventilated room at ambient temperature .The subjects were given demonstration of all the steps of spirometry procedure and were asked to breathe through mouthpiece for some time before the test in order to familiarize him with the equipment. After a few practice breathings, three reproducible lung function values(defined as FVC within 10% of maximal FVC) were produced. Graphs which showed hesitancy or cough were not used in the analyses. The one which showed largest FVC was used to extract data. PEFR was measured by Wrights peak flow meter.

Following parameters were measured: Pre exercise and post exercise PFT parameters were recorded immediately, after 10 min and 20 min intervals of stopping exercise. The subjects were made to relax in between every recording.

I. Forced vital capacity (FVC) L

II. Forced expiratory volume in 1 sec. (FEV 1) L and FEV1%(FEV1/FVC ratio)

III. Forced expiratory flow 25-75 % (FEF 25-75 %)

IV. Peak expiratory flow rate (PEFR) – L/min

Criterion for diagnosis of positive result of EIB: > 10% fall in FVC, FEV1 & PEFR &>35% reduction in FEF-25-75% should be seen.

$$\text{Formula of \% Fall} = \frac{\text{Initial PEF during exercise}}{\text{Initial PEF}} \times 100$$

$$\text{Formula of \% Rise} = \frac{\text{Highest PEF during exercise} - \text{Initial PEF}}{\text{Initial PEF}} \times 100$$

EXERCISE PROTOCOL

The subjects under guidance were advised to exercise for six minutes on treadmill and Heart rate was measured before and after stopping the exercise.

STATISTICAL ANALYSIS

Data was analysed & statistical analysis was done using GRAPH PAD INSTAT version 3.10,32 bit. P value of less than 0.05 level of significance was taken as statistically significant.

FINDINGS

Table -1: Mean values increased immediately after exercise &then coming to normal (or pre-exercise level) at 20 minutes. After applying One way Analysis of variance (ANOVA) in Groups I (n=30) there was no statistically significant difference before and after exercise at different time internals.

Table-2: Mean values were decreased immediately after exercise & then increased after 10 mins and then decreased at 20 mins. After applying One way Analysis of variance (ANOVA) in Groups II (n=30)there was no statistically significant difference before and after exercise at different time internals.

Table-3: We observed > 10% fall in FVC in 4 females and no males in Group I subjects. So 4 females showed Positive EIA response.

Table-4: We observed > 10% fall in FVC in 1 male and 2 females, >10% fall in FEV1 % in 1 male and 4 females, > 10% fall in PEFR in 4 males only in Group II subjects. So 6 males and 6 females (total 12 subjects) showed positive EIA response.

DISCUSSION

In the present study it was found that magnitude of EIB was much higher in first degree relatives of asthmatic population as compared to healthy controls. This study was concordant with the study by Jain et al[10] who compared various parameters of PFTs (FVC,$FEF_{25-75\%}$, PEFR) in 30 healthy first degree relatives of asthmatics and 30 healthy controls, Bronchial lability was noted in 7% of healthy controls and 27% first degree relatives of asthmatics as compared to our study in which abnormal bronchial lability was noted in 6.6% of healthy controls and 33.3% in healthy first degree relatives of asthmatics.

In the study of Jain et al[10] and Raj et al[11]maximum cases have shown positive EIB response in females as compared to males while in our study positive EIB response was seen equally in males and females.

In our study after applying one way ANOVA (Analysis variance) in Group I and Group II, there was no statistically significant difference before and after exercise parameters. We observed > 10% fall in FVC values in 4 females, but no males, immediately after exercise in Group I subjects and we observed >10 % fall in FVC values in 1 male and 2 females and >10% FEVI 10% fall in 1 male and 4 females and >10 % fall in PEFR in 4 males in Group II subjects. The hallmark of exercise induced bronchoconstriction is that acute airflow obstruction peaks rapidly 3 to 15 minutes after exercise stops and spontaneously remits within 20-60 minutes.

Daga et al[12]in their study included 20 healthy first degree relatives of asthmatics and 20 patients of allergic rhinitis and compared them with 20 healthy controls. They measured FVC, FEV_1, $FEF_{25-75\%}$ and PEFR before and after 6 minutes. of simple two step exercise. They found that 25% healthy first degree relatives of asthmatics and 10% allergic rhinitis patients and 10% healthy controls showed exercise induced bronchospasm.

Sinha et al[13] studied the asthmogenic effect of exercise stress in the normal first degree relatives of asthmatic subjects. PEFR was measured before and after 6 minutes run on the ground level, 40% first degree relatives showed exercise induced bronchospasm with no positive responder in the Control Group. However in our study 13.3% males in Group II had showed more than 10% fall in PEFR levels. In our study exercise was conducted by using the treadmill following the Bruce protocol of exercise while Jain et al[10] had used bicycle ergometer and Godfrey et al[14]used treadmill for exercise provocation test.

During and following vigorous exercise there is marked increase in minute ventilation, which the nose is unable to condition. The added burden on the airways, to the 10^{th} generation and beyond, to warm and humidify the air triggers the osmotic and thermal changes.[15] Due to the loss of the water the periciliary fluid layer becomes hyperosmotic that may stimulate the degranulation of pulmonary mucosa mast cells and subsequent release of several inflammatory mediators such as histamine, leukotrienes, prostaglandins, platelet activating factors and neuropeptides from sensory nerves.[16]Theorists propose, these mediators stimulate bronchial smooth muscle[17]and rapid rewarming leads to increased mucosal circulation and engorged capillary beds and airway oedema that may intensify the obstruction.[18]

One interesting observation of our study is that we noted a decreasing trend in the FVC, FEV1%, PEFR and FEF 25 – 75% values immediately after exercise in the Group II followed by a increase in these values after 10 & 20 minutes. On the contrary we noted an increase in the FVC, FEV1%, PEFR and FEF 25 – 75% values immediately after exercise in Group I followed by a decrease in these values after 10 & 20 minutes.Although, these findings were not statistically significant, which may be because of our small sample size, but it supports our hypothesis that the first degree relatives have a hidden bronchial lability after exercise which can be unmasked by a suitable exercise challenge test.

So in Control Group the observed findings may be explained as bronchodiation occurs during the first several minutes of excercise, presumably because of cathecolamines release. This dilation increases flow rate and expired volumes calculated as a % rise equivalent the maximum increment in flow rate or volume expressed as % fall of pre exercise value.[12]

Mechanism leading to airflow obstruction are incompletely understood. Complex pathophysiology of EIB is that there is release of eicosanoids, such as cysteinyl Leukotrienes (cyst LTs) and Prostaglandin D2 (PGD2), into the airways from mast cells, eosinophils and other airway cells. Heat generation & water loss during exercise leads to mast cell degeneration leads to bronchial smooth muscle constriction & increase in bronchial secretions in genetically predisposed first degree relatives of asthmatics. An exercise test can identify the underlying features, including any compensatory mechanisms and can help in diagnosis, treatment and other aspects of managing the condition. In the main determinants of EIB are the duration and intensity of exercise, the underlying bronchial hypereactivity of airway and presence of cold dry air and air pollutants and running on treadmill is associated with greater brochoconstrction than cycle egrometry and requires greater level and of exercise ventilation.

Table 1:Comparison of PFT parameters FVC, FEV1, PEFR, FEF 25-75% Pre exercise, at 0 minutes , 10 minutes, 20 minutes by applying ANOVA in Group I.

Variable	GROUP-I (n=30)				
	Pre exercise	Immediately after exercise (0 min)	10 mins	20 mins	P Value
FVC(L)	3.7±0.45	3.8±0.6	3.7±0.48	3.7±0.52	0.916
FEV1 (L)	3.0±0.34	3.1±0.35	3.1±0.38	3.0±0.38	0.675
PEFR (Lper min)	6.9±0.8	7.1±0.85	7.0±0.83	7.0±0.83	0.816
$FEF_{25.75\%}$(L/sec)	4.5±0.86	4.7±0.86	4.6±0.87	4.5±0.87	0.926

All values were expressed as Mean±SD. FVC – Forced Vital Capacity, FEV_1- Forced Expiratory Volume in 1sec., $FEF_{25-75\%}$- Forced Expiratory Flow-$_{25-27\%}$, PEFR- Peak Expiratory Flow Rate.

Table 2: Comparison of PFT parameters FVC, FEV1, PEFR, FEF25-75% Pre exercise, at 0 minutes, 10 minutes, 20 minutes by applying ANOVA in Group II.

Variable	GROUP-II (n=30)				
	Pre exercise	Immediately after exercise	10 mins	20 mins	P Value
FVC(L)	3.6±0.34	3.4±0.38	3.5±0.33	3.4±0.45	0.132
FEV1 (L)	2.8±0.45	2.7±0.41	2.7±0.41	2.6±0.45	0.426
PEFR (Lper min)	6.6±0.99	6.4±1.07	6.5±1.08	6.4±1.06	0.778
$FEF_{25.75\%}$(L/sec)	4.1±0.7	4.1±0.44	4.1±0.7	4.1±0.7	0.978

All values were expressed as Mean±SD.FVC – Forced Vital Capacity,FEV_1- Forced Expiratory Volume in 1sec., $FEF_{25-75\%}$- Forced Expiratory Flow-$_{25-27\%}$,PEFR- Peak Expiratory Flow Rate.

Table 3: % Fall in PFT parameters FVC, FEV I%, FEF 25-75%& PEFR in Group I (n=30)

Sex	FVC >10% Fall	FEV I % >10% Fall	FEF 25-75% >35% fall	PEFR >10% Fall	Postive EIB response
M (n=18)	0	-	-	-	0
F (n=12)	4	-	-	-	4

M=male, F= female, FVC – Forced Vital Capacity, FEV_1- Forced Expiratory Volume in 1sec., $FEF_{25-75\%}$- Forced Expiratory Flow-$_{25-27\%}$, PEFR- Peak Expiratory Flow Rate.

Table 4: % Fall in PFT parameters FVC, FEV I%, FEF 25-75%& PEFR in Group II (n=30)

Sex	FVC >10% Fall	FEV I % >10% Fall	FEF 25-75% >35% fall	PEFR >10% Fall	Postive EIB response
M (n=17)	1	1	-	4	6
F (n=13)	2	4	-	-	6

M=male, F= female, FVC – Forced Ventilatory Capacity, FEV_1- Forced Expiratory Volume in 1sec., $FEF_{25-75\%}$- Forced Expiratory Flow-$_{25-27\%}$, PEFR- Peak Expiratory Flow Rate.

CONCLUSION

From our study we concluded that first degree relatives of asthmatic patients have higher exercise induced bronchial lability as compared to healthy controls with no history of atopy.The abnormal bronchial lability in first degree relatives asthmatics was found to be associated with trigging mechanism. In reference to PFT parameters, the reduction in FVC ,FEV1 and PEFR was most sensitive measures for identifying EIA. The exercise induced bronchial lability is much higher in apparently healthy relatives of asthmatics patients as compared to healthy controls.

Conflict of Interest: Nil

Source of Funding: Self

Ethical Clearance: Obtained from College and Hospital Ethical committee

Units of Measurements

AGE (Yrs)

WEIGHT (Kg)

HEIGHT (cm)

BMI (kg/m^2)

FVC(L)

FEV1 (L)

PEFR (Lper min)

FEF25.75% (L/sec)

HR(b/m)

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Association between BMI and Cardiovascular Response to Acute Stress in Young Indian Adults

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ABSTRACT

Introduction: Obesity is a commonly encountered health problem in the young adult population of today. The aim of our study was to determine the effect of obesity on cardiovascular reactivity to acute stress in young adults.

Method: This study was done on 60 subjects divided into two groups. The subjects were aged between 18-22 years and were classified into two groups based on their body mass index (BMI): Group 1: BMI: 18-22.9 and Group 2: BMI>23. The cardiovascular reactivity was assessed by measuring the percentage rise in pulse rate and blood pressure following an isometric hand-grip test.

Results: A significant rise in pulse rate and blood pressure was seen following the hand-grip test. Its level of significance being higher in group 1 compared to group 2.

Conclusion: The results of our study suggest a blunted cardiovascular response to acute stress in the obese compared to the non-obese.

Keywords: *cardiovascular reactivity, isometric hand-grip test, obesity*

INTRODUCTION

Obesity or deposition of excess body fat is a known risk factor for numerous health problems particularly of the cardiovascular system like hypertension, coronary heart disease and cardiac arrhythmia. [1-2]

The mechanism linking central adiposity to cardiovascular disease might be due to an exaggerated response of the sympatho-adrenal system to stress. [3-4]

Rise in blood pressure due to increased BMI have been linked to an imbalance in autonomic activity, cardiovascular response to stress, insulin sensitivity, plasma lipid profile derangement, vascular endothelial dysfunction and activity of the Reticular Activating System. [5-6]

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It is important to understand which of the indices of adiposity affects cardiovascular functioning, to help in developing guidelines for preventing the development of Hypertension in the future.[7]

Few studies have been done in India to assess the effect of BMI on cardiovascular response to acute stress. Some authors have selected subjects of the similar age group as ours [8-10], while others have concentrated on a younger age group [11] or on older age group. [12-13] A variety of different stressors have been used besides isometric hand grip test, such as exercise induced stress [14], cold pressor test [12] or even psychological stress. [13]

Only few studies have addressed the relationship between general adiposity , central adiposity and cardiovascular responsivity to stress in the youth[15-17]

The **aims and objectives** of our study were:

1. To determine various anthropometric parameters and cardiovascular response to acute stress in young adults.
2. To correlate the findings of the cardiovascular response to anthropometric measures

MATERIAL AND METHOD

This study was carried out under the STS programme of ICMR for undergraduate students over a period of two months.

Sampling technique: convenient sampling technique

Study type: cross sectional study

Subject selection: Total 60 subjects were selected to be a part of the study. All the subjects were studying in the first and second professional of MBBS. The participants were of both the sexes and were aged between 18-22 years. They were divided into two groups based on their BMI. There were 30 participants in each group

Group 1- BMI – 18.0 to 22.9

Group 2- BMI > 23

The revised BMI cut-off for Asians as recommended by WHO was considered to classify subjects as normal weight and overweight/obese .[18]

Institutional Ethical Clearance, was taken after approval of the project by ICMR and written informed consent was taken from each of the subjects.

Inclusion criteria

1. Adults of both the sexes aged between 18-22 years

The following type of subjects were excluded from the study:

1. Subjects with history of cardiopulmonary disease
2. Chronically ill subjects
3. Medication for long duration
4. History of any major surgery
5. Subjects undergoing any physical conditioning programme

Anthropometric parameters recorded

1. **Weight:** Weight was measured to the nearest 0.5kg in a standard state of clothing, using a digital weighing scale[8]
2. **Height:** Height was measured to the nearest 0.5 cms using a standardised stadiometer[8]
3. **Waist circumference:** This is the minimum circumference between the costal margin and the iliac crest (in cms). It is measured in the horizontal plane with the subject standing.[19]
4. **Hip Circumference**: This should be measured around the widest portion of the buttocks[20]

The various anthropometric parameters measured were used to calculate the following:

1. Quetlet index: ratio between weight (Kg) and height (m^2) [19]
2. W/H ratio: ratio of the waist circumference and hip circumference (in cms)

Effect of acute cardiovascular stress: Acute cardiovascular stress was given to all the participants using an isometric hand -grip test. Hydraulic Hand Dynamometer was used - Model No. SH5001, Made by Saehan Corporation, Korea

The participants used the dominant hand while using the hand-grip. They were asked to contract the dynamometer with maximum effort which is called their maximum voluntary contraction (MVC). Each participant performed this thrice at an interval of 1 minute and maximum of the three readings was considered for each of the subjects.[21]

The participants were instructed to hold the hand grip at 30% of the MVC for 1 minute in the sitting posture

- Blood pressure and pulse rate were recorded at the baseline level and after 1 minute of performing the hand-grip test from the non-exercising arm
- The percentage rise in pulse rate and blood pressure due to isometric exercise was calculated from the pre-exercise and 1-minute exercise values.[21]

STATISTICAL ANALYSIS

All Statistical analysis was performed using Statistical Package for Social Sciences (SPSS) version 17 software for windows (SPSS, INC, Chicago, IL). The results are presented in mean ± SD. Both paired and unpaired 't test' was used to make comparison of the different parameters. Pearson's correlation coefficient was used to find the association of various indices of adiposity with cardiovascular reactivity.

OBSERVATIONS AND RESULTS

Total 60 subjects have been included in this study, divided into two groups of 30 each. The age and sex distribution of the subjects can be seen in **Table 1**. The values are expressed as mean ± SD.

Table 1: Age and sex distribution of the subjects

	Age (yrs)	No of Males	No of Females
Group 1	19.71 ± 1.08	15	15
Group 2	19.42 ± 1.04	15	15

All the various indicators of obesity were significantly higher in the obese compared to subjects with normal weight (**Table 2**)

Table 2: Anthropometric profile of the study population

Variable	Group	N	Mean	Standard Deviation	Significance
BMI (kg/m^2)	1	30	19.77	1.75	<0.01**
	2	30	30.12	3.92	
Waist Circumference (cms)	1	30	69.45	6.93	<0.01**
	2	30	86.85	7.02	
Hip Circumference (cms)	1	30	87.25	6.32	<0.01**
	2	30	98.10	5.76	
Waist/ Hip ratio	1	30	0.79	0.05	<0.01**
	2	30	0.88	0.03	

** -P value < 0.01 – very highly significant

The blood pressure and pulse profile of the subjects can be seen in **Table 3**, where no significant difference in the various cardiovascular parameters was seen when comparison was made between the two groups

Table 3: Comparison of SBP, DBP and PR between the two groups before and after hand-grip

Variable	Group	N	Mean	Standard Deviation	Significance
SBP before (mmHg)	1	30	109.00	8.22	0.55
	2	30	110.70	9.54	
SBP after (mmHg)	1	30	117.20	7.88	0.55
	2	30	118.80	8.93	
DBP before (mmHg)	1	30	75.30	4.60	0.54
	2	30	76.40	6.54	
DBP after (mmHg)	1	30	78.60	5.92	0.24
	2	30	80.90	6.17	
Pulse rate before (beats/min)	1	30	79.35	8.65	0.27
	2	30	76.95	4.37	
Pulse rate after (beats/min)	1	30	84.85	7.90	0.66
	2	30	83.90	5.64	

There was an increase in the blood pressure and pulse rate following the hand-grip test. However, its level of significance was higher in group 1 as compared to group 2 (**Table 4**)

Table 4: Comparison of SBP, DBP and PR before and after hand grip in the two groups

		N	Group 1	Significance	Group 2	Significance
SBP(mmHg)	Before	30	109.00	<0.001**	110.70	<0.01*
	After	30	117.20		118.80	
DBP(mmHg)	Before	30	75.30	<0.001**	76.40	<0.01*
	After	30	78.60		80.90	
PR(beats/min)	Before	30	79.35	<0.001**	76.95	<0.01*
	After	30	84.85		83.90	

* - P value < 0.01, ** - P value < 0.001

On correlating the various parameters of obesity with cardiovascular reactivity, no significant findings were seen in both the groups **(Table 5)**

Table 5: Correlation of adiposity indices with cardiovascular reactivity in the two groups (N=30 in each group)

Variable	Groups	%RSBP		%RDBP		%RPR	
		P value	r value	P value	r value	P value	r value
Weight (Kg)	1	0.79	-0.063	0.61	0.122	0.67	-0.103
	2	0.99	-0.002	0.94	-0.016	0.81	0.057
BMI (Kg/)	1	0.55	0.143	0.33	0.229	0.28	-0.253
	2	0.56	0.134	0.86	-0.042	0.46	-0.170
WC (cms)	1	0.62	-0.119	0.66	-0.105	0.56	-0.137
	2	0.80	0.058	0.60	0.122	0.40	0.196
HC (cms)	1	0.79	0.062	0.50	-0.161	0.46	-0.175
	2	0.85	0.044	0.74	0.077	0.12	0.346
W/H ratio	1	0.34	-0.225	0.96	0.011	0.93	0.023
	2	0.88	0.035	0.60	0.123	0.35	-0.213

% RSBP: Percentage rise in Systolic Blood Pressure at 1 minute of isometric handgrip exercise, %RDBP: Percentage rise in Diastolic Blood Pressure at 1 minute of isometric handgrip exercise, % RPR: Percentage rise in Pulse Rate at 1 minute of isometric handgrip exercise

DISCUSSION

In our study, all anthropometric parameters were significantly higher in the obese compared to the non-obese. The parameters of cardiovascular reactivity showed a lesser rise following isometric handgrip test in the obese as compared to the controls. No significant correlation was seen between the adiposity indices and cardiovascular reactivity in both the groups.

A similar study was done in India on obese females, in the same age group as ours however, their results showed increased cardiovascular reactivity in the obese group as compared to controls.[8] One of the main reasons for difference in findings could be that only female subjects have been selected compared to our study where both males and females have been included.

Many authors like us have reported a lesser increase in the cardiovascular response in the obese as compared to normal weight subjects [22-23], while others have reported their results to be opposite to ours. [24] There are several factors that could have resulted in these controversial results: features of the participants like age, gender, medication history, use of oral contraceptive pills and smoking habits.[25]

Studies that have reported results like ours may be because of the stringent exclusion criteria applied along with the comprehensive statistical adjustments they have

done at the time of analysis.[22] Excessive fat deposition in the tissues leads to increase in the level of hormones like glucocorticoids and catecholamines that influence the body's ability to maintain allostasis .[26] Due to this the individual's stress system may become burned out leading to reduction in his capacity to respond to environmental stress. [27-28]

In a study in the year 2013, a negative correlation was seen between cardiovascular reactivity and abdominal obesity. [29] These results may be due to the strict exclusion criteria applied and the homogenous nature of the sample under study. It has been seen that autonomic regulation may be separately influenced by stress and abdominal obesity and these two factors may also interact to influence the cardiovascular response.[29]

Similar findings have been reported by Burch et al,[30] who found that participants with a high BMI exhibited blunted systolic blood pressure and heart rate reactivity to acute stress.

This reduced sympathetic activity may also contribute to maintenance of the obese state in adults [31] resulting in a disordered homeostatic mechanism thus promoting excessive storage of energy.[32]

A study was done in Odisha to correlate the cardiovascular changes following the hand-grip test with BMI, Body fat percentage, Fat Free Mass and Fat Free Mass Index. They like us did not find any significant correlation between changes in HR and BP and the various indicators of obesity.[33]

LIMITATIONS OF THE STUDY

Since the number of subjects were small, hence the following factors were not considered:

1. The effect of gender on cardiovascular reactivity has not been seen.
2. The overweight and the obese have not been differentiated.

CONCLUSION

The results of our study suggest a lower increase in blood pressure and pulse rate in the obese compared to those with normal weight following the hand-grip test. It becomes essential to understand how adiposity influences the cardiovascular reactivity in young individuals to help in framing guidelines for prevention of cardiovascular morbidities in the future.

Conflict of Interest: Nil

Source of Funding: self

Ethical Clearance: taken from Institutional Ethical Committee

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A Study of Hemoglobin Concentration in Different Phases of Menstrual Cycle

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ABSTRACT

Introduction: The menstrual cycle is a window into the general health and well-being of women, and not just a reproductive event**.** The hormonal changes occurring during menstrual cycle not only affect oocyte maturation and the endometrial and vaginal environment but can also have an effect on a number of other physiological & biochemical phenomena. Hemoglobin being one of the hematological parameters, our present study was conducted to see if there is any variation in the hemoglobin concentration during the three phases of menstrual cycle, because of cyclical hormonal fluctuation or blood loss during menstrual phase.

Aim and Objective: To study the hemoglobin concentration in different phases of menstrual cycle.

Methodolgy: The study was conducted in 100 medical and dental students of Navodaya medical college, Raichur. 2ml venous blood sample was collected under asceptic precautions, and the sample was analysed using automated hematology analyzer.

Results: The hemoglobin concentration in the present study was 11.013±1.198, 11.421±1.218, 11.789±1.10 during menstrual, proliferative and secretory phase respectively.

Conclusion: Our study showed an increase in hemoglobin concentration from menstrual phase to secretory phase which was due to the cyclical fluctuations of oestrogen and progesterone during different phases of menstrual cycle.

