ISSN - 2320-6039 (Print) ● ISSN - 2320-608X (Electronic)

Volume 1 / Number 2 / July-December 2013

INTERNATIONAL JOURNAL OF PHYSIOLOGY

Website: www.ijop.net

International Journal of Physiology

Print-ISSN: 2320-6039 Electronic-ISSN: 2320-608X Frequency: Six Monthly

Website:www.ijop.net

Editor

Dr. R.K. Sharma

Institute of Medico-legal Publications
4th Floor, Statesman House Building, Barakhamba Road,
Connaught Place, New Delhi-110 001

Printed, published and owned by

Dr. R.K. Sharma

Institute of Medico-legal Publications
4th Floor, Statesman House Building, Barakhamba Road,
Connaught Place, New Delhi-110 001

Design & Printed at

M/s Vineeta Graphics, B-188, Subash Colony, Ballabgarh, Faridabad

Published at

Institute of Medico-legal Publications
4th Floor, Statesman House Building, Barakhamba Road,
Connaught Place, New Delhi-110 001

International Journal of Physiology is a double blind peer reviewed international journal which has commenced its publication from January 2013. The journal is half yearly in frequency. The journal covers all aspects of physiology. The journal has been assigned ISSN 2320-6039 (Print Version) and ISSN 2320-608X (Online Version). The journal is covered by Index Copernicus, Poland and many other international data bases.

International Journal of Physiology

www.ijop.net

Contents

Volume 01 Number 02 July-December 2013

DOI Number: 10.5958/j.2320-608X.1.2.001

Effect of Domestic Cooking Fuel on the Health of Non-smoking Women of Uttar Pradesh, India

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ABSTRACT

Air pollution is a significant cause of morbidity and mortality. In developing countries, air pollution tends to be highest indoors, where biomass fuels, such as wood, animal dung, crop residues, and rasses, are burned by many households for cooking and space heating (Smith KR 1996). Here, we analyse the effect of Domestic Cooking Fuel on the health of Non-Smoking women of Uttar Pradesh and compare the pulmonary functions in healthy non- smoking women who used either biomass or liquified petroleum gas (LPG) as their sole cooking fuel using data on 275 healthy non-smoking women included 159 cooked solely with biomass and 116 cooked with LPG. A standardised respiratory symptoms questionnaire was administered to all the subjects and spirometry was carried out. The effects of passive smoking, ventilation, overcrowding and cooking index were also taken into account.

Passive smoking showed no significant difference between the two groups. No statistically significant differences was found in lung functions (FVC , FEV1, FER) in the two groups except for the PEFR, which was significantly lower ($P<0.01$) in women using biomass. No correlation was observed between different variables and pulmonary functions. The step-wise multivariate linear regression analysis showed no correlation between cooking fuel and the pulmonary functions.

The absence of the expected adverse effects of biomass on pulmonary functions was possibly due to better ventilation in the kitchens of subjects in the biomass group compared to previous studies. The results strongly suggest that smoke exposure from the use of biomass fuels for cooking substantially increases the risk of respiratory and lungs problems.

Keywords: *Non- smoking Women, Health, Respiratory symptoms, Biomass, Liquefied petroleum gas*

INTRODUCTION

Approximately three billion people worldwide use biomass (wood, crop residues, and dung) and coal as their primary source of energy for cooking and heating, often in kitchens that are poorly ventilated, resulting in very high exposures to multiple toxic products of incomplete combustion (UNDP 2009).

A majority of the world's population still relies principally on wood, animal dung and crop residues for fuels (Smith et al, 1983). Wood stoves create pollutants both indoors and outdoors because they generate: (i) suspended particles of respirable size, (ii) gases including polycyclic aromatic hydrocarbons (Smith et al, 1983 and Aggarwal et al, 1982). Exposure to irritant gases produced during cooking on Chulha (indigeneous-cooking stove where biomass is used as a fuel) is considered a primary cause of bronchitis and chronic cor-pulmonale (Malik, 1977). The use of liquefied petroleum gas (LPG) for cooking is associated with lowest prevalence of abnormal respiratory findings in non-smoking women when compared to men and smoking females (Jeffrey et al, 1983 and Martin et al, 1979).