Keywords: *Hemoglobin, menstrual phase, secretory phase, hormones*

INTRODUCTION

The normal reproductive years of the female are characterized by monthly rhythmical changes in the rates of secretion of the female hormones and corresponding physical changes in the ovaries and other sexual organs. This rhythmical pattern is called the female monthly sexual cycle or, less accurately, the menstrual cycle[1.] There are three phases of menstrual cycle namely; menstrual phase (MP), proliferative phase (PP) and the secretory phase (SP). The regular cyclic changes may be explained as a phenomenon for periodic preparations for fertilization and pregnancy[2]. The duration of menstrual cycle is between 21-35 days, with a mean of 28 days[3].

The duration is about 4 – 5 days and the amount of blood loss is estimated to be 20 to 80 ml with an average of 50 ml [3.] Menstrual blood is predominantly arterial, with only 25% of the blood being of venous origin[2].

The menstrual cycle is a window into the general health and well-being of women, and not just a reproductive event**.** The hormonal changes occurring during menstrual cycle not only affect oocyte maturation and the endometrial and vaginal environment but can also have an effect on a number of other physiological & biochemical phenomena[4,5]

Hemoglobin being one of the hematological parameters, our present study was conducted to see if

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there is any variation in the hemoglobin concentration during the three phases of menstrual cycle, because of cyclical hormonal fluctuation or blood loss during menstrual phase.

METHODOLOGY

The study comprises of 100 girls between the age group of 18-25 yrs. 2ml venous blood sample was collected under aseptic precautions during a single cycle in three different phases of their menstrual cycle.

Method of collection of data: All the subjects were selected from Navodaya Education trust, Raichur belonging to 1st year MBBS and 1st year BDS. The study was approved by the Ethical clearance committee of NMCH & RC, Raichur. Informed consent for the test was obtained from the students who fulfilled the criteria for the study.

Inclusion criteria:

- Females in the age group of 18-25 years
- Females with regular cycles
- Unmarried

Exclusion criteria:

- Females with irregular cycles
- Presence of anaemia
- History of any gynaecological, endocrinal disorder

The subjects were clinically examined, proper and relevant history was noted, recording of vital signs were done. Assessment of hemoglobin was done using 2ml venous blood which was drawn under asceptic precautions and transferred into EDTA tube. The samples were collected on three different days during the menstrual cycle in a single subject as follows;

- First sample on 2nd day of the menstrual cycle
- Second sample on 11th day of the menstrual cycle, (Proliferative phase) and
- Third sample 8 days before the onset of next menstrual cycle (Secretory Phase)

The collected blood sample was used to estimate the hemoglobin using automated analyzer.

STATISTICAL ANALYSIS [6,7]

Descriptive statistics such as mean, SD, percentage etc was used to present the data. Data were expressed in mean ± SD. The significance of difference among the groups was assessed by repeated measures analysis of variance (ANOVA) followed by post hoc Tukey-Kramer Multiple Comparisons Test for normally distributed data and Friedman test followed by post hoc t test for non-normally data using SPPS v16.0. A two-tailed p-value less than 0.05 were considered as significant.

Statistical software: Statistical analysis of data was performed by SPPS v16.0

RESULTS

Presentation of data:

Table No. 1 shows the baseline parameters

Table No. 2 shows repeated ANOVA with post hoc test of results for hemoglobin levels during different phases of menstrual cycle.

Table No.3 shows the percentage change in hemoglobin concentration during different phases of menstrual cycle.

95% CI for the mean Hemoglobin concentration in gm% % is shown in Graph No. 1

Table No.1 Anthropometric measurements of the subjects (n=100)

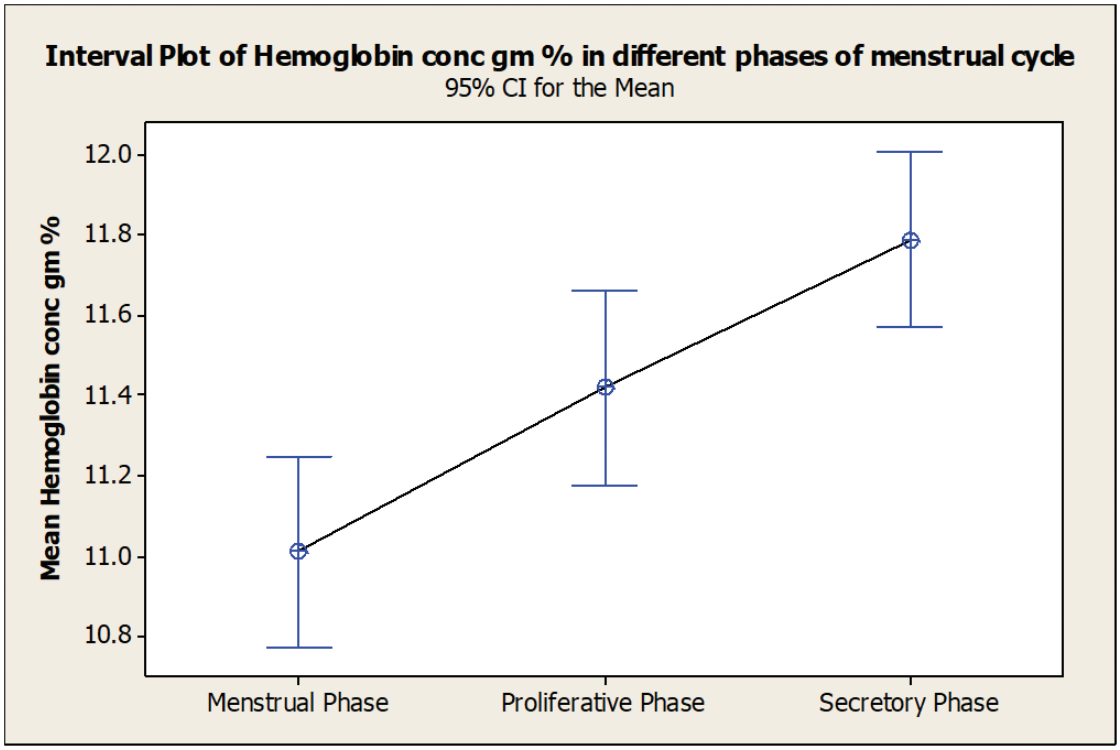
Parameters	Minimum	Maximum	Mean ± SD
Age (yrs)	18	19	18.03 ± 0.171
Height (meters)	1	2	1.52 ± 0.018
Weight (Kg)	40	70	51.69 ± 5.462
BMI	18	30	22.39 ± 2.13

Table No. 2: Repeated ANOVA with post hoc test of results for hemoglobin levels during different phases of menstrual cycle.

Parameter	Menstrual Phase	Proliferative Phase	Secretory Phase	F-value	p-value	Post hoc test
Hemoglobin conc Gm %	11.013 ± 1.198	11.421 ± 1.218	11.789 ± 1.10	20.398	P<0.0001	MP vs PF, q= 4.747, p<0.01 MP vs SP, q= 9.029, p<0.001 PF vs SP, q= 4.282, p<0.01

Table No. 3: Percentage change in hemoglobin concentration during different phases of menstrual cycle.

Phases	MP-PF	PF-SP	MP-SP
Hemoglobin	3.70	3.22	6.58



Graph No. 1: Interval plot of hemoglobin concentration in different phases of menstrual cycle

DISCUSSION

The study was done to assess the changes in hemoglobin concentration during three phases of regular menstrual cycle. The hemoglobin concentration in the present study was 11.013±1.198, 11.421±1.218, 11.789±1.10 during menstrual, proliferative and secretory phase respectively. The percentage change in hemoglobin concentration during menstrual phase and secretory phase was 6.58, which was high when compared between, menstrual phase and proliferative phase (3.70) and proliferative phase and secretory phase (3.22). There was statistically significant increase in hemoglobin concentration from mentrual phase and secretory phase. Usha Rani et al. found increase in hemoglobin concentration and RBC count from menstrual phase to secretory phase which was not significant[4]

Some studies showed that hemoglobin concentrations were significantly lower in follicular phase than in the luteal phase [8,9] .Oestrogens exert several effects that could reduce haemoglobin concentration and thus the haematocrit values. Oestrogens cause fluid retention, depress erythropoietin synthesis and reduce the bone marrow response to available erythropoietin. However,

progesterone antagonises these effects[10]. The blood loss during menstruation results in a negative iron load in women and increases the risk for developing iron-deficiency anaemia.[11, 12, 13, 14]

In some studies, there is a non-significant difference in the haemoglobin concentration, red blood cell concentration and haematocrit during the menstruation and follicular phase of the menstrual cycle[15] .The significant difference in haemoglobin concentration may be due to increased erythropoiesis to compensate for the loss of blood during menstruation.

Studies also show that there can be increase in red blood cell count and haemoglobin concentration from the early menstruation phase until the post ovulatory phase with a subsequent decline towards the end of the menstrual cycle[16]

In a similar study done by Mali patil et al, found a insignificant increase in hemoglobin concentration from menstrual phase to secretory phase [17] which was significant in our study.

CONCLUSION

In the present study there was increase in the hemoglobin concentration from menstrual phase to secretory phase which is due to the cyclical fluctuations in the oestrogen and progesterone.

Source of Funding: Self

Conflict of Interest: Nil

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Effect of Body Fat Percentage on Cognition in Males & Females

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ABSTRACT

Introduction: In the average young adult male 15% of body is composed of fat. Increased body fat % impairs cognition in multiple ways. In the previous studies though the effect of body fat % on cognition was studied, the cognition was assessed by single parameter like Auditory reaction time (ART) or Visual reaction time (VRT) or Critical flicker fusion frequency (CFFF) and no study has revealed the effect of gender on the relation between body fat % and cognition. Therefore this study has been under taken to study the effect of body fat% on cognition as assessed by ART, VRT and CFFF in males & females.

Aims & Objectives :

1. To study the effect of body fat % on cognition as assessed by ART, VRT & CFFF.
2. To know the effect of gender on the relation between body fat % and cognition.

Materials & Methods: The study was conducted on 20 male subjects with mean age 27.4 ±7.5 years and 20 female subjects with mean age 25.65 ± 4.3 years (P =0.37). In all the subjects body fat percentage was measured by Total body fat analyser (Model no: ST-102) M/S High Cedar Enterprises (Taiwan) Co. Ltd. Cognition was assessed by : 1. Auditory Reaction Time 2. Visual Reaction Time and 3. Critical Flicker Fusion Frequency. These parameters were assessed for males and females separately and the effect of gender on the relation between body fat % and ART,VRT, CFFF was analysed.

Results: In males increased body fat % with in normal range is associated with increase in Visual Reaction Time (r = 0.106) & decrease in Critical Flicker Fusion Frequency (r = - 0.187) Where as Auditory Reaction Time is unaffected by body fat % (r =0.087) . In females increased body fat % with in normal range is associated with decrease in Visual Reaction Time (r = – 0.11) and increase in Critical Flicker Fusion Frequency (r = +0.123) where as Auditory Reaction Time is unaffected by body fat % (r = 0.075)

Conclusion: In our study we have found that, increase in body fat % with in normal range in males is associated with increase in Visual Reaction Time , decrease in Critical Flicker Fusion Frequency. where as in females increase in body fat % with in normal range is associated with decrease in Visual Reaction Time & increase in Critical flicker Fusion Frequency. Auditory Reaction Time is unaffected by body fat % in both males & females.

Keywords: *Body fat % - Auditory Reaction Time- Visual Reaction Time - Critical Flicker Fusion Frequency.*

INTRODUCTION

In the avaerage young adult male, 18% of the body weight is protein and related substances,7% is mineral, and 15% is fat. The remaining 60% is water. [1] According to Ulric Neisser, the term " Cognition " refers to all the processes by which the sensory input is transformed, reduced, elaborated, stored, recovered and used.[2] Cognition can be assessed by 1. Auditory Reaction Time 2. Visual Reaction Time & 3. Critical Flicker Fusion Frequency

Increased body fat % is associated with an increased risk of developing nerve conduction slowing and small fibre neuropathy, increased sensory threshold would alter reaction time. Impairment in attention and mental

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flexibility can influence the speed of mental processing and response time. The Cytokines, Chemokines and Tissue necrosis factor secreted by Adipose tissue can cross the blood brain barrier and alter brain functions. Abnormal level of Adipokines result in abnormalities in myelination which could cause disrupted axonal transmission. Therefore neuronal and myelin abnormalities along with axonal degeneration might be responsible for the impairment of cognition as reflected by the prolongation of reaction time and decrease in CFFF.[3]

Women generally have a higher percentage of body fat than men. There exists gender related differences in body fat distribution, regional fatty acid storage, mobilization, oxidation & proportion of energy derived from fat during exercise.[4] Therefore there exists gender based differences in the effect of body fat % on cognition. . Therefore this study has been under taken to study the effect of body fat% on cognition as assessed by ART, VRT & CFFF in males & females.

MATERIALS & METHODS

The study was conducted on 20 male subjects with mean age 27.4±7.5 years and 20 female subjects with mean age 25.65 ± 4.3 years (P = 0.37) In all the subjects body fat % was measured by Total body fat analyser, Model no: ST-102 M/S High Cedar Enterprises, Taiwan Co. Ltd. Cognition was assessed by : 1. Auditory Reaction Time 2. Visual Reaction Time & 3. Critical Flicker Fusion Frequency. These parameters were assessed for males and females separately and the effect of gender on the relation between body fat % and ART,VRT, CFFF was analysed.

Visual Reaction Time & Auditory reaction Time: VRT & ART were recorded using an in house built device called PC 1000. It has a 1000Hz square wave generator & two modules A and B, each has one key with which we can start & stop the oscillator. Module A has start button & module B has stop button. The visual stimulus is a red colour light which is 5 mm in size (LED – Light emitting diode). In module ' A' when ' start ' button is pressed, the red light will glow in module- B, for which the subject has to press 'stop' button in module – B. The number of oscillations produced by the oscillator in this period is recorded as reaction time with an accuracy of 1 msec. Auditory Reaction Time is also recorded in a similar way. The only difference between ART & VRT is, the subject will hear a tone of 1000 Hz in head phones instead of Red colour light in the determination of Auditory Reaction Time.

Determination of CFFF: CFFF was measured using an in house built device. This device can lit a Red colored light emitting diode which is 5mm in size with frequencies in the range of 10Hz to 60 Hz (Square wave) and it is driven by a software called as SweepGen.exe, (V3.7.4.36,2014-sep-06). The subject will be seated in front of the module at near vision distance of 25-30 cms, in a less illuminated room. To begin with the test, the Red light is made to flicker at low frequency of 10Hz and the subject is asked to prompt when the flickering stops. Now the frequency is gradually increased in steps of 1Hz. The frequency at which the subject is no longer able to discriminate individual flickers and he starts perceiving it as a single stimulus is recorded & reported as CFFF. We can try the same in the decremental order of frequency to identify at what frequency he perceives the flicker. [5]

Table 1: Table showing mean age of male & female subjects & p-value

Gender	Mean age	P-value
Males	27.4 ±7.5	0.3715
Females	25.65 ± 4.3	

P < 0.05 -Significant

Table 2: Table showing r-values & p-values for various parameters

	Body fat%	ART	VRT	CFFF
Males	21.4%	0.08	0.10	-0.18
Females	31.87%	0.07	-0.11	+0.12
p-values	0.0000002	0.22909	0.1707	0.60301

P < 0.05 –Significant

RESULTS

In males increased body fat % with in normal range is associated with increase in Visual Reaction Time (r = 0.106) & decrease in Critical Flicker Fusion Frequency (r = - 0.187) Where as Auditory Reaction Time is unaffected by body fat %(r =0.087) . In females

increased body fat % with in normal range is associated with decrease in Visual Reaction Time (r = – 0.11) and increase in Critical Flicker Fusion Frequency (r = +0.123) where as Auditory Reaction Time is unaffected by body fat % (r = 0.075).

DISCUSSION

According to ulric Neisser, the term cognition refers to all the processes by which the sensory input is transformed, reduced, elaborated, stored, recovered and used. Cognition is affected by multiple factors like ageing, gender, obesity, neurological, ophthalmic & haematological disorders, psychiatric conditions etc.

According to WHO, obesity is defined as abnormal or excessive fat accumulation that may impair health. In the year 2016, over 650 million adults were obese i.e., 13% of the world's adult population (11% of men and 15% of women) were obese. The worldwide prevalence of obesity nearly tripled between 1975 and 2016. Although previous studies have established that, increased body fat % above normal range impairs cognition, no study has assessed the effect of increased body fat % within normal range on cognition. In the previous studies, Cognition was assessed by a single parameter like ART, VRT or CFFF. Therefore this study has been under taken to know the effect of increased body fat % within normal range on Cognition. In our study Cognition was assessed by ART, VRT and CFFF.

The reaction time is the interval between the onset of the stimulus and the initiation of the response under the condition that, the subject has been instructed to respond as rapidly as possible. The reaction time is an indirect index of the processing capability of the Central Nervous System and a simple means of determining the sensory motor performance.[3]

Critical flicker fusion frequency is the frequency at which successive flashes of light that are presented are perceived as steady continuous light.[6] Critical flicker fusion frequency serves as a measure of total processing capacity.[7]

Previous studies have shown that, increase in body fat % impairs cognition by multiple ways like increased risk of developing nerve conduction slowing and small fibre neuropathy, increased sensory threshold would alter reaction time. Impairment in attention and mental flexibility can influence the speed of mental processing and response time. The Cytokines, Chemokines and Tissue necrosis factor secreted by Adipose tissue can cross the blood brain barrier and alter brain functions. Abnormal level of Adipokines result in abnormalities in myelination which could cause disrupted axonal transmission. Therefore, neuronal and myelin abnormalities along with axonal degeneration might be responsible for the impairment of cognition reflected by the prolongation of reaction time and decrease in critical flicker fusion frequency.

Women generally have a higher % of body fat than men. There exists gender related differences in body fat distribution, regional fatty acid storage, mobilization, oxidation & proportion of energy derived from fat during exercise.[4] Therefore there exists gender based differences on the effect of body fat % on cognition.

In our study we have found that, increase in body fat % with in normal range impairs cognition in males as evidenced by increase in visual reaction time & decrease in critical flicker fusion frequency and in females increase in body fat % with in normal range has a positive effect on cognition as evidenced by decrease in visual reaction time and increase in critical flicker fusion frequency. Where as Auditory reaction time is unaffected by body fat % in both males & females. Further studies with larger sample size may be required to establish our findings.

CONCLUSION

In our study we have found that, increase in body fat % with in normal range in males is associated with increase in Visual Reaction Time , decrease in Critical Flicker Fusion Frequency . whereas in females increase in body fat % within normal range is associated with decrease in Visual Reaction Time & increase in Critical flicker Fusion Frequency. Auditory Reaction Time is unaffected by body fat % in both males & females. Further studies with larger sample size may be required to establish our findings.

Conflict of Interest: Nil

Source of Funding: Self

Ethical Clearance: Institutional Ethical Committee.

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A Comparative Study of the Impact of Musical Training on Auditory Evoked Potentials

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ABSTRACT

Human brain alters itself according to the environmental demands. Previous studies have proved that musical training induces structural changes in the brain. Long-term musical training is an intense, multisensory and motor experience and offers an ideal opportunity to study structural brain plasticity in the developing brain in correlation with behavioral changes induced by training. Hence the study was conducted to know the differences in the audiological responses in musicians and nonmusicians.

The study included 30 musicians (vocalists) and 30 non-singers in the age group of 19-22 years. Auditory Evoked Potentials of both ears was recorded in a quiet semi-darkened and air-conditioned room by RMSEMGEPMK II software. On statistical analysis, it was found that musicians had lesser absolute latencies for waves I, III, IV and V exhibiting a significant p-value (<0.05). No significant difference was seen with wave II absolute latency. Interpeak latencies of waves I-III, I-V and III-V did not differ significantly between the groups. V/I Amplitude ratio was not significant between musicians and non-musicians.

Keywords: *Auditory Evoked Potentials, Musical training, Absolute and Interpeak Latencies*

INTRODUCTION

Music is an important part of human culture. Beyond its mood-altering effects, engagement in musical activities is purported to improve skills in many areas, including but not limited to memory, attention, spatio-temporal skills, language, social skills, and mathematical ability.[1] Recently neuroscience has revealed that such intensive learning experiences involve changes in brain function and/or anatomy.[2] Repeated practice optimizes neuronal circuits by changing the number of neurons involved, the timing of synchronization and the number and strength of excitatory and inhibitory synaptic connections. Several studies show that musical training and acoustic environments have complex impacts on the auditory system.[3]

Musical training primes musicians for listening challenges beyond music processing suggesting that, akin to physical exercise and its impact on body fitness, music is a resource that tones the brain for auditory fitness.[4] Therefore, the role of music in shaping individual development deserves consideration.

Auditory evoked responses are electrophysiologic recordings of responses from within the auditory system that are activated by sounds. The evoked transient responses can be recorded upto 500 milliseconds from time of onset of the sound stimulus. The evoked potentials of the first 10 milliseconds i.e. Short Latency Response (SLR) is popularly known as Auditory Brainstem Response (ABR)/Brainstem Evoked Response Audiometry (BERA).[5]

Brainstem Evoked Response Audiometry (BERA) is a far – field recording of the synchronized response of numerous neurons in the auditory pathways within the brainstem. It was first described by Sohmer and Feinmesser.[6]

BERA is generated with 100µs rectangular pulse or clicks and recorded with surface electrodes placed on the forehead and mastoid or ear lobes. Recording consists of a series of vertex positive peaks traditionally labelled with Roman numerals I to V. Primary application of

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BERA is as a tool for estimating audiometric thresholds, assessing integrity of auditory pathway till the level of brainstem, newborn hearing screening, monitoring eighth nerve and auditory brainstem function during certain neurotologic operations.[7]

It has long been established that recording of brainstem responses to sound is a valid and reliable means to assess the integrity of the neural transmission of acoustic stimuli [8] and also that many International committees recommend BERA for audiological testing as it is efficient, cost-effective, accurate & non-invasive. Hence we are using Brainstem Evoked Response Audiometry (BERA) to see whether musical training effects auditory processing of sound. The auditory brain has an awesome capacity to change through experience.[9] Music and speech are two cognitively demanding auditory stimuli. Previous research confirms that musical training modifies cortical organization.[10] However, less is known about how long term complex sound experiences such as music, shape subcortical circuitry. Hence this study is undertaken to investigate whether individuals with musical training have enhanced brainstem auditory responses.

AIMS AND OBJECTIVES

To compare the Auditory Evoked Potentials in musicians and non-musicians

- Absolute latencies of waves I, II, III, IV & V
- Interpeak latencies of waves I-III, III-V & I-V
- Amplitude Ratio of wave V-I

MATERIALS AND METHOD

The study included 30 right handed young adults (male) who have had atleast 5 years of continuous formal musical training in singing and were recruited in the musician group. 30 right handed age matched young adults (male) with no musical training either in singing or instrumental music were included in the non-musician group. Institutional Ethical approval was taken before beginning the study. All participants were in the age group of 19-22 years and were having normal hearing. Written informed consent was taken from the participants followed by detailed history taking and thorough ENT examination before recording Auditory Evoked Potentials (AEP).

Procedure: The participants were subjected to AEP testing on RMSEMGEPMARKII software manufactured by RMS Recorders and Medicare system, Chandigarh. Recording was done in a quiet and semi-darkened room with an air conditioner maintaining the room temperature constant. Surface electrodes were placed at vertex (CZ), both mastoids (Ai and Ac) and forehead (ground). The resistance was kept below 5K. Monoaural auditory stimulus (Rate –11.1/second) consisting of rarefaction clicks was given through electrically shielded earphones. Contralateral ear was masked with pure white noise of 40dB. A band pass of 150-3000Hz was used to filter out undesirable frequencies in the surroundings. Responses to 2000 click presentations were averaged.

Parameters studied: Absolute latencies of waves I, II, III, IV and V; interpeak latencies (IPL) of I-III, I-V and III-V and amplitude ratio V/I were considered from the recording for comparison among musician and non-musician group.

The results were expressed as mean and standard deviation. Unpaired t-test was used for intergroup comparisons, p-value of 0.05 or less considered as statistical significance.

OBSERVATIONS AND RESULTS

Mean age of musicians was 20.13 $\pm$ 0.86 years and that of non-musicians was 20.30 $\pm$ 1.17 years which was not significant.

Comparison between right and left ears of musicians: There was no significant difference in the absolute latencies of waves I, II, III, IV & V and that of interpeak latencies of waves I-III, I-V & III-V on both the sides in the musician group. Amplitude ratio of V/I on both the sides was also not significant in case of musicians. (Table 1)

Comparison between musicians and non-musicians: Absolute latencies of Wave I, III, IV and V were significantly lesser in the musician group ($p < 0.05$) where as that of Wave II did not differ much between the musician and non-musician groups (Table 2, Graph 1). There was no significant difference in the interpeak latencies and also amplitude ratio of V/I between the musician and non-musician groups.

Table No. 1: Comparison of BERA parameters in left and right ears of musicians

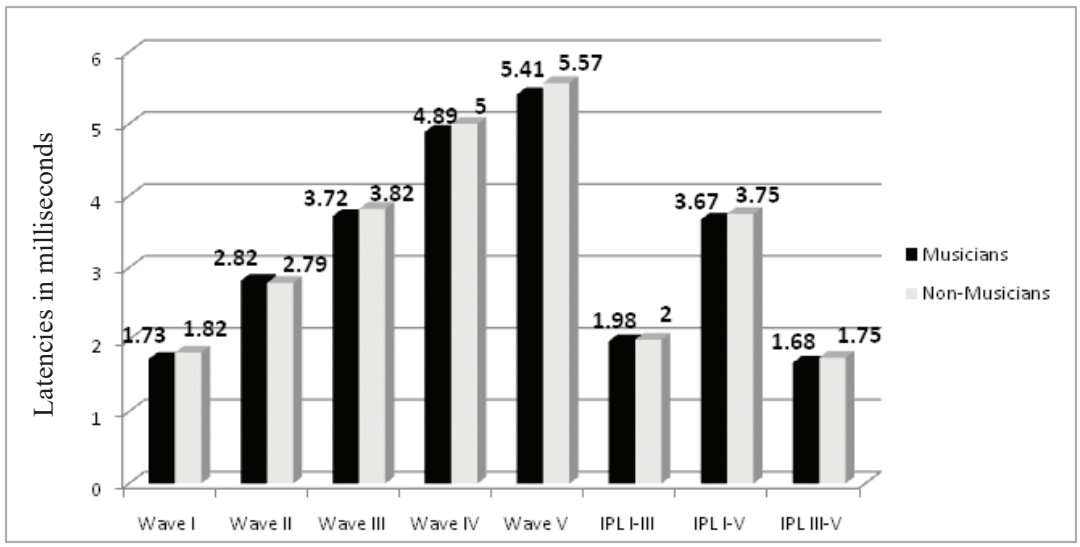
Measurement	Left Ear			Right Ear			Left v/s Right ear	
	N	Mean	SD	N	Mean	SD	P	Significance
I	30	1.73	0.18	30	1.80	0.14	0.15	NS
II	30	2.82	0.19	30	2.76	0.17	0.2	NS
III	30	3.72	0.14	30	3.7	0.15	0.62	NS
IV	30	4.95	0.12	30	4.96	0.13	0.85	NS
V	30	5.41	0.24	30	5.46	0.25	0.39	NS
I-III	30	1.98	0.21	30	1.90	0.19	0.12	NS
I-V	30	3.67	0.27	30	3.66	0.29	0.9	NS
III-V	30	1.68	0.28	30	1.75	0.28	0.3	NS
V/I	30	2.85	1.72	30	2.16	1.52	0.1	NS

Unpaired t – test : NS - Non Significant

Table No. 2: Comparison of BERA parameters in musicians and non-musicians

Measurement	Musicians			Non-Musicians			Musicians v/s Non-Musicians	
	N	Mean	SD	N	Mean	SD	P	Significance
I	30	1.73	0.18	30	1.82	0.15	0.04	S
II	30	2.82	0.19	30	2.79	0.15	0.45	NS
III	30	3.72	0.14	30	3.82	0.19	0.03	S
IV	30	4.89	0.18	30	5.00	0.23	0.04	S
V	30	5.41	0.24	30	5.57	0.27	0.016	S
I-III	30	1.98	0.21	30	2.00	0.24	0.81	NS
I-V	30	3.67	0.27	30	3.75	0.30	0.27	NS
III-V	30	1.68	0.28	30	1.75	0.27	0.33	NS
V/I	30	2.85	1.72	30	2.12	1.51	0.09	NS

* Unpaired t test : HS – Highly significant, NS – Non significant , S-Significant



Graph 1: Comparison of absolute and interpeak latencies between musician and non-musician groups

DISCUSSION

This study investigating brainstem auditory responses included subjects in the age group of 19–22 years. We have used AEP for assessing hearing which has important characteristics- it gives the electrophysiological response of hearing without being subjective, the result of this study is not affected by anaesthetics or sedatives, AEP is rapid, easy and relatively cost-effective test which is both highly specific and sensitive.

With regard to AEP latencies, the amount of variations observed between the musician and the non-musician group were remarkable. The purpose of comparison of various parameters of AEP in both the musician and the non-musician groups was to determine the presence or absence of correlation of these waves with formal musical training in singing.

In this study, we observed that the absolute latencies of waves I, III, IV and V were significantly lesser in the musician group ($p < 0.05$) compared to non-musicians. Earlier studies have reported that the absolute latency of wave V is a consistent and stable parameter which has received primary attention as a valuable factor in response evaluation.[10]

Similar electrophysiological auditory responses were recorded by Wong et al,[11] Lee et al,[12] Parbery Clark et al,[13] Bidelman and Krishnan[14] and Strait et al.[15]

Interpeak latencies (in milliseconds) of I – III and III–V did not differ significantly between the groups. The I-V IPL reflects neural conduction time between the auditory nerve and brainstem nuclei and reflects upon the efficiency of the auditory pathway.[16] Earlier studies have revealed that changes in the interpeak intervals may be related to changes in neural conduction velocity associated with myelination and / or changes in synaptic efficiency of various nuclei of auditory pathway. Amplitude ratio of V/I also was not statistically significant between the two groups.

Changes in waveform morphology of Auditory Evoked Potentials (in terms of decrease in latency and increase in amplitude) are considered to indicate an increase in neural synchrony and strengthened neural connections.[17]

A study by Trainor et al[18] revealed that the brisk audiological responses in musicians indicated neuroplasticity as an effect of musical training. Long term musical training translates into increase in neural synchrony and strengthened neural connections in musicians. Neuroplasticity refers to any change or modification in the central nervous system because of any adaptation or experience to environmental demands. Neuroplasticity denotes changes of structural or functional conditions along with changes at the system or cellular level. Music demands cognitive and neural challenges, which needs precise and accurate timing of many actions. Enhanced auditory perception in musicians is a likely outcome from auditory perceptual learning due to years of practice and training, which are prerequisites for inducing neuroplasticity.

According to Schneider et al,[19] both the neurophysiology and morphology of Heschl's gyrus have a strong effect on musical aptitude. A similar study by Ragert et al[20] revealed stronger capability for plastic reorganization and points to enhance learning abilities implicating a form of meta-plasticity in professional musicians. Hoenig et al[21] reported functional magnetic resonance imaging (fMRI) for conceptual processing of visually presented musical instruments activating auditory association cortex and encompassing adjacent areas in the superior temporal sulcus, as well as right posterior superior temporal gyrus and the upper part of middle temporal gyrus only in musicians, but similar activation was absent in non-musicians. Hence, intensive experience and training in musicians provide a connection between conceptual brain systems and auditory perceptual skills.

Pre-attentive processing is the unconscious collection of auditory stimuli from the environment. At the point when auditory stimuli or sound waves strike the tympanic membrane, message is sent to the brain by means of the auditory nerve for pre-attentive processing. It is hypothesized that musicians have superior pre-attentive auditory discrimination compared to non-musicians.

CONCLUSION

It can be concluded that musical training and experience have a positive effect on the central auditory nervous system and this can be inferred by superior cortical auditory evoked potentials in musicians compared to non-musicians by different auditory stimuli.

Conflict of Interest: Nil

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Autonomic Function Tests between Yoga Practitioners and Controls

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ABSTRACT

Background: In the present age, a great emphasis is being laid on the practice of yogic postures as a form of highly effective physical exercise for keeping the body healthy and also for the control of disease process.

Objective: to evaluate the cardiovascular autonomic function tests among yoga practitioners.

Methods: 90 healthy volunteers (aged 18-35 years)were divided in to three groups; the first two yoga groups (each group, n=20) consisted of subjects who were practicing the yoga (pranayama and suryanamaskarams) for less than 2 years and more than 2 years, respectively and the third group was controls (n=30). Autonomic function tests were performed for both sympathetic and parasympathetic activity, which include deep breathing test, valsalva maneuver, heart rate response to standing posture (30:15 ratio), orthostatic hypotension test and sustained hand grip test.

Results: The statistics showed a significant value for heart rate variability, 30:15 ratio,hand grip test, othrostatic hypotension test and valsalva ratio in group 1 and 2 yoga practitioners ($p<0.05$) than in controls. But no significant difference observed in terms of resting heart rate in all groups. The overall ewing's autonomic dysfunction score was high in controls compared to yoga practicing subjects (($p<0.05$).

Conclusion: It is clear that yoga develops an ability to control cardiovascular autonomic functions and would prepare the body to overcome stress by modulating and optimizing sympathetic activities.

Keywords: *Yoga, Cardiac autonomic Tests, Heart Rate, Deep breathing test*

INTRODUCTION

Yoga is an ancient philosophic system that originated in India whose main objective is the development of the union of mind and body through exercise, respiration and meditation in order to achieve physical and mental well being[1,2]

The most popular branch of yoga is Hatha Yoga, which consists of a combination of postural exercises (Asanas), relaxation and voluntary breathing exercise (Pranayamas). One of the simplest parts of yoga is Pranayama the control of breath. Pranayama helps in the voluntary control of breathing and autonomic centers (chakras - yogic terms) [3]. Suryanamaskar is considered as the best exercise as it consists of important Yogasanas and Pranayamas [4,5].

The Pranayama and its advantages are skillfully incorporated in Suryanamaskar, so Suryanamaskar is an appreciated exercise among all ages from kids to old aged people. Regular practice of Suryanamaskar significantly show reduction in pulse rate, attributed to increased vagal tone and decreased sympathetic activity[6,7]. Decreased sympathetic activity in turn reduces catecholamine secretion and also leads to vasodilation leading to improvement in peripheral circulation. It is also observed that regular yogic practices reduce basal metabolic rate and resting oxygen consumption. All these may be responsible for reduction in resting pulse rate

Yogic practices alter the hypothalamic discharges leading to decrease in sympathetic tone and peripheral resistance and hence the diastolic blood pressure. The

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comparative study of the effect of regular practice of yoga on cardiac functions, is important to better understand its effects on healthy individuals and to provide the basis for the possible use of yoga techniques as alternative treatment module. Hence, the present work was intended to study the beneficial effects of yoga exercises pranayama and suryanamaskarams on cardio vascular autonomic functions.

METHODOLOGY

This study was conducted on 70 healthy students and volunteers aged between 18-35 years of either sex (M 40: F30) from colleges of Guntur area of AP and yogic centres. Subjects were divided into 3 groups: the yoga group 1 (n=20) who had less than 2 years of yoga practicing and the yoga group 2 (n=20) who had more than 2 years of yoga practicing and 3rd group served as healthy control (n=30) . Subjects included in the study were non alcoholic, non smokers, not taking any type of medication and were having similar dietary habits. The study protocol was explained to the subjects and written consent was obtained. Approval by ethical committee of NRI Medical college, Guntur was obtained. All the volunteers were clinically examined to rule out any systemic diseases. Yoga group 1 and 2 were trained under the guidance of a certified "yoga" teacher. They were carrying out yoga exercises (pranayama and suryanamaskarams) in a prescribed manner for atleast 50-60 minutes every day. The set of pranayama performed by yoga groups were Kapalbhati Pranayama, Anulom-Vilom Pranayama (alternate nostril breathing) and Bhramari (honeybee sound during expiration). Regarding suryanamaskar, the participants were already trained to perform suryanamaskar in a slow manner so that each of the 12 poses were held for a duration of 30 seconds. Each round took 6 minutes to complete and 5 rounds were performed in 30-40 minutes. Previously, suryanamaskar pretraining was given for seven days by a yoga trainer and the performance of suryanamaskar was analyzed using performance chart. Practice started at (6.30 am) on an empty stomach in a clean, ventilated, quiet, and pleasant room.

The cardiovascular autonomic function tests were performed on the subjects. The battery of tests performed include resting heart rate, deep breathing test, valsalva maneuver, heart rate response to standing posture (30:15 ratio), orthostatic hypotension test and sustained hand grip test. They were simple, reliable and non-invasive. The presence of cardiac autonomic dysfunction was assessed by Ewing's criteria [8,9]. Results of these tests were graded as normal (score 0), borderline (score 1) or abnormal (score 2). Overall autonomic dysfunction was expressed as a score on a ten-point scale. The data was suitably arranged in to suitable tables under different headings and one way ANOVA and multiple comparisons were done to compare the cardiovascular indices between the 3 study groups. The mean difference was considered significant when $p < 0.05$.

Table 1: Anthropometric measurements in yoga and control groups

Parameter	Yoga Group 1 and 2	Control Group
Height (m)	1.79± 0.07	1.71± 0.09
Weight (kg)	60.69±7.91	58.3 ± 5.69
BMI (Kg/m2)	21.24±2.58	20.39 ± 1.91

Table 2: Comparison of cardiovascular autonomic function tests in 3 groups

Groups	Mean±S.D	P. value
Resting Heart Rate (bpm)		
Controls	77.07± 5.312	>0.05
Yoga group 1	74.13±6.312	
Yoga group 2	75.16±3.300	
Deep Breathing Test(bpm)		
Controls	11.77±4.67	P< 0.001
Yoga group 1	18.86±5.69	
Yoga group 2	17.96±5.58	
Standing to lying ratio (30:15 ratio)		
Controls	1.040±0.021	P< 0.01
Yoga group 1	1.055±0.028	
Yoga group 2	1.054± 0.029	
Valsalva Ratio (VR)		
Controls	1.1622±0.0633	P< 0.001
Yoga group 1	1.1965±0.0593	
Yoga group 2	1.1964±0.0570	
Orthostatic Test (mm Hg)		
Controls	10.48±6.881	P< 0.01
Yoga group 1	8.68±6.487	
Yoga group 2	8.40±7.157	
Hand Grip Test (mm Hg)		
Controls	11.77±4.671	P< 0.01
Yoga group 1	18.86 ±5.699	
Yoga group 2	17.96±5.586	

RESULTS

Anthropometric measurements in yoga and control groups are displayed in Table 1. There was significant difference observed in terms of heart rate variability, heart rate response to standing (30:15 ratio), sustained hand grip test, orthrostatic test and valsalva ratio in yoga performing subjects($p<0.05$) compared to controls. Even though there was a decrease in resting heart rate in both yoga groups compared to controls, but it was not statistically significant (Table 2) . The overall ewing's autonomic dysfunction score was higher in controls than in yoga subjects . This difference was statistically significant ($p<0.05$).

DISCUSSION

Cardiovascular autonomic function test are to asses the status of autonomic nervous system and circulatory system . in modern civilization, stress is the predisposing factor for number of diseases in man psychiatric illness, peptic ulcers, cardiac problems, respiratory diseases, G.I diseases and neuro – endocrine problems. Studies have demonstrated that yogic practices decrease the incidence of stress diseases and maintain the health . yoga also proved to be effective in reducing the dose of the drugs prescribed for chronic illness . the present study is undertaken to compare the autonomic cardio – vascular function in yoga trained individuals and controls group in the 18–31 years .Stress is common in the middle age individuals of all categories . The findings of this study showed n a decrease in resting heart rate among both yoga groups. The present findings were consistent with previous studies by Telles et al (2004) [10], Pratima M et al (2002) [11] and Udupa et al (1975) [12], who had reported that the resting HR decreases after six months of yoga training.

HR and BP response to standing is a measure of cardiac parasympathetic function. Our results showed there was a significant increase in terms of 30:15 ratio in both group 1 & 2 yoga subjects compared to controls. This finding was similar to the results observed by Harinath et al (2004) [13]. Changing from lying to standing position produces an integrated response of cardiovascular system which includes alteration in heart rate and blood pressure. So there is a transient fall in blood pressure on standing with stimulation of carotid baroreceptor and consequent reflex tachycardia and peripheral constriction

As observed in our study, there was a significant increase in valsalva ratio in the subjects of both group 1 and 2 practitioners compared to controls . Valsalva maneuver is a test done to assess the low and high pressure baroceptor integrity.

During deep breathing, changes in heart rate occur primarily because of alterations of vagal-cardiac activity. An impairment of this system can lead to depressed heart rate variability. Decreased HRV is related to cardiac mortality [14]. Our study showed an increased HRV in both yoga groups when compared to controls, which indicates that there is a decrease in sympathetic activity. There was a fall in SBP (orthrostatic test) in both yoga group 1 and 2 than the controls, which again confirms the fact that there is decrease in sympathetic tone.

B.P response to sustained hand grip test in three groups showed significant values. The values in yoga group 2 was higher compared to other groups. This is due to beneficial effect of yoga. The basis for this change in yoga group could be rapid adjustments of circulatory and respiratory parameters during maximum voluntary contraction in sustained handgrip. The onset of cardiac acceleration almost instantaneously follows the start of muscular activity. The initial phase of acceleration is induced through inhibition of cardiac vagal tone, followed by increased activity of sympathetic accelerator nerves. This causes rise in heart rate and blood pressure [15,16]. However, regular practice of yoga increases the baroreflex sensitivity and decreases the sympathetic tone, thereby restoring blood pressure to normal level in patients of essential hypertension was reported by Vijaya Lakshmi et al[17].

There are large number of studies have been carried out to observe physiological effects of prolonged physical training. Bagchi B.K. and Wenger M.A, found changes in autonomic nervous system during 'yoga'. They observed that vagal tone increasesand sympathetic tone decreases after "yoga" practice [18]. K.Joshi studied effect of yoga on cardiac parameters and found that there was decrease in pulse rate and blood pressure [19]. Gharote M.L, studied effects of "yoga" in high school boys and concluded that there was increase in parasympathetic tone after "yoga" [20]. Tulpule T.H et. al, concluded that "asana" practice in patients of myocardial infraction helps in early ambulation and reduced complications[21].

Over all, there was significant difference in terms of HRV, orthostatic blood pressure, heart rate response to standing,hand grip test and valsalva ratio after yoga exercises reflecting a decrease in sympathetic activity and an increase in parasympathetic activities (vagal tone). Additionally there was significant increase in overall CAN scores in controls compared to yoga groups. Hence the practice of yoga and pranayams would benefit the population as it would prepare them in overcoming stress by modulating and optimizing sympathetic activities in stressful situations thereby immediately restoring equilibrium. Further, with yoga there is a gradual build up of inhibitory tone or parasympathetic tone with reduction in the heart rate and decrease in the systolic and diastolic blood pressures.

CONCLUSION

The present study showed an improvement in the activity of cardiac autonomic functions in yoga practitioners. It is evident that yoga can be prescribed as an adjuvant therapy to cardiovascular diseases . However, further work with larger series of yoga subjects and controls is expected to yield more data on this issue with more precise statistical evidence and possibility of wider application of the studies on various yoga techniques.

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Lung Function Tests Between Adult and Children Residents of Kozhikode City, Kerala

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ABSTRACT

Background: Pulmonary function tests has evolved as tools for physiologic study in assessing respiratory status during last few decades. Predicted normal spirometric values have been shown to have significant geographical and ethnic variation.

Objective: To investigate the spirometric measurements in adults and children of Kozhikode city,Kerala.

Methods: the study composed of children and adult group > adult group consists of 30 males and 30 females in age of 19-22 years and in children group, 30 boys and 30 girls of 7-10 years old were selected. The basic spirometric parameters studied were Tidal Volume (TV), Inspiratory Reserve Volume (IRV), Expiratory Reserve Volume (ERV) and Vital Capacity (V.C) by using computerized spirometer [Medspiror]. The data were analysed by using appropriate statistical tests.

Results: A significant reduction in lung volume in children group when compared to the adults groups. Simple spirometric values were significantly lower in adult female than the adult male, but no difference observed between boys and girls in children group

Conclusion: This study showed that the spirometric parameters obtained were normal in both children and adult groups and it collaborates well with the standard values.

Keywords: *pulmonary function tests,children, adult*

INTRODUCTION

In the assessment of lung function the measures of Tidal volume (TV), Inspiratory Reserve volume (IRV), Expiratory Reserve volume(ERV) and vital capacity(VC) are most commonly used. Such measurements, to be of any value, must be compared with expected normal values of the subject. These values may be influenced by a number of factors especially sex, height, age, usual habitat, and ethnic and racial origin of the subject[1]. Estimation of lung volumes are highlighted the functional ability of the lungs by which the blood is perfusing from the alveoli, so that the need of the O_2 to the tissues can be met in a normal manner. Ventilation of the air in to the lungs and the perfusion of blood into the alveoli is called ventilation perfusion ration (0.84). Both ventilation and perfusion is necessary for the normal healthiness and work efficiency of an individual. There are several studies conducted about the estimation of normal ranges of these measurements for each racial or regional group [2, 3, 4, 5]. In this aspect, we planned to make an attempt to analyze the lung volumes in the males and females between the age group of 7-10 and 19 - 22 years of Kozhikode city area. Therefore, the present study is aimed to evaluate the simple spirometric measurements in adults and children of this area and to compare these measurements in adults and children including males, females and boys, girls.

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METHODS

Pulmonary Function Tests (PFTs) was evaluated in Adult and children groups including male, female & boy, girls of Kozhikode city,Kerala India

Source of Data: Adult and children students in this area during the period January 2015-December 2015 were taken for the study.

Sample Size: Pulmonary Function Tests (PFTs) was evaluated in 60 healthy adult group including 30 males and 30 females and compared with that of healthy children group including 30 boys and 30 girls. The subject were selected on the basis of inclusion and exclusion criteria.

Adult Group (n=60):

Inclusion criteria:

1. Healthy
2. Non-smoking males & females
3. age group 19-22 years age

4.College students

Exclusion criteria:

1. Adults below 19 and above 22 years of age
2. Smoker
3. Pregnant women
4. Subject with Cardiopulmonary disease subject having symptoms of cough, wheezing sputum production, dyspnea, hemoptysis.
5. Chest deformities, kyphosis, scoliosis.

Children Group (n=60) :

Inclusion criteria :

1. Healthy
2. Age group between 7-10 years

Exclusion criteria :

1. Children below 7 and above 10 years
2. Smokers
3. Subjects with Cardiopulmonary diseases

A spiroanalyzer was used for this study. General physical examination was done height was measured in standing position and without shoes in centimeter and weight was measured in kilogram.

Based on educational status, the subjects were divided in to two groups.

Group-1: High School educated

Group-2: College educated

Spirometric measurements were recorded by using computerized spirometer [Medspiror].

Test was performed in sitting position. Reference values for spirometry were based on age, sex and height provided in the software.

The whole procedure was explained and demonstrated to the subject before the testing. Later the subject was asked to perform the Tidal volume, Inspiratory Reserve Volume (IRV) , Expiratory Reserve Volume (ERV), Vital Capacity (VC), was recorded after a normal inspiration and expression in to the mouth piece. Pulmonary Function Tests (PFTs) maneuvers were performed and the best maneuvers was selected and accepted

Data were expressed as mean±SD. Student's t-test was used to compare the significance of difference between means.. The level of significance was set at $P<0.05$.

RESULTS

The Pulmonary Function Tests (PFTs) were evaluated in adults and children including males and females of Kozhikode area. Results of Pulmonary Function Tests (PFTs) are shown in tables.

Table 1: Profile of adults & children groups

Variable	Adult group	Children group
Number	60	60
Age (Years)	21 ± 2	10 ± 2
Height (Cms)	156.77 ± 3.03	120 ± 5
Weight (Kgs)	55 ± 5	25 ± 2

As evident from table 1, the mean age in adults group and children group were 21±2 years and 19±2 years. The mean height in adult group and children group were 156.77±3.03 and 120±5 cm. Mean weight of adult group and children group 55±5 and 25±2 Kgs. The adult and children were both literate and belongs to the nandyal, Kurnool District. Andhra Pradesh. India

Table 2: Result of Pulmonary Function Tests(PFTs) in adult and children group

	S. No.	PFT	Males	Females	Total Number	Percentage
Children	1.	Normal	30	30	60	100%
	2.	Abnormal	-	-	-	-
Adult	1.	Normal	30	30	60	100%
	2.	Abnormal	-	-	-	-

Result of Pulmonary Function Tests (PFTs) in adult group. In 60 subjects of adult group, including 30 males & 30 females had normal Pulmonary Function Tests (PFTs) i.e. 100%. Even results of Pulmonary Function Tests (PFTs) of children group showed normal spirometric measurements in both boys and girls. (Table 2, graph 1).