As per Unicef Report 2011, India derives the bulk of its cooking energy needs from solid fuels, such as firewood and cattle dung. An overwhelming majority—about 80% of rural homes in India—continue to use biomass—firewood, crop residue or cow dung—as their primary cooking fuel (NFHS 1995)

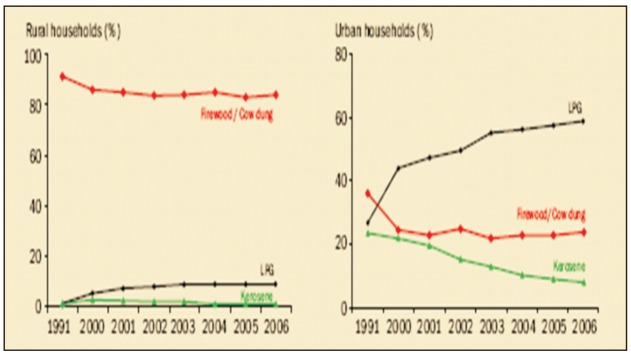

Fig. 1. Fuel trends in rural and urban India (NSSO 2007-2008)

According to the Indian National Census (2001), 75% of households use solid fuels (primarily firewood and cow dung), with the prevalence of solid fuel use as high as 90% in rural areas. In India, an estimated 400,000 deaths from acute lower respiratory infection in children younger than five and 34,000 deaths from chronic obstructive pulmonary disease in women are attributed annually to household solid fuel use, making this the third leading risk factor amongst all risk factors contributing to the national burden of disease and exceeding the burden attributable to outdoor air pollution (Smitt KR 2000 & Smith KR et. al.2000).

As a result of the household use of unprocessed biomass fuels in developing countries, concentrations of health-damaging air pollutants tend to be highest indoors, where biomass fuels such as wood, animal dung and crop residues are burned by many households for cooking and heating (Smith 1996; Warwick and Doig 2004; Saldiva and Miraglia 2004). Biomass smoke contains many noxious components, including respirable particulates, carbon monoxide, nitrogen oxides, formaldehyde and polyaromatic hydrocarbons such as benzo pyrene (WHO, 1992, Smith KR 1993)

This study examines the effect of Domestic Cooking Fuel on the health of Non-Smoking women of Uttar Pradesh and compares the pulmonary functions in healthy non- smoking women who used either biomass or liquified petroleum gas (LPG) as their sole cooking fuel. The analysis is limited to persons age 25 and over.

MATERIAL AND METHOD

In this part of the study, 338 healthy women between the age group of 25-55 years of Uttar Pradesh, was undertaken. Study participants were recruited from the female attendants of patients who were seeking medical care at the Sir Sunderlal Hospital, BHU, Varanasi, Uttar Pradesh, India. Eligible subject were life-time non-smokers and who were using either biomass or LPG for cooking for a minimum period of 10 years. All subjects were free of acute or chronic cardiopulmonary disease and chest deformities. Informed consent was taken from all subjects.

The questionnaire used for this study was based on the American Thoracic Society Questionnaire and Division of Lung Disease [ATS-DLD], which was developed by the Epidemiology Standardization Project Committee (George et al, 1979).

After the test-retest study, a study was conducted over a period of one year and seven month from July 2008 in Varanasi, Uttar Pradesh. Forced vital capacity (FVC), Forced expiratory volume in the first second (FEV_1) and Peak expiratory flow rates (PEFR) was determined with a calibrated Micro-Plus Spirometer.

In this study the predicted values for FVC, FEV_1 and PEFR were calculated by using the equation of Udwadia et al (1989) [Y= C (Constant)+ Age in years x Age Coefficient + Standing height in cm x height coefficient]. Statistical analysis was done with the statistical package SPSS 15.0 and SYSTAT.

RESULTS

A total of 338 healthy females who met the inclusion criteria were interviewed. Of these, 284 subjects agreed for pulmonary function studies after researcher explained its purpose. Nine female was excluded because she could not properly comprehend and perform reproducible pulmonary function test. There were 159 cooked solely with biomass and 116 cooked with LPG. The baseline parameters of the subjects in the two groups are shown in table 1.