Table 3: Pulmonary Function Tests of males & females in adult group

Test	Adult group		P.Value
	Male	Female	
TV (ml)	500±0	500±0	1
IRV(ml)	2891.66±32.83	1810±175.66	0.125
ERV(ml)	850 ± 78.82	768.33 ± 74.09	1
VC(litres)	4.03±0.56	3.15±0	1

The IRV,ERV and VC values were higher in males when compared to the females in adult group, but were statistically insignificant. Whereas TV was same in both males and females(Table 3)

Table 4: Pulmonary Function Tests of boys & girls in children group

Test	Children group		P.Value
	Boys	Girls	
TV	395±30.37	380±30.34	0.815
IRV	2891.66±32.83	1810±175.66	0.125
ERV	636.66 ± 23.52	630.33 ± 22.68	0.5
VC	1.47±0.794	1.4±0.65	1

The TV, IRV,ERV and VC values were higher in boys when compared to girls in children group (Table 4),but were not statistically significant.

Table 5: Comparison of spirometric values in adult group and children group.

Test	Adult group		Children group		P.Value	
	Male	Female	Boys	Girls	Adult	Children
TV	500±0	500±0	395±30.37	380±30.34	1	0.815
IRV	2891.6±32.83	1810±175.66	518.33 ± 68.83	513.3 ± 65.30	0.0125	0
ERV	850±78.82	768±74.09	636.66±23.52	630.33±22.68	1	0.5
VC	4.03±0.56	3.15±0	1.47±0.794	1.4±0.65	1	1

There was significant decrease in Inspiratory Reserve Volume (IRV) values in children group than the adults. There was significantly decrease in Expiratory Reserve Volume (ERV) values in children group than the adult group ,while a significant decrease in Expiratory Reserve Volume (ERV) values in females than the males was observed (table 5).

As shown in table 5, there was significant decrease in vital capacity values in children group when compared with adult group and even a significant decrease in Vital Capacity values in females than in males. But vital capacity values was insignificant between boys and girls of children group.

DISCUSSION

Pulmonary Function Tests (PFTs) was evaluated in 60 person of adult group and compared with 60 children group. The data collected was age matched. Body size has a tremendous effect on Pulmonary Function Tests (PFTs) values. A small man will have a smaller Pulmonary Function Tests (PFTs) result than a man of the same age who is much larger [5,7]. Normal tables account for this variable by giving predicted Pulmonary Function Tests (PFTs) data for males or females of a certain age and height. As age advances they begin to increase their body mass by increasing their body fat to lean body mass ratio. If they become obese, the abdominal mass prevents the diaphragm from descending as far as it could and the PFTs results will be lower PFTs than expected i.e., the observed values are actually lower than the predicted values.

Race affects PFTs values like Blacks, Hispanics and Native Americans have different PFTs result compared to Caucasians [4,5,6,7,8]. Therefore, a clinician must use a race appropriate table to compare the patients measured pulmonary function against the results of the normal table written for that patient's racial group. Other factor such as environmental factor and altitude may have an affect on Pulmonary Function Tests (PFTs) results but the degree of effect on PFT is not clearly understood.

Our study considers A C Guyton's spirometric values as the reference or standard value [9]. According to the P-value, the tidal volume values were higher in adult group when compared to that of children group, which is due to the difference in lungs size, body mass index, hormonal variation in both adult and children. The Tidal volume was almost equal in male and female subjects of adult group (P value =1 & 0.815, respectively). Even tidal volume was equal in boys and girls of children group. The findings was similar to observation of A.C. guyton reference value.

With reference to 'P' - value, the Inspiratory Reserve Volume (IRV) was higher in adult group when compared to children group ('P' value =0.0125 & 0.5 respectively) ,which is due to the difference in lungs size, body mass index, hormonal variation in both children and adult. The IRV values were higher in the male adults when compared to the female adults. The Inspiratory Reserve Volume (IRV) values in children group was almost equal according to P-value. The findings were similar to the observation of A.C. Guyton.

The Expiratory Reserve Volume (ERV) values were significantly higher in adult group when compared to children group due to the difference in lungs size, body mass index, hormonal variation in both adult and children . In children group ERV values were slightly lower in female group. The Expiratory Reserve Volume (ERV) values were more in adult male when compared to female adults. The finding was similar to the observation of A.C. Guyton. According to the P-value, there was no difference between males and females of adult group and boys and girls of children group ('P' value =1and 1, respectively). The females' vital capacity values in adult group were significantly lower than that of males due to the role of testosterone in males. The finding correlates with that of A.C. Guyton's reference value.

As a person ages, the elasticity of the lungs decreases. This translates in to smaller and smaller lung volumes and capacities. Besides, Chatterjee *et al* proposed that age related decline in pulmonary function measurements might be due to progressive loss of elastic recoil with aging even in absence of impairment by cigarette smoking and pulmonary diseases [10]. Such age related changes might not have appeared in the present young population.

In relation to gender, lung volumes and capacities of males are larger than the lung volumes in capacities of females. Even when males and females are matched for height and weight, males have larger lungs than females. The lung volumes are probably at the peak due to the secretion of the sex hormones like testosterone in males[9]. Testosterone has a predominant role in the development of muscular strength by increasing the muscular mass[9]. Hence the muscle power enable expansion and contraction of the alveoli of the lungs to their best of ability, there by increases the volumes as well as capacities of the lung. In present study, there might be significant role of testosterone in giving the higher values in males. Apart from this, the normal healthiness of alveoli i.e., elastic nature and the proper perfusion of the blood is also necessary.

Pulmonary function tests are sensitive and simple test to identify early respiratory impairment as compared to history and physical examination[4,5]. Our study showed

all simple spirometric parameters were normal in both children and adult groups.

CONCLUSION

The present study showed that Pulmonary Function Tests (PFTs) are significantly decreased in children group than the adult group. Tidal Volume, Inspiratory Reserve Volume , Expiratory Reserve Volume, Vital Capacity were significantly decreased in adult female when compared to the adult male, but no significant difference observed between boys and girls in children group. From the present investigation it can be concluded that the adults and children had normal range of pulmonary function in both the sexes. Further studies in large population are needed to draw a definite conclusion

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State Anxiety Response to Examination Stress in Medical Students-Its Relation to their Adjustment Pattern

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ABSTRACT

Background: Medical students in their first year face extreme stress due to adjustment problems related to professional course environment and its curricular pattern. This added with the stress of facing an academic examination increases the stress response and its associated anxiety with a negative impact on their performance. However, this perceived anxiety depends on the student's coping abilities in such situations.

Aim and Objectives: This study was done to observe the pattern of adjustment / coping & anxiety response to academic evaluation related situations in its natural form and the relation between the two among first year medical students.

Material and Methods: 58 first year medical students were included in the study. Their adjustment pattern and state anxiety were assessed by Bell's Adjustment Inventory (BAI) and State-Trait Anxiety Inventory (STAI) respectively. Anxiety levels were measured during four days related to their regular internal assessment examination (before and after exam situations) and compared with their adjustment profile. Results were expressed in numbers and percentages. Student-t test was used to calculate significant differences of means between good and poor adjusters.

Results: The good adjusters had better social and emotional adjustments and had significantly lower state anxiety ($P < 0.05$) in all situations. Poor adjusters had sustained high anxiety in all the three post exam situations (53%, 59% & 56% respectively).

Conclusion: This study suggests that emotional and social adjustments of a student determine their overall adjustment. Anxiety levels are highest just before facing exam and inversely related to adjustment pattern. Poor adjusters show prolonged anxiety response to an academic stressor and also maintain higher basal anxiety levels.

Keywords: *state anxiety, emotional adjustment, examination stress, medical students.*

INTRODUCTION

Anxiety is a common response to any form of psychological stress, characterized by an abnormal and overwhelming sense of apprehension and fear, often marked by physiological signs of increased sympathetic activity such as, increase in blood pressure, heart rate etc. Mild to moderate anxiety during a stressful situation benefits the person by alerting on the impending challenge to be faced and take necessary action.This anxiety response depends not only on the nature of the stressor and other factors such as anticipation, preparedness, controllability and feedback of the stressful event,but largely on the way it is perceived.[1,2] This difference in perception of a situation as more or less stressful depends on the individual's coping abilities.[3] Coping abilities vary from individual to individual based on factors such as their home and social environments which in turn influences

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their emotional status. Based on these factors, one adopts an active or passive coping strategy in a stressful situation as a fight or flight response.[4] Academic stress is the best accepted model for studies on psychological stress and its psycho-neuro-endocrine correlations.[5] Medical students are subjected to enormous stress during their entire course of study by virtue of its curricular framework & training process.[6] The first year students are said to have the highest stress among all the years, due to the transition from pre-university to professional course in addition to other factors.[7] Failure to adopt appropriate coping strategies in overcoming the academic stress, associated with poor social support has lead to the rise in stress induced disorders such as anxiety, depression, suicidal tendencies & other personality disorders among these students, with a secondary drop in their academic performance.[8-10] Studies done so far correlating academic anxiety and coping/adjustment in medical students have focused on stress response or anxiety levels a few days before facing an academic exam than on the day of exam and have compared the same with their baseline levels of anxiety. However there are no studies to document anxiety response to an academic stressor and its recovery pattern in a natural setting among medical students.Hence this study was done on medical students to observe their anxiety response to an academic stressor of a natural form and the impact of their adjustment/coping abilities on the same.

MATERIALS AND METHOD

This observational study was conducted on first year M.B.B.S. students of a premier medical college in South India. The study was done in the Department of Physiology during the scheduled time of conducting 2nd internal assessment exams and included participants in the age group of 18 – 21 years (both males & females). The study was begun after obtaining the Institutional Ethical Committee clearance. A briefing of the study objectives & design was given to all the 150 students in the class. Subsequent inclusion of students for the study was based on fulfilling the selection criteria.

Inclusion & Exclusion criteria: Subjects aged between 18-21 years, having given written consent & being apparently healthy at the time of study were included for the study whereas subjects with any chronic or acute illness within 3 months before the time of study and with known endocrine disorders or neuro-psychiatric problems were excluded.

A voluntary written consent for participation in the study was obtained from all the 58 students who fulfilled the criteria for inclusion (45 males & 13 females). The participants were given two questionnaires (tools) to answer – (i) **The Bell's Adjustment Inventory (Student form) and (ii) State Trait Anxiety Inventory (State form – Form X-1).**

Description of tools:

Bell's Adjustment Inventory (Student form): A self administered standardized 140 item questionnaire, which provides information on overall adjustment type of an individual by considering its determinants i.e., Home, Health, Social & Emotional adjustments. Answering is done on a "Yes", "No" or "?" basis. Questions included here helps to differentiate the mal-adjusted students from well adjusted students based on cut-off scores for each of the four determinants of adjustment & overall/ total adjustment. A total score ≤44 indicates good overall adjustment whereas >44 indicates poor adjustment.

State Trait Anxiety Inventory (STAI- State form X-1): Also self administered, standardized questionnaire for measurement of state / situational anxiety. Consists of 20 statements which indicates how the respondents feel "at that moment" or "right then", graded on a 4 point Likert scale. A score of ≤ 40 indicates low anxiety whereas > 40 indicates high anxiety (range = 20 – 80).

The Bell's adjustment inventory was administered a day before the commencement of internal assessment whereas the STAI was administered on four days related to the exam process (situations).

The four situations were as follows:

Situation 1: The day of second internal assessment (theory) for all three basic science subjects (one hour before its commencement).

Situation 2: The day after completing exams in all the three subjects (3 days after situation 1).

Situation 3: The day after the results of internal assessment were announced (7 days post situation 1).

Situation 4: 3 days after announcement of the results.

Statistical analysis: Data entry and statistical analysis was performed using MS-Excel and Epi-Info software respectively. Results are expressed in numbers (n) & percentages (%). Student-t test (unpaired) was applied to

determine the significant difference in means & standard deviations (Mean ± SD) of adjustment and anxiety scores. A two tailed P-value < 0.05 was considered statistically significant.

RESULTS

Of the 58 students enrolled for the study, 45 were males and 13 females with the mean age of 18.71± 0.90.

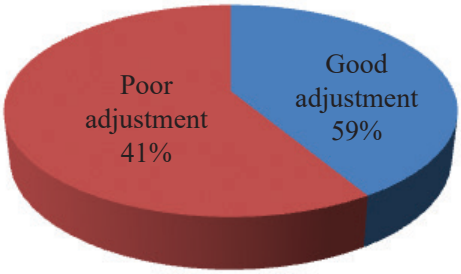
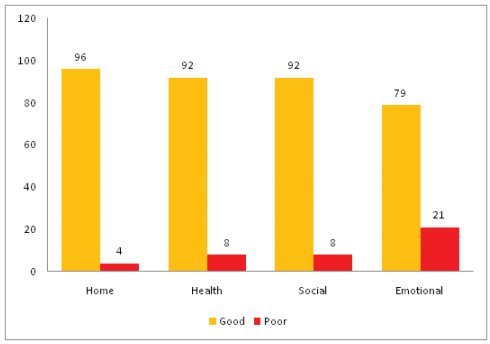
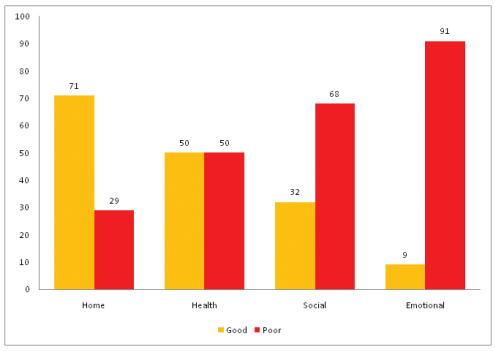


Figure 1: Adjustment pattern among the students based on total adjustment (%).

Figure 1 indicates the adjustment pattern of the students based on their overall / total adjustment. There is predominance of poor adjustment among the students with 34 students (59%) having poor adjustment of the total 58.



(A)



(B)

Figure 2: Pattern of "determinants of adjustment" in Good (A) and Poor (B) adjustment group of students (%).

The percentage of students with poor adjustment in all the four determinants is higher in poor adjustment group. This difference is most evident in social (68% against 8%) and emotional (91% against 21%) adjustments **(Figure 2 A & 2B)**.

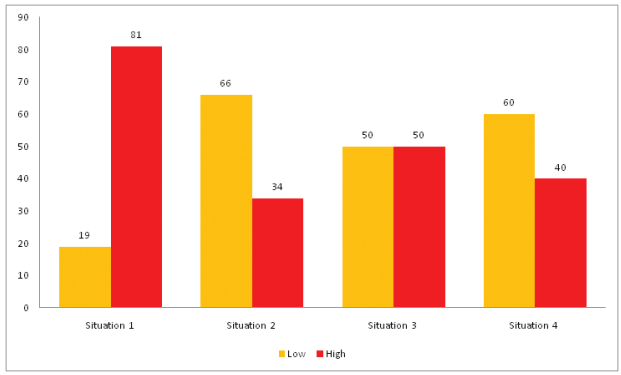
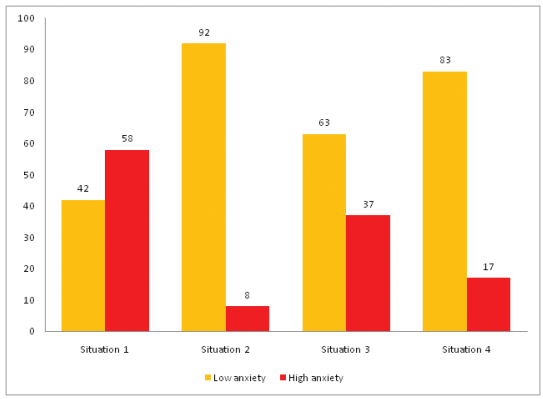
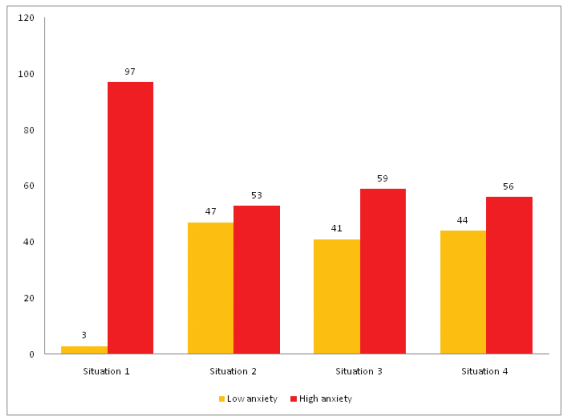


Figure 3: Anxiety pattern in all four situations among the students (%).

The general pattern of state anxiety in the study group as a whole indicates that pre-exam situation (Situation 1) is the most stressful with 81% students having high anxiety compared to the post-exam situations **(Figure 3).**



(A)



(B)

Figure 4: Anxiety pattern in Good (A) & Poor (B) adjustment group of students in all situations (%).

The poor adjusters show dominance of high anxiety individuals in all the four situations with pre-exam situation being maximally stressful compared to the good adjusters 97% against 58% respectively **(Figure 4A & 4B).**

Table 1: Anxiety scores in Good (n=24) and Poor adjustment (n=34) groups of students in all situations (Mean±SD).

Situations	Adjustment	Anxiety	t-value	Significance
Situation 1	Good Poor	45.42±12.21 55.09±9.17	-3.445	P < 0.001
Situation 2	Good Poor	33.17±6.78 42.41±8.74	-4.335	P < 0.001
Situation 3	Good Poor	38.38±8.93 44.94±9.52	-2.652	P < 0.05
Situation 4	Good Poor	34.00±7.93 42.82±8.74	-3.929	P < 0.001
Student-t test, unpaired (two tailed)		**Significance @ P < 0.05**		

DISCUSSION

In this study we documented the adjustment pattern and state anxiety response to a natural form of academic stress (routine internal assessment) in first year medical students and also observed the impact of adjustment on anxiety response.

Adjustment pattern of students: Results of our study clearly indicate that prevalence of adjustment problem in high among medical students in their first year, with 59% of the students having overall poor adjustment **(Figure 1)**. A Singh & S Singh in their study observed that professional students have more adjustment problems in their learning environment than their non-professional counterparts.[10]

Among the determinants of overall adjustment, social and emotional components appeared to have a greater influence on the overall adjustment in these students. 68% and 91% of poor adjusters had low social and emotional adjustments respectively against 8% and 21% in the good adjusters **(Figure 2)**. Monk et.al, observed that medical students have poor emotional adjustment and this was attributed to lack of social support and other personality factors in addition to pattern of the course work.[11] In a Malaysian study on adjustment pattern in students, it was reported that gifted learners have better emotional and social adjustments than their non-gifted counterparts,[12] thus indicating the importance of social and emotional aspects of adjustment in determining the overall adjustment of a student.

State anxiety response to examination stress: Comparison of state anxiety in all the four situations in the study population as a whole indicated that pre-exam situation (situation 1) was the most stressful with 81% students having high anxiety **(Figure 3)**. This high level of anxiety could be due to the unavoidable nature of this stressor and the significance attributed to it, though the students could partially control the same based on their prior experience and preparation. It is well known that the stressfulness of a situation increases when the resources available to overcome it are limited. Studies done by Spangler[13] and Herbert J[14] to document psychological and physiological responses during an exam found heightened state anxiety response only before the exam. A similar observation was made by Ruchi Singh et.al,[15] on medical students during their viva-voce exam.

State anxiety immediately after result announcement (situation 3) was elevated in comparison to other two post-exam situations (situation 2 & 4). This could be due to mixed emotional response (excitement, depression and indifferent) secondary to the outcome of the exams **(Figure 3)**. Croes et.al,[16] observed an increase in cortisol following failure and a decrease following success after a mental task in normal humans compared to endogenously depressed patients who showed little or no change. Vitaliano et.al,[17] in their study on 305 first year medical students identified four different types of students based on a reliable measure of perceived stress – resistors, persistors, adaptors and maladaptors. This implies that the emotional response of the students to success and failure and its associated anxiety depends on their personality type.

Adjustment pattern vs State anxiety response: Poor adjusters in our study showed a significantly higher perceived anxiety compared to good adjusters in all four situations ($P < 0.05 – <0.001$) **(Table 1)**. Another study done on first year medical students also found a similar negative correlation between adjustment and anxiety.[18] Comparison of anxiety patterns in the two groups in all the situations indicated a high pre-exam anticipatory and immediate post-result increase (situations 1 & 3), with a restricted recovery in the poor adjusters (situations 2&4). Further, the persistence of high anxiety in the poor adjusters 4 days following announcement of results of the exam (situation 4) probably indicates a higher basal anxiety in these individuals compared to good adjusters **(Figure 3)**. The coping strategies adopted by an individual under stress is said to determine the anxiety and outcome of the event. The good adjusters probably adopted 'problem focused coping' [19] hence gained better control in situation 1 (pre-exam) and adopted 'emotion focused coping'[20-22] in situation 3 (immediate post-result). The poor adjusters in contrast probably adopted 'avoidance coping'[19] and were also external in their approach towards handling the stress. Spangler[13] in his study to identify psychological and physiological responses during an exam in relation to the personality characteristics observed that, those students who had high ego-resiliency showed more flexible adaptation than the ones with low ego-resiliency both on emotional and physiological levels, whereas subjects with high ego-control exhibited a lower physiological reactivity under both conditions. This implies that emotional and social aspects of adjustment determine the perceived stress of a situation.

CONCLUSION

With the above observations made from the results of this study, we would conclude that, (i) Examination stress in its natural form induces higher state anxiety than an experimental form. (ii) Anxiety response is highest just before facing the exam. (iii) Students with good emotional and social adjustments show lesser perceived stress and more flexible adaptation to stressful situations related to an examination process. Hence it is necessary for all the medical colleges to have a good student support system to guide and help students overcome stress due to adjustment problems faced, particularly in the first year of their medical course.

LIMITATIONS

Since this study is done on students of one particular medical college, the outcome of this cannot be generalized. Factors other than examination stress such as socio-economic status, home-sickness among hostellites and entry level knowledge of the student which could also potentially alter the perceived anxiety was not considered in our study.

RECOMMENDATIONS

We recommend that multi-centric studies including students from medical colleges with creamy and non-creamy layers of students be done to have a more valid and generalized outcome.

Conflict of Interest: Nil

Source of Funding: Self funded

Ethical Clearance: Ethical Clearance was obtained from Institutional Ethical Committee.

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Exclusive Breast Feeding Practices and Nutritional Status of Under Five Children in a Urban Slum

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ABSTRACT

Introduction: Improper infant breastfeeding practice among preschool children has an association with under nutrition and child deaths particularly in developing countries like India. Nutritional status of children of urban slums is worst amongst all urban groups and even poorer than rural average. Hence the present study was taken to investigate the exclusive breastfeeding practices and its effects on nutritional status of preschool children in a urban slum.

Materials and Methods: Mid arm circumference (MAC) nearest to 0.1 cm was noted by standard methods as reported by D.B. Jelliffe. WHO child growth standards age and sex specific Z score values were used for assessment of nutritional status. Information regarding exclusive breastfeeding was obtained from mothers. Data obtained was statistically analyzed using chi square test.

Results: 29.88% boys and 27.17% girls were malnourished. Excusive breast feeding was seen only in 64.36% of boys and 48.91% girls. Malnutrition was less among exclusively breastfed boys and girls when compared to non exclusively breastfed boys and girls.

Conclusion: The present study shows that non exclusive breast feeding is highly prevalent in urban slums, and is significantly associated malnutrition in children. Hence the awareness regarding benefits of exclusive breastfeeding needs to be emphasized in the urban slum areas.

Keywords: *Excusive breastfeeding, Malnutrition, Under five, Urban slum.*

INTRODUCTION

Exclusive breastfeeding (EBF) is defined as giving only breast milk to an infant from birth up to six months of age without giving any other food items including water, except for medicine and vitamins.[1]

Exclusive breastfeeding is recommended by the World Health Organization (WHO) and American Academy of Pediatrics (AAP) as the ideal nutrition for infants and is sufficient to support optimal growth for the first six months of life.[2,3]

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A child's development is affected by various factors like genetic potentiality, family size, socio-economic status, infections, nutrition and the availability of medical care. Among them, nutrition is the most important factor. There are plenty of studies which have shown the beneficial effects of breast feeding on nutritional status of children and its role in prevention of infections.[4]

Nutritional status of children of urban slums is worst amongst all urban groups and even poorer than rural average.[5] Poverty leads to decreased calorie and protein intake. Duration of breast feeding is also reduced by poor socioeconomic condition according to the findings observed by Giashuddin and Kabir (2004).[6]

Improper infant breastfeeding practice among preschool children has an association with under nutrition and child deaths particularly in developing countries like India.[7]

There is limited evidence on relation between exclusive breast feeding and nutritional status among preschool children in a urban slum, hence the present study was taken to investigate the exclusive breastfeeding practices and its effects on nutritional status of preschool children in a urban slum.

MATERIALS AND METHODS

The present study was conducted on 179 under five urban slum children. Among them 87 were boys and 92 were girls. Study details were explained and consent was taken from the parents/guardians of children before collection of data. Ethical clearance taken from Institutional ethical committee.

Sex of the child and Age in completed months was noted. Mid arm circumference (MAC) nearest to 0.1 cm was noted by standard methods as reported by D.B. Jelliffe.[8] For MAC, the right arm was selected, while hanging freely, at its mid point (i.e. between the tip of acromian process of the scapula and the olecranon process of ulna) with the help of a fibre tape. To avoid the compression of soft tissues, the tape was applied gently, but firmly.

WHO child growth standards age and sex specific Z score values were used for assessment of nutritional status. Z score < - 2 standard deviation was taken as malnutrition.[9]

Information regarding exclusive breastfeeding was obtained from mothers.

Data obtained was statistically analyzed using chi square test.

RESULTS

Table 1 shows, prevalence of malnutrition based on mid arm circumference (MAC) among boys and girls. 29.88% boys and 27.17% girls were malnourished.

Table 2 shows, distribution of exclusive breastfeeding among boys and girls. Excusive breast feeding was seen only in 64.36% of boys and 48.91% girls.

Table 3 and 4 show, breastfeeding and malnutrition among boys and girls. Malnutrition was less among exclusively breastfed boys and girls when compared to non exclusively breastfed boys and girls.

Table 1: Prevalence of malnutrition based on mid arm circumference (MAC) among boys and girls.

Nutritional status	Boys	Girls
Normal	61 (70.11%)	67 (72.82%)
Malnutrition	26 (29.88%)	25 (27.17%)
Total	87 (100%)	92 (100%)

Table 2: Distribution of exclusive breastfeeding among boys and girls.

Type of feeding	Boys	Girls
Exclusive breastfeeding	56 (64.36%)	45 (48.91%)
Non exclusive breastfeeding	31 (35.63%)	47 (51.08%)
Total	87 (100%)	92 (100%)

Table 3: Breastfeeding and malnutrition among boys.

Nutritional status	Exclusive breastfeeding	Non exclusive breastfeeding
Normal	50 (89.28%)	11 (35.48%)
Malnutrition	6 (10.71%)	20 (64.51%)
Total	56 (100%)	31(100%)

(*f*=25.05, df=1, P<0.0001)

Table 4: Breastfeeding and malnutrition among girls.

Nutritional status	Exclusive breastfeeding	Non exclusive breastfeeding
Normal	39 (86.66%)	28(59.57%)
Malnutrition	6(13.33%)	19 (40.42%)
Total	45 (100%)	47 (100%)

(*f*=7.21, df=1, P=0.0072)

DISCUSSION

It is known that a child's earlier months of growth are vulnerable, where there is rapid growth with metabolic activity. Breastfeeding can improve children's health and in particular their weight, during early infancy.[4]

MAC appears to be a better predictor of childhood mortality than weight for height.[10] Overall muscle development can be assessed by mid arm circumference

(MAC). MAC is a simple technique and can be easily measured with a young child sitting in front of examiner on mother's lap.[8] Malnourishment is indicated by Poor muscle development or muscle wasting which are characteristic features of all form of protein calorie malnutrition.[10]

In the present study, percentage of malnutrition was 29.88% among boys and 27.17% among girls based on MAC. Our study reveals that both boys and girls showed almost equal percentage of malnutrition. Malnutrition rates in the present study are in agreement with Mishra B K et al, who have reported 27% malnourishment among urban boys and girls taken together.[11]A study by Chatterjee and Saha [12] has revealed 28.6% malnutrition among children. A higher prevalence rates of malnutrition of 58.0% and 64.5% respectively are reported by Mishra and Mishra et al[11] and Mandal G et al[13] using in MAC in their studies.

The data from our study shows that only 64.36% of boys and 48.91% of girls were exclusively breastfed. Similar to present study, Chakrabarty S et al[14] have reported exclusive breast feeding in 52.47% of under five children. The study done on Malawian population by Kuchenbecker et al[15] have reported 43% of exclusive breastfeeding in infants of <6 months age group. The previous study done by MDHS (Malawi Demographic Health Survey) in 2010 reported that 71% of infants (0 – 5 months) were exclusively breastfed.[16] The high rate of non exclusive breast feeding in our study may be due to poor socio-economic status, illiteracy, poor nutrition in nursing mothers of slum area, and also may be due to the fact that many urban slum mothers are engaged in daily labor activities.

In the present study, the percentage of malnutrition was less in exclusively breastfed boys and girls compared to not exclusively breastfed boys and girls and the difference was statistically significant indicating that breast feeding decreases the prevalence of malnutrition. Chakrabarty S et al [14] have reported a undernutritional status of 35.64% (36 out of 101) using MAC among exclusive breast fed under five children. They have also reported that, there was a significant increase in proportion of underweight children with increase in age of children and with delayed initiation of breastfeeding and lower duration of exclusive breastfeeding. Chirmulay and Nisal[17] in 1993 have reported a high prevalence of malnutrition among tribal children of Ahmadnagar who were poorly breastfed and this was significantly related.

In conclusion, the present study shows that non exclusive breast feeding is highly prevalent in urban slums, and is significantly associated malnutrition in children. Hence the awareness regarding benefits of exclusive breastfeeding needs to be emphasized in the urban slum areas.

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Effects of Physical Activity (PAL) on Simple Visual Reaction Time (SVRT) in Healthy Indians - A Pilot Study

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ABSTRACT

Objective: To examine the association between physical activity and simple visual reaction (SVRT) time in a pilot study.

Material and Method: Twenty (20) healthy volunteers of both the genders who were aged between 18 and 50 years were recruited so far in this pilot study. Reaction time (RT), is the elapsed time between the presentation of a stimulus and the subsequent behavioral response to occur. Subjects were presented with green light stimulus for both the genders. The measurement of simple visual reaction time has been used to evaluate the processing speed of central nervous system and the coordination between the sensory and motor system. The physical activity level (PAL) was determined by administering a physical activity level questionnaire developed in the Division of Nutrition, St. John's Medical College, and Bangalore. The PAL is classified as <1.4 as sedentary, 1.55 to 1.75 moderately active, and >1.75 heavily active.

Results: imple visual reaction time (SVRT) is more in lower level of physical activity (PAL) i.e 1.32± 1.4. The visual reaction time is slightly higher in male 0.50±.20 msec. In this study we observed that Simple visual reaction time is prolonged for the persons with higher BMI.

Conclusions: A lower level of physical activity is a risk factor for higher visual reaction time which determines the cognitive function of brain. Reaction time is a measure of function of sensorimotor association and performance of an individual. Simple visual reaction time (SVRT) has physiological significance and is a simple and non-invasive test for peripheral as well as central neural structures.

Keywords: *Simple Visual reaction time (SVRT), Physical Activity Level (PAL), Body mass Index (BMI), Gender*

INTRODUCTION

Reaction Time is defined as the interval of time between the presentation of a stimulus and appearance of appropriate voluntary response in the subject [1]. Luce and Welford described three types of RT. 1. Simple RT: Here there is one stimulus and one response. 2. Recognition RT: Here there is some stimulus that should be responded to and other that should not get a response. 3. Choice RT: Here there are multiple stimulus and multiple responses[2].

Reaction time study is an important method used for central information processing speed and fast coordinated peripheral movement response. It is an external indicator of the ability of the nervous system to receive process and initiate a response to incoming stimuli. Responses that take more time to initiate are assumed to require longer information processing times. Measurement of RT is common method to evaluate psychomotor fitness [3, 4]. RT in response to a situation can significantly influence our lives due its practical implications. Fast RTs can produce rewards (e.g. in sports) whereas slow RT can produce grave consequences (e.g. driving and road safety matters). Factors that can affect the average

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human RT include age, sex, left or right hand, central versus peripheral vision, practice, fatigue, fasting, breathing cycle, personality types, exercise, and intelligence of the subject[5, 6].

Physical inactivity is an important risk factor for development of cardiovascular diseases, the other diseases like non-insulin dependent Diabetes mellitus, obesity, chronic respiratory diseases, osteoporosis, and certain type of cancers make up 60% of all deaths. Physical inactivity would tend to increase the risk of the above diseases and may also decrease the cognitive function. So, we found it necessary to assess the physical activity and how it is related to the reaction time.

Exercise can improve reaction time. Welford in 1980 found that physically fit subjects had faster reaction times [2], and Levitt and Gutin in 1971[9]. showed that subjects had the fastest reaction times when they were exercising sufficiently to produce a heart rate of 115 beats per minute. Kashihara and Nakahara (2005) found that vigorous exercise did improve choice reaction time, but only for the first 8 minutes after exercise[5].

MATERIAL AND METHOD

Twenty male and female volunteers were recruited for the present study. They were aged between 18-50 years [2]. The subjects had no history of diabetes, hypertension, visual and auditory disturbances, alcohol intake, and no history of recent illness from any diseases. Ethical clearance for the study was obtained from the Institutional Ethical Committee. Participation in the study was voluntary and informed consent was taken from every participant.

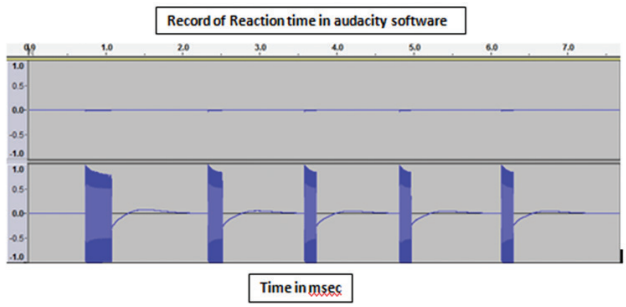
PC 1000 Hertz's Reaction Timer*:* We used an in house build add on device called PC 1000, to measure visual reaction time. PC 1000 is a1000 hertz square wave oscillator which has a soft key for start and stop function. PC 1000 Reaction timer instrument has two components (A &B) connected to each other.

First component (A) has a start button and it is handled by the examiner only.

Second component (B) has a stop button which will be handled by the subject alone and also it has a small red LED which receives the visual stimulus. Red light is selected for the experiment as it persists for a long time in retina.

Component A and component B are in turn connected to a personal computer which has audacity software installed in it. Audacity software records the reaction time in 0.001sec accuracy in wave format[10].

Minimum five trials were given for SVRT measurement. Minimum time recorded was considered as final SVRT.



Physical activity level (PAL): This is used as composite index of Physical activity patterns and is calculated as: 24 hr energy expenditure/basal metabolic rate. 24 hr energy expenditure is calculated as the sum of energy expenditures of all reported activities computed for a single day. Basal metabolic rate is calculated from age and gender specific regression equations recommended by WHO, that include height and weight as predictor variables. Cutoffs for PAL's that describe grades of physical activity are <1.4 =sedentary, 1.55-1.6= moderately active and >1.75= heavily active. Thus, lower PAL's indicate more sedentary physical activity profiles [6,11].

Calculation of 24 hour energy expenditure: The activity reported for one month are recomputed for 24 hours as the sum of energy expenditure related to sleep, occupational energy expenditure, discretionary leisure time energy expenditure and "residual energy expenditure". In order to calculate energy expenditure for each of these components BMR/min is first computed. For every reported activity MET (metabolic equivalent) which is essentially a multiple of BMR is applied. Higher MET 's indicate higher levels of physical activity. "Residual energy expenditure" relates to those periods in a day which are unaccounted for by recall, and for which intensities of activities have to be assumed. Individuals tend to underreport sedentary, therefore we employ a uniform MET of 1.4 for all "residual time" [11].

Calculation of BMI: Anthropometric parameters; height (meters) and weight (kg) were noted for each subject. Height of the subject was measured using a measuring scale whose least count is 0.1 cm. Height of each subject

was converted in unit of metres. Weight was measured using weighing machine whose least count was 0.5 kg. BMI of each subject was calculated using Quetelet's index: BMI= Weight (kg)/Height2 (m) [12].

RESULTS

Mean was calculated for different parameters in each study group. Mean is a measure of central tendency and is the one value around which other values are dispersed. Standard deviation (S.D) which denotes the measure of variability or dispersion from the mean value was calculated. The recorded values were expressed as Mean±SD in Table 1.

Linear regression analysis with Bonferronni correction was carried out to establish the correlation between the groups and to obtain the R value.

Table 1:

Subject characteristics	Male	Female
Age(years)	32±5.52	29.8±5.23
BMI(kg/m^2)	24.3±4.83	20.5±2.40
PAL	1.32±1.4	1.6±0.20
SVRT(sec)	0.5±0.20	0.4±0.10

DISCUSSION

Human reaction time (RT) works by having a nervous system recognise the stimulus. The neurons then relay the message to the brain. The message then travels from the brain to the spinal cord, which then reaches person's hands and fingers. Factors that can affect the average human RT include age, sex, left and right hand, central versus peripheral vision, practice, fatigue, fasting, breathing cycle, exercise and intelligence of the subject[5].

In this pilot study, we have observed that the visual reaction time has decreased with the increase in physical activity level (PAL) in both the genders. There was a decrease of SVRT from 0.5±0.02 msec to 0.4±0.01 msec with increase of PAL score from1.32±1.4 in males' to 1.6±0.in females (Table 1). We could draw a statistical fitment which shows there is a linear correlation between the PAL and VRT with a R^2 value of 0.026 which is significant. In contrary to the some literature, our study showed gender prevalence of female over male [6, 7, 8]. However, according to Skandan et al, mental alertness in the girls from the age of eight years onwards is superior as compared with that in boys as also the latency age in the capacity to use intellectual abilities to a year or two ahead of the boys[13]. In this present study, all the confounding factors like age, BMI, PAL went for the gender female.

There are several problems that confound the assessment of physical activity profiles in India using the existing International questionnaires. First, games sports which are the major components of discretionary leisure activities in developed countries may not be so for the adult population in India. Second, household chores which are often not addressed in the questionnaires may constitute a significant portion of the daily physical activity, especially in non-mechanised households and in housewives and the unemployed. Third, job titles in industrialised and developing countries may have different connotations in terms of actual activity involved in the job[11].

The reaction time is an important component of the motor movements. The reaction time includes the latency in the sensory code which traverses the peripheral and the central pathways, the perceptive and the cognitive processing a motor signal which traversed both the central and the peripheral neuronal structures and finally, the latency in the end effecter activation i.e. the muscle activation [14,15].n. It is one of the important methods to study a person's central information processing speed and the fast coordinated peripheral movement response [16]. In this study, VRT was increased in the overweight individuals when they were compared to the values in the normal weight girls.

In our present study, there was a significant positive correlation found between BMI and simple visual reaction time in males and females in age-matched group. Male had higher BMI of 24.3±4.83 kg/m^2 compared to female 20.5±2.40kg/m^2 in this study(Table 1). This finding is consistent with the observation of Skurvydas that subjects with greater body mass index react significantly slower than others [18]. In this present study, there is a tendency of increase of VRT with linear increase of BMI with a R^2 value of 0.017 which is significant.

Gunstad J et al. showed that the younger and the middle-aged adults (age 21-50 yrs) and the obese individuals had a poorer memory performance when they compared persons across the adult lifespan (age 21-82 yrs). They also showed the relationship between the elevated BMI values and the reduced cognitive performance and suggested that this relationship does not vary with age[19].

CONCLUSION

Our pilot study concluded that there is a slightly prolonged visual reaction time in males compared to females. Visual reaction is lesser in more physically active individuals. Visual reaction time is prolonged for the subjects with higher body mass index (BMI).

Limitation of the study: This is a pilot study. So, lesser number of subjects were recruited and only visual reaction times were measured. We are currently progressing with larger number of subjects and assessment of auditory reaction time is also included in the study.

Conflict of Interest: We declare that there is no conflict of interest.

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Effect of Indian Classical Music Therapy on Depression, Anxiety and Stress Levels in Patients with Depression Measured by DASS-21: A Pilot Study

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ABSTRACT

Background and Objectives: Depression is a common global psychiatric disorder. The use of pharmacotherapy in the treatment of depressive symptoms has some disadvantages, such as side effects, long response time, and poor compliance to the medication regime. Various complementary interventions have been sought to reduce depressive symptoms and music listening can be one of it.[1] Therefore, this study is done to evaluate the effects of Indian classical music therapy on depression, anxiety, and stress levels in patients with Depression.

Method: Depression, Anxiety and Stress levels was assessed by the DASS-21 item questionnaires before and after Indian classical music (Raga-bilahari) therapy in patients with depression.

Results: There was statistically significant changes in depression (p=0.016), anxiety (p=0.018) and stress (p=0.025) scores in depression patients after music therapy.

Interpretation and Conclusion: Indian classical music (Raga-bilahari) therapy is beneficial in patients with depression, showing decreased levels of depression, anxiety and stress levels.

Keywords: *DASS-21, depression, Raga- bilahari*

INTRODUCTION

According to the World Health Organization (WHO), depression is a common psychiatric disorder affecting about 121 million people worldwide and is characterized by persistent low mood which leads to changes in appetite, sleep pattern and overall functioning.[2] Various psychiatric conditions are treated with either psychopharmacological or psychotherapeutic approaches and have been shown to be efficacious in many but not in all patients. For example in depression, only small differences have been found between anti-depressants and active placebos.[3] Recent evidence suggests that depressed young people prefer counselling than medication and active treatment.[4] Hence, the need for additional, innovative forms of therapy for treating psychiatric conditions. Music therapy is one such innovative form of therapy.

Music therapy is defined as " a systematic process of intervention wherein the therapist helps the client to promote health, using music experiences and the relationships developing through them as dynamic forces of change." Music experiences mean musical interaction, which can be either free or improvised. It includes either active music playing by patients or active listening to music or both. Other modes include playing composed music on instruments, singing and writing songs.[5]

The healing force of music is known since ancient times. The ancient Greek philosopher, Plato (428-

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347BC), quoted "music gives wings to mind". Plato considered that music played in different modes would arouse different emotions. Traditional systems of healing in India such as Ayurveda and Yoga systems include various musical treatment approaches. The Indian system of music treatment is defined as an "individualistic, subjective and spiritual art, aiming at personal harmony with one's own being and not at symphonic elaborations. Indian music therapy in contrast to the western form, which has its theoretical background predominantly based on psychotherapy, involves expression of devotional feelings as a key factor. The most common approach used in the Indian form of music therapy is the "raga based approach." This approach is found to be stimulating, anxiolytic, increases attention and is able to target musical preference and listening pattern.[6]

Bilahari raga: Bilahari is a raga in Carnatic music. It is a janyaraga (derived scale from the 29th melakarta scale, Shankarabharanam). It is a combination of the pentatonic scale Mohanam and the Sampurna raga scale Shankarabharanam.[7] Bilahari raga is suitable for the mornings exuding positivity and happiness. It reduces anxiety, pressures, skin diseases and allergies. Bilahari is known for the bhakti rasa that it pours forth. Ragas like bilahari, kedaram and dhanyasi (Prabhat ragas) are sung after sunrise. The ragas sound pleasant when they are sung at the proper time and sure to enhance the mood.[7,8]

OBJECTIVES

1. To assess the depression, anxiety and stress levels using DASS-21 scale before and after Indian classical music therapy along with standard care for depression in the intervention group.
2. To compare the depression, anxiety and stress levels using DASS-21 scale before and after Indian classical music therapy along with standard care in the intervention group, and standard care alone in the control group.
3. To examine whether, the Indian classical music therapy helps reduce symptoms of depression in patients with depression.

MATERIAL AND METHOD

Ethical clearance for the study protocol was obtained from the Institutional Ethical Committee (IEC NO: SIMS&RC/IECC/06/2012). Sample size was calculated from previous literature and 20 participants were enrolled, after taking written informed consent.

This pilot study is a randomized controlled trial with a pre-intervention–post-intervention design consisting of intervention group (n = 10) and a control group (n=10) using simple random sampling method.

Participants were recruited from Sapthagiri Medical College and Research Centre, Bangalore, Psychiatric OPD. Participants were adults (18–50 years of age) with a primary diagnosis of depression according to ICD-10 (F32 or F33) as assessed by Psychiatrist. Musical skills or any given musical background are not required, although these do not prevent from participation. Patients with psychosis, substance abuse, adjustment disorders, and other psychiatric disorders were excluded from the study. The study involved noninvasive procedures with no financial burden on the subjects.

Participants received adequate information regarding aim, benefits, and risks of the study before data collection. Participants in the intervention group listened to Indian classical music (Raga-bilahari) between 10am to 1pm, twice a week, each session lasting 60 minutes over a period of 2 months along with standard care. Thus, the intervention group received a total of 16 sessions of music therapy. The intervention tools included a laptop and a headphone of Hewlett Packard company. Raga-bilahari was recorded in the instrumental form and in vocal form, after obtaining 2 music experts' opinion.

The control group received only the standard care without music therapy. The standard care includes pharmacotherapy with psychiatric counselling.

The degree of patient's depression, anxiety and stress levels were measured using of 21-item Depression Anxiety and Stress Scale (DASS) at baseline i.e before treatment and after 1 month and 2 months of treatment, in the intervention group (Indian classical music therapy along with standard care) and in the control group (standard care alone).

The DASS is a 42-item self-administered questionnaire developed by Lovibond, S.H. and Lovibond, P.F.[9] This scale was designed to measure the magnitude of three negative emotional states: depression, anxiety, and stress. The **DASS- Depression** focuses on self reports of low mood, motivation and self-esteem, **DASS–Anxiety** on physiological arousal,

perceived panic, and fear, DASS–**Stress** on tension and irritability. A respondent indicates on a 4-point scale the extent to which each of the 42 statements in the DASS-21 scale applied over the past week. A printed overlay is used to obtain total scores for each subscale. Higher scores on each subscale indicates increasing severity of depression, anxiety, and stress. Completion takes 10 to 20 minutes. A shorter, 21 item version of the DASS (DASS-21) which takes 5 to 10 minutes to complete is also available. Subscale scores from the shorter questionnaire are converted to the DASS normative data by multiplying the total scores by 2.[10]

The essential function of the DASS is not only to assess the severity of the core symptom of Depression, Anxiety and Stress but a means of which a patient's response to treatment is also measured. DASS provides a comparison of symptoms from week to week, it is best given in first presentation and again after a period of time has lapsed long enough for the chosen treatment to have effect. DASS should be interpreted along side the clinical interview.[11]

In the statistical analysis, mean and standard deviation were used to describe data. Independent t-test, chi-square test of significance and ANOVA were used to analyze and compare the means. P<0.05 was considered the level of significance. Data were analysed by SPSS version (version-18.0) and R environment ver.R.3.2.2. software.

RESULTS

Demographic characteristics: As shown in table 1: In the present study, there was no statistically significant difference in demographic characteristics - age, gender, residence (rural/urban) and education level among participants of two groups (intervention group and control group). The participants of the two groups were demographically matched and comparable.

Table 1: Demographic characteristics of two groups

		Intervention group (n=10) No.(%)	Control group (n=10) No.(%)	P value
Age in years	21-30	2(20%)	4(40%)	0.355[a]
	31-40	5(50%)	5(50%)	
	41-50	2(20%)	1(10%)	
	>50	1(10%)	0(0%)	
	Mean±SD	37.70±8.33	34.20±8.16	
Gender	Female	4(40%)	5(50%)	1.000[b]
	Male	6(60%)	5(50%)	
Residence	Rural	1(10%)	2(20%)	1.000[b]
	Urban	9(90%)	8(80%)	
Education	Upto 10th std	5(50%)	4(40%)	1.000[b]
	Above 10th std	5(50%)	6(60%)	

[a]student t-test [b]chi-square test

Depression score: As shown in Table 2: The baseline (pre-treatment) Depression score of the intervention group was lower than the baseline Depression score of the control group, but statistically not significant (p>0.05). After 1 month of treatment, the Depression score was lower in the intervention group than in control group but statistically not significant (p>0.05). However, depression score was lower in the intervention group compared to control group after 2 months of treatment and was statistically significant(p=0.016).

Anxiety score: As shown in Table 2: The baseline (pre-treatment) Anxiety score of the intervention group was higher than the baseline Anxiety score of the control group, but statistically not significant. (p>0.05). After 1 month of treatment, the Anxiety score was lower in the intervention group than in the control group but statistically not significant (p>0.05). However, the Anxiety score was lower in the intervention group, compared to control group , after 2 months of treatment and statistically significant(p=0.018)

Stress score: As shown in Table 2: The baseline (pre-treatment) Stress score of the intervention group was lower than the baseline Stress score of the control group, but statistically not significant. (p>0.05). After 1 month of treatment, the Stress score was lower in the intervention group than in the control group and was statistically significant (p=0.032). However, stress score was more significantly lower in the intervention group, compared to control group after 2 months of treatment(p=0.025).

Table 2: Changes in Depression, Anxiety and Stress score (Mean±SD) from baseline to 1 and 2 month.

		Intervention group (n=10) Mean ± SD	Control group (n=10) Mean ± SD	P value
Depression scores	Baseline	28.40±13.69	31.40±9.34	0.574
	After 1 month of treatment	14.80±10.80	20.60±8.90	0.206
	After 2 month treatment	3.80±3.05	8.60±4.81	0.016*
Anxiety scores	Baseline	17.00±9.15	14.80±10.92	0.631
	After 1 month of treatment	4.40±4.40	9.00±6.06	0.068
	After 2 month treatment	0.80±1.03	3.60±3.24	0.018*
Stress scores	Baseline	28.80±9.81	34.00±6.99	0.189
	After 1 month of treatment	10.80±8.23	19.80±9.02	0.032*
	After 2 month treatment	1.80±1.75	5.40±4.33	0.025*

*Significant unpaired t-test (p<0.05)

As shown in table 3: A significant (p<0.05) mean change was observed in depression, anxiety and stress scores in both intervention group and control group from baseline to 1 and 2 month and from 1 to 2 month, however, mean change was lower in intervention group than control group.

Table 3 : Mean changes in Depression, Anxiety and Stress score (Mean±SD).

	Difference	Intervention group (n=10) Mean ± SD	Control group (n=10) Mean ± SD
Depression	Baseline to 1 month (P value)	13.60±7.98 (< 0.001**)	10.80±3.29 (< 0.001**)
	Baseline to 2 month (P value)	24.60±11.70 (< 0.001**)	22.80±6.12 (< 0.001**)
	1 month to 2 month (P value)	11.00±7.92 (0.002**)	12.00±4.86 (,<0.001**)
Anxiety	Baseline to 1 month (P value)	12.60±5.66 (< 0.001**)	5.80 ±5.20 (0.006**)
	Baseline to 2 month (P value)	16.20±8.61 (< 0.001**)	11.20±8.33 (0.002**)
	1 month to 2 month (P value)	3.60±3.74 (0.014*)	5.40±3.52 (0.001**)
Stress	Baseline to 1 month (P value)	18.00±7.24 (< 0.001**)	14.20±4.26 (< 0.001**)
	Baseline to 2 month (P value)	27.00±8.75 (< 0.001**)	28.60±6.18 (< 0.001**)
	1 month to 2 month (P value)	9.00±6.68 (0.002**)	14.40±6.45 (< 0.001**)

*2×3 Repeated measures ANOVA (p<0.05)

In the present study, the primary outcome was improvement in the symptoms of depression, anxiety and stress levels in the intervention group (music therapy along with standard care) compared to control group (standard care alone) as measured by DASS-21.

DISCUSSION

Human nervous system processes music in different ways – perceptual processing and emotional processing.[6]

Perceptual processing: Music is primarily made of sound waves and enters the primary acoustic circuit through the outer ear. Human primary acoustic circuit involves auditory nerve, brainstem, medial geniculate body of the thalamus and the auditory cortex. In the inner ear- cochlea, the transduction of music into neural signal takes place and cochlea filters these signals and the outputs are tonotopically ordered.[12] These neural signals from cochlea are processed by the auditory brain

stem and sends them to thalamus, which then projects into the auditory cortex. The primary auditory cortex, secondary auditory cortex, the posterior and the anterior auditory fields are also involved in processing of music. These areas carry out perceptual analysis in terms of rhythm (timing of musical sound), pitch, intensity and roughness.[13,14]

Emotional processing: Cingulate gyrus, medial orbitofrontal cortex and amygdala are found to have auditory projections and there is evidence to suggest that music activates these regions. These regions are also involved in processing of emotional behaviors.[13,15] Research on different neuronal responses to pleasant and unpleasant music shows that, the brain activity for pleasant music is predominantly present in frontal lobes and for unpleasant music in temporal lobes.[16]

Neurochemistry: In subjects listening to pleasant music, dopamine is released from the ventral striatum and in the ventral tegmental area and thus postulated to be involved in the enjoyment of music.[13,17] Listening to music releases endorphins and nitrous oxide which produces physical effects such as local warming of the skin, reduction in blood pressure and vasodilatation and thus involved in emotional perception of music. [13] A study has found that listening to techno-music is accompanied by a significant increase in plasma norepinephrine, β-endorphin, adrenocorticotropic hormone, cortisol and growth hormone. However, while listening to classical music, no significant changes were detected in hormonal concentrations.[18]

In the present study, the music therapy with Indian classical music (Raga-bilahari) showed significant changes in the intervention group. The depression, anxiety and stress scores were decreased and was statistically significant. Our results are consistent with Deshmukh et al[19] who reported that depression scores improved with Indian classical music therapy intervention group compared to the control group and these effects persisted beyond the treatment period. Our results are also consistent with Gupta and gupta,[20] who found a significant decrease in the score on depression, state and trait anxiety in study participants who used Indian music compared to pre-test measurements.

CONCLUSION

In our study, Indian classical music therapy along with standard care showed a statistically significant beneficial changes in patients with depression showing improvement in levels of depression, anxiety and stress. Therefore, it is recommended to implement music therapy, as an adjunct in the management of depression. This technique is non-invasive, inexpensive, simple, and safe.

Limitations of the study: Further studies are required to examine the effect of music therapy over a longer time period, a larger sample size, and different forms of raga's in Indian classical music.

Conflicts of Interest: There are no conflicts of interest

Source of Funding: Self

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Effect of High and Low Intensity Aerobic Exercise on the Body Fat of Overweight Young Men

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ABSTRACT

Background: Regular aerobic exercise reduces body fat and improves weight control, increases HDL&Vo2 max. With increased awareness about the importance of fitness many people are taking various modalities of treatments and exercise programs. Though aerobic exercise is found to reduce body fat, the relative merits of different intensities of aerobic exercise in reducing body fat in overweight people is still uncertain.

Objectives: 1.To Study the Effects of High and Low intensity aerobic exercise on body fat composition of overweight young men.2.To study socioeconomic status & dietary habits among study population

Materials and Method: 80 sedentary men (18-40 years) were randomized in to 2 equal groups (High Intensity & low intensity group). Anthropometry like Height, weight, BMI, WHR (waist hip ratio) was recorded. Body fat percentage was measured using skin fold thickness method. The High [80% HR max] & Low intensity [50 % HR max] groups underwent aerobic exercise training using Bicycle ergo meter (COSCO MODEL-CEB-JK-7007 A) at 900kpm & 540kpm, for 15mins/day & 30mins/day respectively, 5days a week, for a period of 12weeks.

Results: After 12weeks of aerobic training the mean body fat percentage reduced in both High & low intensity groups .However the reduction in body fat percentage in high intensity group was statistically significant ($p<0.05$). Whereas the reduction in body fat percentage in low intensity group was not statistically significant.

Conclusion: High intensity aerobic training is more effective in reducing the BF% than low intensity aerobic training in overweight men.

Keywords: *Aerobic exercise, Body fat, cycle ergo meter.*

INTRODUCTION

According to World Health Organization BMI greater than or equal to 25 is overweight and greater than or equal to 30 is obesity.[1] India's current National Family Health Survey indicates that more than 20 percent of urban Indians are overweight or obese. And in the northwestern state of Punjab, nearly 40 percent of all women are overweight or obese, whereas in Karnataka 17.3% of all women are overweight or obese.[2]

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Regular aerobic exercise improves health in the following ways: Reduces body fat and improves weight control and resting blood pressure (systolic and diastolic), increases HDL maximal oxygen consumption (VO_2 max) and blood supply to the muscles, decreases total cholesterol.[3]

With increased awareness about the importance of fitness many people are taking to various modalities of treatments and exercise programs. It is well established that aerobic exercise can be an important component of weight loss intervention, and therefore is commonly included as part of a comprehensive weight management program. But however, there is a controversy over whether high intensity exercise or low intensity exercise

is more important for stimulating a decrease in the body fat content

Though aerobic exercise is found to reduce body fat, the relative merits of low and high intensity aerobic exercise in reducing body fat in overweight people is still uncertain. Hence, this study will help in guiding the people and fitness trainers in deciding the fitness training programs for overweight people

AIMS & OBJECTIVES

1. To study the effects of High and Low intensity aerobic exercise on body fat composition of overweight young men.
2. To study socioeconomic status & dietary habits among study population.

MATERIALS & METHOD

80 sedentary male aged between 18-40years were recruited from two fitness centres. Subjects were informed about the study & informed written consent was taken. Subjects were allocated in to two equal groups of Low intensity & High intensity exercise regimen by using random number table.

Inclusion criteria

- Men aged between 18 to 40 years who volunteered to participate in the study.

Exclusion criteria

- Involvement in a regular exercise or weight loss program for at least 6 months prior to the recruitment.
- H/o cardiovascular disorders
- H/o endocrinologic or orthopaedic disorders

The anthropometric measurements included weight, height, WC (waist circumference), WHR (waist to hip ratio) & WSR (waist to stature ratio) following the recommendations of the World Health Organization[4]

Body Fat Percentage Using Callipers: Four site skin fold thickness was taken at Biceps, Triceps, Sub scapular & Supra iliac sites. Skin fold thickness were measured using caliper (Accumeasure fitness 3000).[5]All measurements were taken on right side of the body.

Biceps: was taken on the center of the front of the upper arm .The fold was taken in a vertical direction.

Triceps: This is located halfway between the shoulder and elbow joints. The fold was taken in a vertical direction, directly on the centre of the back of the arm.

Sub-scapular: This is located just below the shoulder blade. The skin fold was taken at 45 degrees angle.

Supra Iliac: This is located just above the iliac crest, a little towards the front from the side of the waist. The fold was taken approximately horizontally.

Body fat percentage was calculated using Durnin and Womersley formula.[6]

Exercise Training Protocol: Digital Cycle ergo meter (COSCO, MODEL-CEB-JK-7007 A) which displays heart rate & level of exercise was used for the aerobic exercise. The aerobic training was designed to exercise the upper and lower body.

For High Intensity Group: Subject exercised at Level 5, at 50rpm, accounting to 150 watts (900kpm) for a period of 15 min at 80% HR max (80% VO2 max).

For Low Intensity Group: Subject exercised at Level 3, at 75 rpm, accounting to 90 watts (540kpm) for a period of 30 min at 50 % HR max (50% VO2 max).

Both the groups exercised at different duration so that the work done by both the groups were almost equal. Subjects used to exercise either in evening or morning depending on their convenience. All subjects used to exercise 5 days a week continuously for a period of 12 weeks. At the end of 12weeks all the parameters (Weight, BMI, Waist circumference, Waist hip ratio and Body fat percentage) were measured again.

Statistical Tests: SPSS 16.5 version of statistical package was used for analysis of the data. Descriptive statistics like mean & standard deviation were calculated. Paired‘t’ test of significance was used to study the difference between the baseline & post interventional values of study variables

RESULTS

Majority of our study population (55%) were between 21-30yrs of age group, very few were below 20yrs (Table 1)

Table 1: Age wise distribution of study population

AGE GROUPS (In years)	HIGH INTENSITY GROUP n = 40	LOW INTENSITY GROUP n = 40	MEAN DURATIONOF OVERWEIGHT IN YEARS
<20	3 (7.5%)	5(12.5%)	3.12±1.22
21-30	23(57.5%)	21(52.5%)	4.55±1.65
31-40	14(35%)	14(35%)	6.45±1.72

Majority (55%) of our study population belong to class II.Mean BF% was higher in classII & class III than class I (Table 2)

Table 2: Socioeconomic status of study population

CLASSIFICATION *	HIGH INTENSITY (n = 40)	MEAN BF%	LOW INTENSITY (n = 40)	MEAN BF%
Class I	9(22.5%)	26.98±3.4	9 (22.5%)	27.24±2.1
Class II	23 (57.5%)	27.26±3.2	21 (52.5%)	27.96±2.2
Class III	8 (20%)	27.29±3.0	10 (25%)	28.14±2.4
Class IV	0	0		0
Class V	0	0		0

Chi square; 0.34, df: 2, p>0.05

*According to modified kuppuswamy classification

Majority (71.25%) of the study population had sedentary occupation & their mean BF% was more than moderate activity group, only few (41.25%) had moderate activity & none of the subjects had heavy activity occupation (Table 3)

Table 3: Distribution of study subjects based on occupation

OCCUPATION	HIGH INTENSITY n = 40	MEAN BF%	LOW INTENSITY n = 40	MEAN BF%
SEDENTERY	28(70%)	27.8±1.82	29(72.5%)	28.2±4.22
MODERATE	12(30%)	26±2.32	11(27.5%)	26.8±3.24
HEAVY	0	--	0	--

We also found that majority of the study subjects (57.5%) used to consume an average of 2000-2500kcal/day & few (31.2%) consumed more than 2500kcal /day. So from the table we can make out that subjects who consumed more calories had more BF% (Table 4)

Table 4: Average calorie intakes among study population

AVERAGE CALORIE INTAKE(kcal)	HIGH INTENSITY n = 40	MEAN BF%	LOW INTENSITY n = 40	MEAN BF%
<1500	0	0	0	0
1500-2000	4 (10%)	23.9±2.86	8(20%)	24.8±2.82
2000-2500	25 (62.5%)	26.87±2.55	23(57.5%)	26.2±3.03
>2500	11 (27.5%)	29±2.42	9 (22.5%)	28.9±2.91

Mean BMI & BF% decreased in both the groups being more significant in HI group. There was significant decrease in WHR in HI than LI group (table 5)

Table 5: Comparison of study variables among 2 groups of study population

VARIABLES	LOW INTENSITY			HIGH INTENSITY		
	BEFORE	AFTER	t value	BEFORE	AFTER	t value
WEIGHT(kg)	68.8 ± 4.65	7.1 ± 4.9	5.4	74.8 ± 7.09	70.45 ± 7.2	7
BMI (kg/m^2)	26.39 ± 1.17	25.6 ± 1.2	2.58	28.57 ± 2.44	27.39 ± 2.46	6.58*
WHR	0.90 ± 0.06	0.84 ± 0.04	3.14	0.95 ± 0.08	0.85 ± 0.04	5.22*
BODY FAT %	26.8 5± 2.07	26.2 ± 1.99	2.46	27.5 ± 1.3	26.11 ± 1.4	5.66*

*SIGNIFICANT (P<0.05), WHR- waist hip ratio, RHR –resting heart rate

DISCUSSION

The results showed that only subjects in HI had a significant decrease in their percent body fat BMI and WHR also decreased significantly in HI. Even though the BF% decreased in LI group, it was not statistically significant.

The present study results were similar to Bryner et al [7] and Rahman Rahimi [8] in which the group engaging in the high intensity exercise (75 at 90% HR max) had a significant percent fat reduction, while that performing the moderate-intensity physical exercise (60 at 70% HRmax) had no significant loss

The present study results were contradictory to Grediagin et al [9] & Swenson & Conlee [10] study where BF% decreased in both HI & LI exercises without statistical difference between both the groups.

As we know, exercise training increases the ability to use both fat and carbohydrates, with fat oxidation being predominant at low and moderate exercise intensity, and carbohydrate utilization being the dominant fuel for HI exercise.

Brooks and Mercier [11] have reviewed exercise macronutrient utilization based on the interaction between exercise intensity-induced responses and exercise-induced adaptations. They describe the crossover point as the power output at which energy derived from carbohydrates predominates over energy derived from lipids, with further increases in exercise intensity producing incremental increases in carbohydrate utilization and concomitant decreases in fat oxidation.

During high intensity exercise, the carbohydrate-related adaptations in the trained individual allow the utilization of large amounts of glucose needed for high power output. After exercise training, the same amount of sub maximal work can be performed with a greater contribution of fat oxidation to meet the energy requirement.[12]

Therefore, the results of this study may be related to this physiological principle, as the results have shown that HI training results in a greater improvement in body composition than the MI (moderate intensity)training protocol. Although the energy expenditure was not measured, based on previous studies it was concluded that these results can partially be related to greater carbohydrates being depleted in high intensity – rather than moderate intensity - weight training programs.

Socioeconomic Status & Body Fat: Previously it was thought that obesity is common in people with Higher SES [13], but the present review, on studies conducted in adult populations from developing countries, published between 1989 and 2003, shows a different scenario for the relationship between SES and obesity, three main conclusions emerge from the studies reviewed:

1. Obesity in the developing world can no longer be considered solely a disease of groups with higher SES
2. The burden of obesity in each developing country tends to shift towards the groups with lower SES as the country's gross national product (GNP) increases
3. The shift of obesity towards women with low SES apparently occurs at an earlier stage of economic development than it does for men.[14]

Calorie Intake & Body Fat: A recent RDA of calorie for Indians has been changed. [15] A reduction of 4-8 % of energy (100 kcal for sedentary, 145 kcal for moderate and 310 kcal for heavy work per day) has been recommended on account of a lower physical activity level in men. In

women the requirement remains similar on account of a higher body weight .in our study subjects with high calorie intake had high BF%.

CONCLUSION

HI aerobic exercise significantly reduces WEIGHT, BMI, and BF%. Also HI is better modality to reduce weight than LI aerobic exercise.

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How Common is the Postpartum Anemia− Evidence From a Cross Sectional Study

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ABSTRACT

Background: About half of the non-pregnant and pregnant women in India are anaemic. But the whole focus of government is on managing anaemia during pregnancy because of associated adverse consequence for both mothers and newborn. Very often, very little attention has been paid to address the problem of postpartum anaemia. The objective of this study was to assess the prevalence of anaemia among women six weeks after childbirth.

Materials and Method: This was a hospital-based cross-sectional study. The haemoglobin and other indices of the iron reserve were measured among women coming to immunize their child between six to seven weeks after delivery. Logistic regression was used to identify factors associated with postpartum anaemia.

Results: The prevalence of any degree of anaemia and severe anaemia at the end of the post-partum period was 54.0% and 12.5 % respectively. The mean haemoglobin at 6-7 weeks postpartum was 11.10±1.12 g/dL. Anemia at last antenatal visit, history of blood transfusion during pregnancy, younger maternal age (< 21 years), consuming < 50 tablets during pregnancy, and not receiving iron supplementation during the postpartum period were identified as significant predictors of anaemia at 6 weeks postpartum.

Conclusion: Government needs to strengthen the post-partum iron supplementation program as only a fraction of women received iron supplementation at the time of discharge from the hospital.

Keywords: *postpartum, anaemia, women, India.*

INTRODUCTION

Anaemia is widely recognized as a major public health problem in India. The adverse effects of anaemia for women include an increased risk of maternal morbidity and mortality, lowered physical activity and reduced mental concentration and productivity.[1,2] About 53.1% of non-pregnant women and 50.3% of pregnant women in India are anaemic.[3] The postpartum period also referred to puerperium, is the time from childbirth to the subsequent six weeks.[4] For most women, iron requirements decline after childbirth as iron is no longer needed to support fetal growth. Simultaneously iron losses are reduced due to the postpartum amenorrhea that follows childbirth.[5] Lastly, only relatively small and decreasing amounts of iron are excreted through breast milk, which is considered a poor source of iron.[5,6] The postpartum period is probably the most neglected period for the mother as, after childbirth, the attention of the caretaker, as well as the health-care providers, shifts from mother to child.[7] A number of studies have been conducted regarding anaemia during pregnancy but not many studies have been conducted in developing countries to assess the prevalence of anaemia at the end of the postpartum period.[8-9] We defined the postpartum period as between six-seven weeks after the delivery of a child. The present study was carried out in order to assess the prevalence of anaemia at the end of the postpartum period and to identify the determinants of anaemia in the postpartum period.

MATERIAL AND METHOD

Study design: This was a health centre based cross-sectional study.

Study location: The present study was conducted at the hospitals associated with Gandhi Medical College, Bhopal.

Study Duration: The total duration of the study was 8 months. The period of data collection was 6 months.

Study setting: As per Maternal and Child Tracking System, every woman coming to the health centre is given a unique identification number and maternal and child health card at the first antenatal visit itself.[10] We recruited women coming to immunize their child between six-seven weeks after birth at the selected immunization centres.

Study participant: Women of all ages and parity coming to immunize their child.

Exclusion criteria:

(i) Women who refused to give consent for the study

(ii) women not having the MCH card with her at the time of immunization.

(iii) women coming to immunise their child after seven completed weeks of childbirth.

Outcome variable: The main outcome variable was the haemoglobin level of the women between six to seven weeks after delivery (end of puerperium). The haemoglobin level was classified as per WHO recommended guidelines for the diagnosis of anaemia during pregnancy and postpartum period.[11]

Sample size: We recruited all women coming to immunize their child who fulfilled the selection criteria during the period of data collection.

Data Collection Tool: A systemic review of the literature was undertaken to study the determinants of anaemia in pregnant and postpartum women.[7-9,12-14] We also referred to World Health Organization and government of India's guidelines for postpartum iron supplementation.[11,15] After the review of the literature, a questionnaire was designed; it had three parts. First part collected data related to the first antenatal visit, pregnancy and childbirth. Second part collected data related to the socio-demographic variables and third part collected data related to the postnatal period.

Data collectors: Data collectors were undergraduate medical students.

Data Collection: Before collecting the data, the women were explained about the purpose and objectives of the study. Thereafter they were asked for informed written consent. For illiterate women, the consent form was read and explained in native language (Hindi) and thumb impression was taken in the presence of the accompanying person. The haemoglobin level and another measure of iron stores were measured as per government of India's guidelines. A blood sample was collected by the investigator during the final visit for a haemoglobin level estimation using the indirect cyanmethemoglobin method. On an ordinary filter paper, 0.02 mL blood was pipetted using a haemoglobin pipette. Each sample was processed at the central pathology laboratory of Gandhi Medical College within one week of collection. The completed questionnaires were initially checked manually for completeness of data. Thereafter data was entered in SPSS version 21.0 for analysis. Each variable was run individually to cross-check the missing entries. Categorical variables were presented using percentages and frequency counts. Continuous variables were presented as mean and standard deviations. On occasions, the continuous variable was converted into categorical variables for analysis. The conceptual model for the determinants of anaemia for low and middle-income countries was used to select the variables in the multivariable logistic regression model.[16] Adjusted odds ratios (AOR) were used as measures of the associations in the multivariable analysis, respectively. The precisions of the measures of associations were given by their 95% confidence interval (CI). A P-value of <0.05 indicates the statistical significance of the findings

RESULTS

A total of 689 women came to immunize their child at the selected health centres during the period of data collection. Of those 56 (8.1%) women were excluded following the selection criteria, thus the final analysis was conducted on a total of 633 women. The baseline socio-demographic characteristics of the participants are presented in Table 1. The mean age of the women was 24.8 ±3.18 years, with a minimum age of 17 and a maximum age of 32.

Table 1: Socio-demographic characteristic of study participants (n = 633)

Study variable	n	%
Mother's age at Marriage (in years)		
<18	114	18.0
≥18	519	82.0
Mean	21.6	

Contd…

Mother's current age (in years)		
< 18	29	4.6
18-≤ 25	423	66.8
26 or more	181	28.6
Mean	24.8	
Occupation		
Housewife	103	16.3
Labor/agriculture	82	13.0
Business/Service	287	45.3
Others	161	25.4
Educational qualification of women		
Illiterate	45	7.1
Literate without formal education	57	9.0
School-educated	339	53.6
College educated	192	30.3
Total number of children		
1	165	26.1
2	287	45.3
3 or more	181	28.6
Gap between last two childbirths (in months) (n = 468)		
≤15	74	15.8
16-≤ 24	127	20.1
25-≤36	175	27.6
≥ 37	92	19.7
Mean	23.4	
Household food security		
Food secure	571	90.2
Insecure	62	9.8

The pregnancy characteristic of the study participants is detailed in table 2. More than half of study participants made the first antenatal visits within 11-12 weeks of pregnancy and only 12.3 % of women had fewer than three antenatal visits during last pregnancy. About 13.7 % of women received blood transfusion due to pregnancy-related complications and only 7.7 % of women received iron supplementation at the time of discharge from hospital after childbirth.

Table 2: Distribution of Obstetrics variables among study participants (n = 633)

Study variable	n	%
Timing of first antenatal visit (in gestational weeks)		
≤10	186	29.4
11–12	364	57.5
>12	83	13.1
Total number of antenatal visits		
< 3	78	12.3
3	138	21.8
4	267	42.2
5 or more	150	23.7
Total Number of IFA tablets consumed during pregnancy		
<50	168	26.5
50-75	252	**39.8**
76-100	144	22.7
>100	69	10.9
Blood transfusion during pregnancy/labour		
Yes	87	13.7
No	546	86.3
Gestational age at the time of delivery (in weeks)		
< 34	67	10.6
34-36	83	13.1
37 or more	483	76.3
Type of delivery		
Vaginal	551	87.0
C-section	82	13.0
Birth weight of newborn		
< 2	43	6.8
2- <2.5	132	20.9
2.5-< 3	344	54.3
≥ 3	114	18.0
Type of pregnancy		
Single	621	98.1
Twin	12	1.9
Received Iron Supplementation after childbirth		
Yes	49	7.7
No	584	92.3

Table 3: Hemoglobin level of study participants at different stages of study (n = 633)

Hemoglobin level	n	%
At the time of last antenatal visit		
≥11	329	52.0
10.9 -7	243	38.4
<7	61	9.6
Between six-seven weeks after pregnancy		
≥12	291	46.0
10-< 12	157	24.8
< 10-8	106	16.7
< 8	79	12.5

Table 3 details the haemoglobin level of study participants. The prevalence of any degree of anaemia and severe anaemia at the last antenatal visit was 48.0% and 9.6 % respectively. The prevalence of any degree of anaemia and severe anaemia at the end of the post-partum period was 54.0% and 12.5 % respectively. Table 4 details the result of multivariable logistic regression to identify the predictors of severe anaemia among women at the end of the post-partum period. As per the multivariable logistic regression model the odds of having anaemia at the end of postpartum period were very narrow birth interval (< 15 months), consuming < 50 IFA tablets during pregnancy, having severe anaemia at last antenatal visit, birthweight of child > 3 kilograms, having three or more

Table 4: Predictors of anaemia at the end of puerperium; results of multivariate analysis

Variable	AOR	95%CI	P value
Total number of children			
3 or more	3.46	1.59-5.96	0.01
2	1.76	1.03-2.23	0.02
1	1		
Gap between previous two births (in months)			
< 15	4.91	2.89-9.18	0.007
15-23	2.28	1.23-4.53	0.01
≥24	1		
Hemoglobin level at last antenatal visit			
<7	2.18	1.13-3.82	0.04
7-10.9	1.19	0.77-2.42	0.06
≥11	1		
Blood transfusion during pregnancy			
Yes	2.11	1.11-2.59	0.023
No	1		
Number of iron tablets consumed during pregnancy			
< 50	4.14	1.49-7.82	0.018
50-75	1.39	0.87-1.92	0.06
75 or more	1		
Type of delivery			
C-section	2.12	1.19-3.82	0.018
Vaginal	1		
Birthweight (in Kilogram)			
> 3.0	1.92	1.32-5.12	0.01
< 2.0	1.21	0.81-2.09	0.07
2-3	1		
Type of pregnancy			
Multiple	4.76	2.68-7.24	0.01
Single	1		
Number of antenatal visits			
<3	1.22	0.81-2.42	0.07
≥3	1		

AOR-Adjusted Odds Ratio, CI-Confidence Interval children, and multiple pregnancies.

DISCUSSION

In our study, we observed that the prevalence of anaemia at the end of the postpartum period was 54.0 % and the prevalence of severe anaemia was 12.5%. As per the government's own survey, the prevalence of anaemia among non-pregnant and pregnant women in the district Bhopal was 47.5 % and 37.8% respectively.[17] Blood loss during labour aggravates the pre-existing anaemia among pregnant women resulting in higher prevalence of anaemia among postpartum women as compared to pregnant and non-pregnant women. This may well be the reason for the difference in prevalence rate among women in our study and those reported by government's survey. Similar to our observations, a study conducted at outskirts of Delhi, reported the prevalence of anaemia at the end of the postpartum period was 70.0%.[12] Another study conducted in Bangladesh reported that by two weeks postpartum nearly 50% of all women were anaemic.[13] A study conducted among low-income women of USA reported that the prevalence of postpartum (6.8 +

2.3 weeks) anaemia was 19.1%.[18] Such lower prevalence of postpartum anaemia among women of the USA might be due to better haemoglobin level among non-pregnant women of USA.

In our study, we observed that only 10.9% of women consumed 100 or more tablets of iron folic acid (IFA) during the pregnancy. As per the government's own survey, only 37.1% of women in Bhopal consumed 100 or more IFA tablets during pregnancy. [17] Such is the trend despite the fact that 100 tablets of IFA are distributed free by the government of India for pregnant women. This, however, is not an unusual observation, in fact, many studies conducted in India have reported a significant proportion of pregnant women do not consume all the IFA tablets provided to them due to a variety of reasons. Studies have proven serum ferritin which represents total iron stores in the body remain at low levels up to six months postpartum among women who did not consume IFA tablets during pregnancy.[18-19] Additionally, many other studies have proven that women who take iron supplements during pregnancy do not suffer the same post-natal reduction in haemoglobin as those who do not.[20] This may well be the reason for the higher prevalence of postpartum anaemia among our study participants as the majority of women consumed fewer than 75 tablets of IFA. This is also reflected by the fact that 13.7% women received a blood transfusion for severe anaemia during pregnancy. Only 7.7% of women were given the IFA tablets at the time of discharge. Similar to our study *Somdatta et al.* in a study conducted on the outskirts of New Delhi reported that no women consumed IFA supplementation for up to six weeks postpartum.[12]

One of the strong predictors of anaemia at the end of postpartum was the very narrow inter-pregnancy interval (< 15 months). The ideal gap between successive childbirth should be three years; in our study, we observed that only 19.7 % of women had such inter-pregnancy gap. Among other predictors of were consuming < 50 IFA tablets during pregnancy, birthweight of child > 3 kilograms, having three or more children, and multiple pregnancies.

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Hemispheric Dominance Pattern in Medical, Engineering and Arts Students

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ABSTRACT

The present study was undertaken to observe the hemispheric dominance pattern in Arts, medical and engineering students. The current observational study was approved by institutional ethical committee of little flower institute of Medical Sciences and Research, Angamaly, Kerala. A total of 150 apparently healthy male and female medical (n=50) and engineering (n=50) and arts (n=50) students were part of the study after obtaining written, voluntary informed consent Engineering and Medical students were tend to be Left dominant. Whereas Arts students: were Right dominant. Further on Principal Co-ordinate Analysis at Axes1/5, it was found that the Left quadrant was dominated by Medical and Engineering students and Right quadrant was dominated by Arts students. We have observed that Medical and Engineering students are Left dominant Arts students are Right dominant. We recommend further detailed studies in this area for better understanding of hemisphere dominance.

Keywords: *Medical, Engineering, Arts, Hemisphere dominance.*

INTRODUCTION

The idea that the left and right hemispheres exhibit different patterns of thought caught the Public attention and have inspired several educational theories notably "Eight ways of Knowing" by David Lazear, and numerous other self-help books. The cortex is divided into two hemispheres, left and right connected by a thick layer of cells called the corpus callosum. Much of the theory of Left – Right specialization has been developed through examining patients who have had physical defects in one part of the brain.[1] One of the earliest of these investigations was Paul Broca's work in 1861 with a patient nicknamed Tan who had a large cyst in the left hand side of his brain. Tan could only say one word: "Tan", hence the nickname.[2] This indicated that some language functions were concentrated in the left hand side of the brain. Further study of eight patients who all had language problems revealed they also had left hemisphere lesions and the study of left-right specialization was born. Since Broca's early work there has been much research into the processing of language. Several specific areas of the brain have been identified which play a part in language (for most people these all reside in the left hemisphere).[3]

The right side of the brain controls muscles on the left side of the body and the left side of the brain controls muscles on the right side of the body. Also, in general, sensory information from the left side of the body crosses over to the right side of the brain and information from the right side of the body crosses over to the left side of the brain. The Left eye crosses over to the Right-hand side of the brain and vice-versa via optic chaisma.[4] Therefore, damage to one side of the brain will affect the opposite side of the body. In 95% of right-handers, the left side of the brain is dominant for language.[5] Even in 60-70% of left-handers, the left side of brain is used

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for language. Back in the 1860s two neurologists (Paul Broca and Karl Wernicke) observed that people who had damage to a particular area on the left side of the brain had speech and language problems. People with damage to these areas on the right side usually did not have any language problems. The two language areas of the brain that is important for language now bear their names: Broca's area and Wernicke's area. In 95% right-handed people the left hemisphere controls language.[6] Left-handers have a more even distribution of language in both hemispheres. In 68% this is concentrated in the left hemisphere, and in 19% it is concentrated in the right hemisphere, the remainder has language processing in both hemispheres.[7] The difference in the ratios of grey matter to white matter in the two hemispheres deserves some investigation. From a computational point of view the difference in these ratios can partially explain some of the differences in functioning of the two hemispheres.[8-10] The present study was undertaken to observe the hemispheric dominance pattern in Arts, medical and engineering students**.**

MATERIALS AND METHOD

Participants: The current observational study was approved by institutional ethical committee of little flower institute of Medical Sciences and Research, Angamaly, Kerala. A total of 150 apparently healthy male and female medical (n = 50) and engineering (n = 50) and arts (n = 50) students were part of the study after obtaining written, voluntary informed consent.

Methods:

Hemispheric Dominance Inventory Test: This is a standard test to determine which side of your brain left or right is dominant. In this test a total of 18 questions will be there with two options. The participant has to go through the questions and select the option which is more relevant to him.

Statistical analysis: Data was represented as mean scores and percentages of the responses. SPSS 20.0 was used for data analysis.

Results: Table no 1 presents the average scores and percentage of right and left dominant brain scores of the participants. Engineering and Medical students were tend to be Left dominant. Whereas Arts students: were Right dominant. Further on Principal Co-ordinate Analysis at Axes1/5, it was found that the Left quadrant was dominated by Medical and Engineering students and Right quadrant was dominated by Arts students.

Table No. 1: Average scores and percentage of right and left dominant brain scores of the participants

S. No.	Group	Average Score as right brained person	Average Score as left brained person
1.	Medical (n = 50)	6 (33.33)	12 (66.66)
2.	Engineering (n = 50)	4 (22.22)	16 (88.88)
3.	Arts (n = 50)	11 (61.11)	7 (38.88)

DISCUSSION

If we accept the theory of left-right dominance and learning styles then there are profound implications for education. These variations have implications throughout the process of education. Selection of appropriate courses: both those suited to the learning style of student, but also those aimed at strengthening certain aspects. Methods of delivery of material; using techniques, which appeal to a range of senses but also with a mix of big picture and detail. Some students may prefer to see the big picture first and then break it down; other may prefer to study the details first working up in a logical manner to more involved material. Activities that appeal to and strengthen different styles. Assessment methods that reward different styles but which also stimulate different modes of thinking. Awareness of students learning styles may help in tailoring a course, although there is a danger of pigeonholing. These need no necessarily be through a formal questionnaire, a teacher may become aware of the styles as they work with the student, showing a good differentiation. Though the appearance of hemisphere is symmetrical, it has structurally different. Both the hemispheres process information of all types but one is more efficient than other. Left hemisphere operates linear sequential manner with logical, analytical, and propositional thought. On the other hand, the right hemisphere operates in a nonlinear, simultaneous fashion and deals with nonverbal information as well as dreams and fantasy.[12] Earlier studies have reported that occupations and

academics are associated with brain hemisphericity.[13] It was reported that right hemisphericity correlates with the tendency to express emotions and left hemisphericity with the tendency to inhibit emotions.[14]

Conclusion: We have observed that Medical and Engineering students are Left dominant Arts students are Right dominant. We recommend further detailed studies in this area for better understanding of hemisphere dominance.

Conflict of Interest: nil

Source of Funding: self

Ethical Consideration: The present study was approved by institutional ethical committee of Little Flower Institute of Medical Sciences and Research.

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Study of Relationship Between Body Mass Index and Lung Function in Young Adult Males

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ABSTRACT

Background: Relationship between lung function and body mass index has been debated. Also, the above parameters have not been studied well in the underweight and pre-obese population. Hence a study was undertaken to explore a possible correlation between body mass index with pulmonary function.

Methodology: 200 healthy adult non-smoker males in the age group of 18 to 30 years underwent computerized spirometry. Subjects were grouped into underweight, normal, overweight and obese based on BMI using standard WHO classification. Results were compared across the groups.

Results and Conclusion: It was found that subjects falling in 'normal' BMI range had better lung function in terms of FVC, FEV_1, PEF and MVV, than underweight, overweight and obese subjects. The difference was statistically significant.

Keywords: *Body Mass Index; Underweight; Obese; Lung functions; Spirometry; FEV1; FVC; PEF; MVV*

INTRODUCTION

It is well known that obesity alone, in absence of other disease processes, affects respiratory function in humans[1]. Previous studies have shown that subjects with excessive body weight tend to be chronically hypoventilated and have reduced aerobic capacity[2]. To those limitations, one must add reduced cardiopulmonary ability as indicated by measurements of exercise tolerance and aerobic capacity. These abnormalities have been confirmed by physiologic tests, during which a high metabolic cost for breathing, both at rest and after exercise, can be detected.[3] Although several studies have shown that body weight may affect pulmonary function, these data are still in question.

A study showed Basal respiratory function test parameters were lower in study group as compared with control group. There were strong negative correlations between body mass index (BMI), relative weight, skin fold thickness, waist/hip circumference ratio and basal forced vital capacity (FVC), forced expiratory volume in one second (FEV1), and peak expiratory flow (PEF) values.[4]

Another study found that there were significant linear relationships between BMI and vital capacity and total lung capacity. It was also found that BMI had significant effects on all lung volumes, and greatest effects were on Functional Residual capacity and Expiratory reserve volume, which occurred at BMI values <30kg/m^2. At BMI of 30 kg/m^2, FRC and ERV were only 75% and 47% respectively, of values for lean person with a BMI of 20kg/m^2.[5]

Some other studies concluded that BMI didn't significantly affect lung function. For instance, in a study by Zaid et al, it was found that mean FVC in obese and non-obese subjects did not vary significantly.[6] In study by Saxena Y et al, it was found that mean FVC and FEV1 were significantly different in obese and non-obese female subjects but there was no significant difference of the same parameters in obese and non-obese male subjects.

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However, the study found that in non-obese individuals, Vital capacity was directly proportional to BMI.[7]

Most of studies have taken adult obese or morbidly obese individuals as subjects. Not much is known about lung functions and physical output in underweight and borderline classes of BMI. Since aerobic capacity also depends on respiratory muscle strength and general nutritional status, low BMI can also be expected to have adverse bearing on lung function parameters. The current study is taken up to explore the same.

OBJECTIVES OF THE STUDY

- To assess pulmonary function parameters in young adults.
- To correlate the above with Body Mass Index.
- Thereby to test the hypothesis that Body mass index and lung function parameters are significantly related.

MATERIAL AND METHODS

A cross sectional study was undertaken. Subjects of study were 200 young adult males selected by random sampling method, from students of MBBS,BDS and Paramedical courses of Vijayanagar Institute of Medical Sciences,Ballari, and also from general population of city. Participation was voluntary on part of subjects. Following inclusion and exclusion criteria were set:

Inclusion Criteria:

1. Young adult males in age group of 18 to 30 years.
2. No history of respiratory or cardiovascular illness.
3. Health status normal on clinical examination.
4. Those willing to participate in study with written consent.

Exclusion Criteria:

1. History of pulmonary illness like Asthma, or Emphysema.
2. History of other significant illness like Epilepsy,Rheumatoid arthritis,Diabetes mellitus, cardiac problems.
3. Smoking and alcohol use in dependent pattern.
4. Physical disability/deformity which may interfere with spirometry.
5. History or features suggestive of thyroid or other endocrine dysfunction.

Procedure: Subjects were explained purpose and nature of study. Written consent was obtained from each willing participant. Thorough medical history was collected and Physical examination carried out with reference to inclusion and exclusion criteria. Socio-demographic data of the subjects was collected and documented.
Anthropometric parameters of each subject were recorded. Weight was measured in kilograms using weighing scale.Height was measured in centimeters using a vertical scale and then converted to meters. Body Mass Index of each subject was calculated using the following formula:

$$BMI = \frac{\text{Weight in Kg}}{(\text{Height in m})^2}$$

Each subject was then tested for pulmonary function using computerized spirometer. Parameters- Forced Vital Capacity (FVC) in liters, Forced Expiratory Volume in 1st second (FEV_1) in liters, FEV_1/FVC ratio, Peak Expiratory Flow rate (PEFR) in liters/second, Forced Expiratory Flow between 25-75%($FEF_{25-75\%}$) of expiration in liters/second, Maximum Voluntary Ventilation (MVV) in liters/minute were measured and recorded.

Pulmonary function testing using computerized spirometer: Pulmonary function test was performed using computerized spirometer Kit micro (RS 232). Procedure of PFT was explained to the subject and once demonstrated by the investigator. Subject's data such as name, age, gender, height and weight were entered in interface. The software automatically calculates his body surface area and makes predictions for expected values of the chosen lung function parameters based on the subject's anthropometric details and race as per ERS-93 (European Respiratory Society) protocol incorporated in the Spirometer software. The system was set to make predictions for south Indian population.

Subject was made to sit erect with feet firmly on the floor. He was then urged to breathe in fully, seal his lips around the disposable mouth piece, blast air out 'as fast and as long as he can' until lungs are completely empty, then breathe in again as forcibly and fully as possible. At least 3 technically acceptable maneuvers were obtained and the largest volume was quoted. The following guidelines were used for ideal performance:

- Minimum of 3 acceptable blows.
- Rapid start is essential.
- At least 6 seconds expiration.
- Take largest FEV_1 even if not from the same curve as the best FVC.
- Smooth, rapid take off with no hesitation, cough, leak, tongue obstruction, glottic closure,etc.
- **Reproducibility:** The highest and second highest FEV_1 should agree to within 0.2L.

From above maneuver, system displays best value for each parameter. For each of lung function parameter, the value predicted by the system based on the subject's anthropometric profile was also noted down.

For measuring MVV, following a similar procedure, subject was instructed to breathe in and out as deeply and as rapidly as he can, into the spirometer mouthpiece, for duration of at least 12 seconds, to a maximum of 15 seconds. From this, the system makes automatic extrapolation and displays MVV in liters/min which was documented. The predicted value for MVV was also noted down.

Each lung function parameter was expressed not only in absolute values but also as percentage of the predicted value. Both were used in statistical analysis.

Based on the BMI, study group was divided into four classes as per WHO global guidelines,[8]

Table1: WHO classification of BMI

BMI kg/m²	Category
<18.5	Underweight
18.5 to 24.9	Normal range
25 to 29.9	Overweight/Pre-obese
>/=30	Obese

Data was tabulated and subjected to statistical analysis.Results were expressed as Mean ± Standard Deviation. Level of significance was set as $p<0.05$. Analysis of variance (ANOVA) was used to find significance of study parameters between three or more groups of patients. Student t test (two tailed, independent) was used to find the significance of study parameters between two groups. Kruskal Wallis test was used to find significance of PFT parameters expressed as percentage of predicted, between groups.

RESULTS AND OBSERVATION

After statistical analysis of data, following observations were made:

Table 2: Distribution of subjects in different groups of BMI:

BMI (kg/m²)	Group	Number	%
<18.50	I (Underweight)	64	32.0
18.50-24.9	II (Normal)	85	42.5
25.0-29.90	III (Overweight)	28	14.0
30.0 & above	IV (Obese)	23	11.5
Total		200	100.0

Table 3: Comparison of Anthropometric variables in subjects of different groups

Variables	Group I	Group II	Group III	Group IV	P value
Age in years	20.34 ± 2.66	21.78 ± 2.86	22.07 ± 2.91	22.65 ± 3.46	F = 5.299; p = 0.052
Height in meters	1.71 ± 0.06	1.74 ± 0.06	1.73 ± 0.06	1.71 ± 0.05	F = 10.601; p = 0.051
Weight in kg	49.52 ± 4.38	66.74 ± 7.55	78.20 ± 4.91	89.17 ± 6.71	F = 289.769; p<0.001**
BMI in Kg/m²	16.88 ± 1.03	21.45 ± 1.80	25.93 ± 1.19	30.38 ± 0.59	F = 16.106;p<0.001**

Above table shows that subjects in different groups were matched for age. Anthropometric parameters viz., mean weight and BMI were significantly different in the four groups.

The following table(No. 4) depicts comparison of PFT parameters in different BMI groups. It is evident that in case of FVC,FEV1,PEF and MVV, the performance of different groups was significantly different. Lung function parameters were significantly different on comparison across groups and when each group was compared with normal BMI group. Subjects with normal BMI were able to perform better than underweight, overweight, and obese individuals. The above observation holds good for both absolute values of lung function parameters and also in case of values as percentage of predicted values.

$FEF_{25-75\%}$ however, did not show statistically significant difference.

Table 4: Comparison of PFT parameters of subjects in different groups of BMI

PFT Variables		Group I (Underweight)	Group II (Normal)	Group III (Overweight)	Group IV (Obese)	P value
FEV1 (L)	Observed	2.96 ± 0.33	3.60 ± 0.40	3.42 ± 0.39	3.27 ± 0.30	<0.001**
	%Predicted	79.50 ± 7.50	92.82 ± 9.89	86.96 ± 8.11	79.79 ± 4.61	<0.001**
FVC (L)	Observed	3.27 ± 0.45	4.10 ± 0.58	3.89 ± 0.47	3.94 ± 0.66	<0.001**
	%Predicted	75.60 ± 9.13	90.23 ± 11.99	85.55 ± 7.67	81.71 ± 8.92	<0.001**
FEV1/FVC	Observed	0.91 ± 0.08	0.88 ± 0.08	0.88 ± 0.06	0.85 ± 0.11	0.006**
	%Predicted	109.23 ± 9.37	105.83 ± 9.14	105.34 ± 6.84	100.28 ± 12.11	0.002**
PEF (L/s)	Observed	8.30 ± 1.26	9.20 ± 1.10	8.95 ± 1.21	8.99 ± 1.09	<0.001**
	%Predicted	86.83 ± 16.19	92.38 ± 11.23	89.99 ± 11.76	91.4 ± 15.7	0.026*
FEF 25-75%	Observed	4.38 ± 0.95	7.46 ± 14.72	7.21 ± 15.46	4.22 ± 0.95	0.304
	%Predicted	84.96 ± 17.7	90.11 ± 19.43	83.33 ± 16.29	80.08 ± 17.7	0.113
MVV (L/min)	Observed	120.35 ± 16.64	149.34 ± 22.08	132.13 ± 16.58	129.02 ± 15.27	<0.001**
	%Predicted	80.04 ± 8.82	97.98 ± 15.1	85.57 ± 9.96	81 ± 9.85	<0.001**

DISCUSSION

Subject's performance on computerized spirometry depends on a large number of factors other than the status of pulmonary system. The most important of these is the subject's anthropometric profile. Also, the performance depends on certain other factors such as athletic training, familiarity with the use of the instrument and a variety of psychological factors such as understanding, level of motivation, anxiety state, etc.

In the current study, values for lung function parameters were taken in both formats, i.e., as the absolute value performed by subject and also this value converted to a percentage of value predicted for that particular subject by system. In this way it was possible to assess to what extent subjects could reach the prediction made for them, thus making accommodation for above mentioned limitations and influencing factors. Conversion to percentage scale also provides uniformity for ease of comparison across groups.

The Indian consensus for classification of individuals as overweight and obese is different from the global classification. This is because Asians are considered to be at greater cardiovascular disease risk, even at lower BMI values, than are the Caucasians. Though for purpose of quantifying disease risk, this classification is applied to Asian population, WHO has still recommended use of global classification for purpose of reporting and comparison across the world.[8]In our study, we have used the same. Analysis of data has shown that BMI has an effect on almost all lung function parameters.

Mean FVC in underweight group was 3.27 L. In normal group it was 4.1 L. In overweight and obese, it again decreased to 3.89 L and 3.94 L respectively. On percentage scale, it was noted that while normal individuals reached 90.23% of the value predicted for them, the underweight, overweight and obese subjects could reach respectively 75.6%, 85.55% and 81.4% of predicted value only.

Similarly, FEV_1 in normal group was 3.6 L, in underweight 2.96 L, in overweight 3.42 L and in the obese 3.27 L. In percentage scale, the trend was 79% in underweight, increased to 92.82%, in the normal and decreased to 86.96% and 79.79% in the latter groups respectively.

FEV_1/FVC showed a slightly different trend of changes. In both absolute and percentage scales, ratio was found to gradually decrease from group I to IV. The significant increase between groups I and II was not seen as in case of FVC and FEV_1. This is probably because ratio is dependent on two variables which are changing independently of each other. Thus, trend of changes in ratio is affected by net change in values of both constitutive variables.[9] Both FVC and FEV_1 have increased proportionately from underweight group to normal group. Hence increase in the ratio is not found significant. However, decrease in ratio as BMI increases from normal to overweight to obese, is quite evident and statistically significant.

PEF in underweight group was 8.3 L/s, in normals, increased to 9.2 L/s, then decreased to 8.95 L/s and 8.9 L/s in above normal groups. Percentage values for the four groups were respectively 86.83%, 92.38%, 89.99% and 91.4% respectively. PEF depends not only on intrinsic status of respiratory system but also on external factors such as muscular strength of individual. Thus, underweight group understandably performed poorer both on absolute and percentage scale. The normal group outperformed all the other groups. But overweight and obese groups though had greater body mass had poorer performance probably because greater adiposity compromises muscular strength of the chest wall and may have compressive effect on the chest wall[10].

$FEF_{25-75\%}$ though showed similar changes as other lung function parameters, the magnitude of change did not reach statistical significance. This can be explained on the basis that $FEF_{25-75\%}$ is an indicator of the status of distal (medium and small) airways.[9]It depends more on intrinsic caliber of these distal airways rather than extraneous factors such as body mass and adiposity. Hence BMI probably failed to produce any significant change in $FEF_{25-75\%.}$

Observed MVV in the underweight group was 120.35 L/min, in normal group 149.34 L/min, in overweight 132.13 L/min, in obese 129.02 L/min. Percentage of predicted values for the above groups were 80.04, 97.98, 85.57 and 81% respectively. Again it is evident that subjects with normal BMI have outperformed subjects in all the groups. Since MVV is a determinant of breathing reserve of an individual, it can be safely assumed that increased obesity leads to diminution of this breathing reserve.

Findings of the current study are in agreement with those of various other studies. For example, a study by Jones RL and Nzekwu MU showed that BMI has significant effects on all of the lung volumes, and the greatest effects were on FRC and ERV, which occurred at BMI values < 30 kg/m^2.[5]

ThyagarajanB, Jacobs DR, Apostl GG, et al conducted a study to establish longitudinal association of BMI with pulmonary function. They found that those individuals who were underweight to begin with, showed an increase in FVC with increase in BMI which later reached a stable value till the mean age of 38 years. Those who had higher BMI at beginning of the study showed a gradual decrease in FVC and FEV_1 as they gained more weight over the study period.[11]

In 1978, Schoenberg et al reported that, due to the related increase in muscle strength, pulmonary function initially increases in parallel with weight gain, although subsequent impairment of chest wall mobility results in reduced pulmonary function.[12]

CONCLUSION

BMI affects all parameters of lung function. Individuals with normal BMI have better lung function than those who are underweight, overweight and obese.

Source of Funding: Self

Conflict of Interest: None

Ethical Clearance: Obtained from Institutional ethics committee

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Effect of Academic Stress and Its Relationship With HRV in Young 1St year MBBS Students

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ABSTRACT

Stress affects all the organs of the body, its effect on autonomic nervous system reflects end response of various organs. Academic stress is predominantly psychological and stress leads to several physiological responses such as increased heart rate variability through alteration in the autonomic activity that is increased sympathetic or decreased parasympathetic activity Management of stress with the aim to prevent its complication such as cardiovascular and cerebrovascular diseases, to improve the performance of student by relaxation technique forms the basis of this research. Consented 40 subjects were enrolled for the study, subjected to short term heart rate variability(HRV) recording for 5 minutes following standard protocol. The recording of the HRV was done using AD instruments eight channel polygraph where standard limb lead II recording of electrocardiogram (ECG) was done. To determine results of the heart rate variability lab chart 8 pro of AD instruments was used which selectively uses around 300 beats good interval artifact free for obtaining report of time domain and frequency domains of heart rate variability. This short-term recording of heart rate variability was carried on twice once the students were enrolled to the course before completion of one month and second time was before the starting of the second internal examination.Our study results highlighted the event of examination is highly challenging which is demonstrated by altered heart rate variability parameters. We suggest active intervention by means of continuous evaluation process to be replaced by one-time evaluation which currently is practiced.

Keywords: *Autonomic nervous system, Heart rate variability, Stress.*

INTRODUCTION

Medical curriculum is highly demanding which involves laborious input by its disciples for the mastery to be achieved at the end of the course. In the present curriculum which has been revised by medical council of India the first two semesters are highly challenging as they involve vast portion with 10 month duration for completion.

The students entering the profession are highly competitive and are usually tuned to the course of hard work required. The teaching- learning process is entirely different when compared to the education they had for last 10-12 years. The student is expected here to master various aspects and reproduce at the time of examinations. Hence stress begins to affect the students right from the beginning of the course.

Stress affects all the organs of the body, its effect on autonomic nervous system reflects end response of various organs. Academic stress is predominantly psychological and stress leads to several physiological responses such as increased heart rate variability through alteration in the autonomic activity that is increased sympathetic or decreased parasympathetic activity [1.] Management of stress with the aim to prevent its complication such as cardiovascular and cerebrovascular diseases, to improve the performance of student by relaxation technique forms the basis of this research.[1,2]

Heart rate variability is the indicator of sympathetic and parasympathetic activity which can be easily measured non-invasively. The study of Medical

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and dental students is more difficult than any other professional courses, so the amount of stress generated is also more[3].

MATERIALS AND METHOD

The study was carried out in the research laboratory of physiology department M.R. Medical College after obtaining ethical clearance from the institutional ethical committee. The students recruited to the study after obtaining the informed consent, who fulfilled the inclusion criteria. The subjects who were included in the study special emphasis were laid that they did not had any acute illness during the period of recording which was done as per the standard guidelines. Each student's personal detail along with anthropometric measurements, supine blood pressure were recorded and subjected to short term heart rate variability (HRV) recording for 5 minutes following standard protocol. The recording of the HRV was done using AD instruments eight channel polygraph where standard limb lead II recording of electrocardiogram (ECG) was done. To determine results of the heart rate variability lab chart 8 pro of AD instruments was used which selectively uses around 300 beats good interval artifact free for obtaining report of time domain and frequency domains of heart rate variability. This short-term recording of heart rate variability was carried on twice once the students were enrolled to the course before completion of one month and second time was before the starting of the second sessional examination.

The time domain and the frequency domain parameters recorded are mentioned below

RMSSD ("*root mean square of successive differences*"), the square root of the mean of the squares of the successive differences between adjacent NNs

The number of pairs of adjacent RR-intervals differing by more than 50 ms to all RR-intervals (Prr50).[4]

The computer program calculates the standard deviation (SD) of the given R-R interval sequence and the Coefficient of variation (CV) around the mean RR interval for that sequence (CV=SD/mean x100)

To calculate the square root of successive R-R interval differences isRMSSD

Very low frequency (VLF) band: It indicates the sympathetic activity

LF band: It indicates the sympathetic innervations of heart

High frequency (HF) band: It indicates the parasympathetic innervations of heart

LF/HF ratio: This is a ratio between the power of LF and HF band. This measure indicates an overall balance between sympathetic and parasympathetic system.[5]

Statistical data analysis was done using the student's paired t-test before and during the sessionalexamination,A p value <0.05 was considered statistically significant. Data were analyzed by using SPSS 20.0 version software.

RESULTS

40 subjects were enrolled for the study but 10 students were not able to complete the recording due to personal reasons hence 30 student's complete data collected was analyzed for the purpose. 18 males and 12 female subjects with mean age 17.94 ± 0.56 years.

As presented in Table No.1 the mean systolic blood pressure was raised during the time of examination but diastolic raise in blood pressure was not significant. The mean RR interval, average and standard deviation RR interval were significantly reduced on recording during the time of examination which is statistically significant except Prr50 which showed reduction was not statistically significant.

In Table No. 2 the frequency domain parameters presented shows total power during the time of examination is significantly reduced. VLF measures were not statistically reduced, a component in both high frequency (HF) and low frequency (LF) were significantly reduced during the time of examination and LF/HF ratio was not altered.

Table No.1: Comparison of the means of parameters (Time domain of HRV) and Blood pressure before examination and during university examination

Parameters	Before examination (n = 30)	During examination (n = 30)	Paired t-test value	P-value and Significance
	Mean ± SD	Mean ± SD		
Systolic BP	114.80 ± 8.53	119.74 ± 10.58	t = -2.45	P = 0.02*
Diastolic BP	76.25 ± 7.17	79.12 ± 7.52	t = -1.57	P = 0.18^
Average RR(ms)	685.75 ± 119.53	624.13 ± 82.0	t = +3.12	P = 0.01*
Mean RR(ms)	681.98 ± 119.7	621.13 ± 82.27	t = +2.97	P = 0.013*
SDRR(ms)	46.49 ± 14.19	40.27 ±16.58	t = +2.21	P = 0.034*
CV RR	0.069 ± 0.019	0.060 ± 0.021	t = +2.12	P = 0.043*
AVERAGE RATE	90.85 ± 16.75	98.18 ± 12.13	t = -2.55	P = 0.014*
RMSSD	39.87 ± 20.29	30.39 ± 23.60	t = +2.36	P = 0.018*
Prr50	16.41 ± 13.09	7.43 ± 10.26	t = +3.48	P = 0.008^

ms = milliseconds * = Significant, ^ = Not Significant

Table No. 2: Comparison of the means of parameters (Frequency domain of HRV) before examination and during university examination (n = 30)

Parameters Mean ± SD		Before examination(n=30)	During examination(n=30)	Paired t-test value	P-value and Significance
		Mean ± SD			
Total power		2198.98 ± 1718.85	1544.64 ± 1177.17	t = +2.42	P=0.025*
VLF	P(us^2)	754.95 ± 651.67	523.36 ± 413.83	t = +1.23	P=0.243^
	%	31.98 ± 18.35	31.31 ± 12.24	t = +1.39	P=0.182^
LF	P(us^2)	780.34 ± 559.84	652.82 ± 423.59	t = +2.17	P=0.043*
	%	43.49 ± 8.83	41.43 ± 11.77	t = +2.22	P=0.036*
	nu	53.47 ± 14.05	59.02 ± 17.12	t = 1.02	P=0.322^
HF	P(us^2)	968.49 ± 623.94	444.27 ± 309.25	t = +1.57	P=0.121^
	%	32.30 ± 15.03	36.54 ± 12.5	t = +1.17	P=0.311^
	nu	45.73 ± 12.96	38.04 ± 15.84	t = +2.24	P=0.034*
LF/HF		1.38 ± 0.96	2.25 ± 1.24	t = -0.917	P=0.363^

P = power, us2 = millisecond2, nu = normalized unit, * = Significant,^ = Not Significant

DISCUSSION

Stress is a physiological phenomenon of immune for dangers it encounters, it prepares the multiorgan system for flight or fight response. The symptoms of stress are both physical and psychological hence it becomes challenging to identify the sensors of stress. Short-term stress is beneficial but when stress prolongs it gradually decreases efficiency of various organs. Hence this study was oriented in identifying academic stress and its effect on autonomic nervous system which is chief regulator of involuntary functions.

Medical profession is more challenging because of the high expectations expected of the students joining the course and at the same time the stress present in the students is recorded to be maximum during the period of examinations especially in the first year of the course[6,7].

Our study results indicated an increase in the systolic blood pressureand in the mean heart rate during the period of examination which are in consistent with Kahneman D et.al[8] and Carrol D[9] who observed similar trends in their study.

Zeller, A et al[10] and Elizabeth Tet al.[11] in their observation noticed decrease in mean RR duration and its average along with SDRR which was observed in our study during the period of examination on comparison to the earlier period of recording suggesting time domain parameters of heart rate variability decreases significantly during the time of examinations which indirectly hints towards activated sympathetic discharge and decreased tone of parasympathetic component.

In evidence to that our study results in frequency domain parameters of heart rate variability suggested increased activity of sympathetic nervous system with significant decrease in Total frequency component and low frequency component which agree to results obtained by other studies[10,11] during the time of examinations.

Our study results indicated examination is a stressful event and the medical curriculum evaluation process is one of the triggering event which does cause the alteration in the autonomic nervous system as demonstrated and further may progress to cause other psychological events which though in our study have not been evaluated

CONCLUSION

Our study results highlighted the event of examination is highly challenging which is demonstrated by altered heart rate variability parameters. Medical curriculum teaching learning process needs to be redesigned in an appropriate manner which helps in imparting learning without disturbing the physiological phenomenon. Though our study could not directly relate any other event as a stressor which is a limitation of our study. We suggest active intervention by means of continuous evaluation process to be replaced by one-time evaluation which currently is practiced. we recommend medical teachers and parents of students to support them emotionally which will help in overcoming these stressful conditions.

Conflict of Interest: Nil

Source of Support: Self

Ethical Clearance: Approval of institutional ethical committee was taken to conduct the study.

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Effects of Stress and Stress Hormones on Heart Rate Variability Parameters in 1st Year Medical Students

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ABSTRACT

Stress in present world is inevitable where each individual in pursuit of achieving the maximum undergoes through this event. Stress in medical education has resulted in decreasing the confidence of students and cause of various abnormal psychological conditions. Anxiety induced stress is common and this exaggerates during the time of examinations. This altered state of mind results in variation of heart rate variability indices and biochemical parameters which needs to be examined. The present study attempts to correlate stress with biochemical and HRV parameters. The present study inducted first year medical graduate course students after obtaining informed consent. 30 students participated in the study among them 18 were male and 12 female students with mean age of 17.9±0.55 years The students were subjected for 5minute recording of ECG under standard conditions for heart rate variability parameters. The recording of these parameters was done once when the students joined the course and the second recording was obtained after 6 months when the 2nd Internal examination Viva-voce were conducted Similarly for evaluation of the biochemical physiological stressors was evaluated by collecting 5ml of venous blood and subjected to serum cortisol and uric acid levels analysis immediately using Fully automated Bidirectionally Interfaced Chemi Luminescent Immuno Assay for cortisol and Photometry for uric acid levels twice when the recording of heart rate variability (HRV) was done. Results were subjected to statistical analysis using statistical software SPSS 20.0. Students "t" test and Pearson's tests were done. A p value of <0.05 was considered to be statistically significant. Our results showed correlation of uric acid levels with time domain parameters of heart rate variability and LF/HF ratio of frequency domain. The cortisol levels could not directly link with heart rate variability parameters. Serum cortisol and uric acid levels are good indicators for determination of stress as demonstrated in our study of academic environment. Though we could establish uric acid levels correlating with decrease in short term recording of heart rate variability parameters. We would suggest further studies with larger sample size and recordings during university examinations which would predict its usefulness. We suggest academic stress can lead to chronic illness and thus detoriate the quality of life lead by health professionals. Hence we suggest early intervention and change curriculum as well as evaluation process which can reduce the stress perceived by students.

Keywords: *Stress ,Serum cortisol ,Serum uric acid, heart rate variability,*

INTRODUCTION

Stress refers to the patho-physiological process that various organs of our body undergo for a particular stimulus. Stress also refers inadequacy of body by mental, physical or emotional aspects in day to day activities. Stress in present world is inevitable where each individual in pursuit of achieving the maximum undergoes through this event. Stress in medical education has resulted in decreasing the confidence of students and cause of various abnormal psychological conditions[1, 2].

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Stress within certain limit is essential for the overall development of the individual and hence is essential even in educational field. The stress can increase the functioning ability of the various organs bringing best in them and hence promote learning. In recent years research workers have linked mental and emotional workload to measurable biochemical and physiological parameters. If we can utilize the body reactions that would help us to link the parameters and determine the process of stress early for active intervention[3].

The autonomic control over cardiovascular system is best reflected by various heart rate variability indices. The variations in beat-to-beat intervals during cardiac cycle are traditionally expressed as time domain measures and spectrum of power as frequency domain measures. As suggested by Task Force: Vagal modulation of heart is sensitive to persistent emotional stress regardless of age, gender and cardio-respiratory fitness[4].

Anxiety induced stress is common and this exaggerates during the time of examinations. This altered state of mind results in variation of heart rate variability indices and biochemical parameters which needs to be examined. The present study attempts to correlate stress with biochemical and HRV parameters.

MATERIALS AND METHOD

The study was conducted in Physiology department of MR Medical College after permission granted by Institutional ethical committee. The study period was nearly 10 months. The present study inducted first year medical graduate course students after obtaining informed consent. The students were subjected for 5minute recording of ECG under standard conditions for heart rate variability parameters[4].

This was done using Power Lab eight channel physiograph with labchart8 pro software inbuilt for analysis of heart rate variability. The recording of these parameters was done once when the students joined the course and the second recording was obtained after 6 months when the 2nd Internal examination Viva-voce were conducted. Similarly for evaluation of the biochemical physiological stressors was evaluated by collecting 5ml of venous blood and subjected to serum cortisol and uric acid levels analysis immediately using Fully automated Bidirectionally Interfaced Chemi Luminescent Immuno Assay for cortisol and Photometry for uric acid levels twice when the recording of heart rate variability (HRV) was done.

Frequency-domain measures were obtained by fast Fourier transformation. The absolute powers obtained by integrating the powers in the very low frequency (VLF) band of 0.0033–0.04 Hz, low frequency (LF) band of 0.04–0.15 Hz, high frequency (HF) band of 0.15–0.4 Hz, and the total power in all the 3 bands together. The normalized units (nu) of LF and HF power and the LF/HF ratio were used for comparison and analysis.

Time domain parameters like mean of all the RR intervals (mean RR), standard deviation of the normal to-normal RR intervals (SDNN), root mean square of successive differences between adjacent RR intervals (RMSSD) and the percentage of number of RR intervals with differences >50 ms (Prr50) were calculated and analyzed.

Results were subjected to statistical analysis using statistical software SPSS 20.0. Students ”t” test and Pearson’s tests were done. A p value of <0.05 was considered to be statistically significant.

RESULTS

30 students participated in the study among them 18 were male and 12 female students with mean age of 17.9±0.55 years.

Table No. 1: Levels of Cortisol and Uric acid before and during exam

	Minimum	Maximum	Mean	Std. Deviation
Cortisol (Before exam)	2.88µg/dL	12.09 µg/dL	7.36 µg/dL	2.52
Cortisol (During exam)	4.57 µg/dL	17.34 µg/dL	10.78 µg/dL	3.23
Uric acid (Before exam)	2.20mg/dL	6.50mg/dL	4.42mg/dL	1.23
Uric acid (During exam)	2.40mg/dL	7.40mg/dL	4.90mg/dL	1.31

Table No. 2: Comparison of Cortisol and Uric acid levels before and during exam

	Paired Differences					t	Df	Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
				Lower	Upper			
Cortisol	3.41	3.37	0.61	2.15	4.67	-5.549	29	0.000
Uric acid	0.48	1.83	0.33	-0.20	1.16	-1.443	29	0.160

As shown in Table no.1 and 2 both the parameters uric acid and cortisol levels were raised during the stressful event. The differences were statistically significant in both cases

Table No. 3: Heart Rate Variability Parameters before and during examination

Parameters Time Domain	Before exam (n = 30)	During exam (n = 30)	Parameters Frequency Domain Mean ± SD		Before exam (n = 30)	During exam (n = 30)
	Mean ± SD	Mean ± SD			Mean ± SD	
SBP	114.80 ± 8.53	119.74 ±10.58	Total power		2198.98 ± 1718.85	1544.64 ± 1177.17
DBP	76.25 ± 7.17	79.12 ± 7.52	VLF	$P(us^2)$	754.95 ± 651.67	523.36 ± 413.83
Average RR(ms)	685.75 ± 119.53	624.13 ± 82.0		%	31.98 ± 18.35	31.31 ± 12.24
Mean RR (ms)	681.98 ± 119.7	621.13 ±82.27	LF	$P(us^2)$	780.34 ± 559.84	652.82 ± 423.59
SDRR(ms)	46.49 ± 14.19	40.27 ±16.58		%	43.49 ± 8.83	41.43 ± 11.77
SDARR	± 0.0	± 0.0		nu	53.47 ± 14.05	59.02 ± 17.12
SDSD	39.84 ± 20.22	30.37 ± 23.60	HF	$P(us^2)$	968.49 ± 623.94	444.27 ± 309.25
CV RR	0.069 ± 0.019	0.060 ± 0.021		%	32.30 ± 15.03	36.54 ± 12.5
RMSSD	39.87 ± 20.29	30.39 ± 23.60		nu	45.73 ± 12.96	38.04 ± 15.84
Prr50	16.41 ± 13.09	7.43 ± 10.26	LF/HF		1.38 ± 0.96	2.25 ± 1.24

Table No. 4: Correlation of Cortisol and Uric acid levels with HRV parameters before and during examination

Parameter (Correlation with P value)	Cortisol (Before exam)	Uric acid (Before exam)	Cortisol (During exam)	Uric acid (During exam)
SDRR	-.005	.462	.119	-.115
	.978	.010*	.532	.544
CVRR	.076	.392	.062	-.039
	.689	.032*	.743	.837
SDSD	-.155	.382	.050	-0.52
	.414	.037*	.791	.785
RMSDD	-.157	.381	.042	-.057
	.406	.038*	.826	.765
LF/HF	0.40	-.378	-.151	-.412
	.833	0.39*	.427	.024*

*- p value <0.05 statistically significant

As depicted in Table No.4 uric acid level was significantly correlating with time domain and frequency domain LF/HF ratio before the examination and after the exam only LF/HF had significant correlation and no other value had correlation. Though we found significant raise in the cortisol levels during the time of examination they had no correlation with heart rate variability parameters.

DISCUSSION

The present study examined the serum cortisol and uric acid levels before the examination and during the examination in relation to heart rate variability parameters. As predicted the levels of cortisol and uric acid levels were significantly increased during the time of examination in relation to non-exam period.

It is well documented fact that stress whether in physical or psychological form derails normal functioning process of organ system which is mainly reflected in form of altered Autonomic nervous system[5]. The response of stress on individual varies from individual to individual based on their handling capacity and also emotional state. The role of increased autonomic nervous system activity with hypothalamo-pitutary-adrenal axis during stress is termed due to adaptive mechanisms[6, 7].

Delaney and Brodie et. al[8] observed the effect of short-term psychological stress on HRV analysis and observed a decrease in HF and increase in LF and LF:HF signifying the increased sympathetic and decrease in parasympathetic activity. Our study results are similar to the results demonstrated but variation in sense the stress developed in our study is gradual as academic stress perceived by students vary from individual to individual but demonstrated decrease in both time domain and frequency domain parameters of heart rate variability.

Stress stimulates hypothalmo-pitutary-adrenal axis and lead to excess production of cortisol and its by product uric acid as observed in our study similar to be demonstrated by Miller and Callaghan et.al. [9]. Hence suggesting academic stress at the level of first year medicine can lead to pathological state in students if proper care is not provided to students. Similar results were obtained by Goyal s et. al. [10] suggested chronic stress to be associated with increased cortisol levels.

Our results showed correlation of uric acid levels with time domain parameters of heart rate variability and LF/HF ratio of frequency domain. The cortisol levels could not directly link with heart rate variability parameters. One of the prime reasons for the observation would be the small sample size and duration of stress in the present sample study could not be correlated.

CONCLUSION

Serum cortisol and uric acid levels are good indicators for determination of stress as demonstrated in our study of academic environment. Though we could establish uric acid levels correlating with decrease in short term recording of heart rate variability parameters. We would suggest further studies with larger sample size and recordings during university examinations which would predict its usefulness

Recommendations: We suggest academic stress can lead to chronic illness and thus detoriate the quality of life lead by health professionals. Hence we suggest early intervention and change curriculum as well as evaluation process which can reduce the stress perceived by students.

Source of Funding: Self

Conflict of Interest: Nil

Ethical Clearance: Obtained from ethical clearance committee of M.R. Medical College kalaburgi,Karnataka,

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