Table 1. Characteristics of subjects in the two groups

S. No.	Variables	LPG Group (mean ± SD)	Biomass Group (mean ± SD)
1.	Age (years)#	36.68 ± 9.98	37.00 ± 9.86
2.	Height (cm)#	152.26 ± 3.66	150.68 ± 5.88
3.	Weight (kg)	60.88 ± 6.49	57.68± 4.70
4.	BMI= kg/m^{2*}	26.08 ± 6.35	24.42 ± 3.54
5.	No. of persons sleeping per room**	2.54 ± 0.60	3.96 ± 1.66

not significant ≤ 0.05, *p<0.01 ** p < 0.001.

Data are mean ± SD except for passive smoking exposure.

The two groups are comparable in age and height

(p>0.05). Body mass index (BMI) of subjects in the LPG group was significantly higher than in the biomass group. The biomass group had greater over-crowding than the LPG group (p<0.001) (Table 1). The family size of the biomass group was also significantly larger.

103 of the 116 women in the biomass group did not feel that there was excessive smoke in their kitchen. None of the subjects in LPG group complained of any respiratory symptoms, but twenty one subjects in the biomass group complained of lacrimation and nasal discharge while cooking.

Table 2. Comparison of lung functions in the two groups.

S. No.	Lung Function Tests	LPG Group (mean ± SD)	Biomass Group (mean ± SD)
1	FVC (L)#	2.78 ± 0.86	2.84 ± 0.62
2	FVC% Predicted#	118.47 ± 18.18	122.33 ± 15.82
3	FEV1 (L)#	2.34 ± 0.54	2.32 ± 0.38
4	FEV1 % Predicted#	80.98 ± 1.68	80.57 ± 1.52
5	FEV1/FVC %#	81.37 ± 6.22	80.42 ± 8.36
6	PEFR (L/min)*	374.70 ± 50.20	348.65 ± 52.88
7	PImax (cm of water)#	78.52 ± 26.87	75.52 ± 28.72
8	PEmax (cm of water)#	88.21 ± 22.67	89.50 ± 23.22

not significant (p>0.05 * p<0.05.)

Lung functions including forced vital capacity (FVC), forced vital capacity as a percentage of predicted (FVC%), forced expiratory volume in one second (FEV_1), forced expiratory volume in one second per cent predicted (FEV_1% predicted), forced expiratory volume in one second and forced vital capacity ratio as percentage (FEV_1/FVC%), peak expiratory flow rate as a percentage of predicted (PEFR%), maximum inspiratory pressure (PImax), and maximum expiratory pressure (PEmax) were not statistically different in the two groups. However, the peak expiratory flow rate (PEFR) in women using LPG was significantly higher than in women using biomass for cooking (p>0.01).

Multivariate Regression Analysis

The correlations among height, age, weight, income, educational status and various parameters of pulmonary functions were not significant. Step-wise multivariate linear regression analysis was done with lung function indices as dependent variables FEV_1, FVC, FEV_1/FVC ratio and PEFR.

The following models to predict FEV_1, FVC, FEV_1/FVC, and PEFR were obtained.

(i) FEV_1=3.05 - 0.08 × Ventilation – 0.07 × Cooking Index - 0.16 × Group.

The multiple regression analysis for predicting FEV_1 from type of ventilation, cooking index, and group (Biomass vs LPG) variables yielded an R square value of 0.135. In other words 13.5% of the variation in FEV_1 values is accounted for by variation in the three predictor variables.

(ii) FVC= 3.80 - 6.46 × Ventilation - 7.72 × Cooking Index - 6.96 × Passive Smoking - 0.19 × Group.

This model yielded an R square value of 0.085.

(iii) FEV_1/FVC = 88.59 - 0.72 × Ventilation - 3.55 × Cooking Index - 2.37 × Passive Smoking - 0.34 × Group.

This yielded an R square value of 0.047.

(iv) PEFR= 373.88 - 7.90 × Ventilation - 023 × Cooking Index - 8.79 × Passive Smoking - 13.75 × Group.

This model yielded an R square value of 0.088.

Thus, none of the models had a satisfactory predictive capacity.

DISCUSSION & CONCLUSION

The health studies related to solid fuel use have a long history in India. Globally, increased risks have been reported for several health outcomes in women and children exposed to cooking smoke. Evidence for lung cancer is strong while insufficient evidence is currently available for carcinogenicity of biomass smoke (Straif et al 2006).

Smoke from fires in huts has been implicated in chronic respiratory disease in India, Nepal, and New Guinea (Malik, 1984; Pandey, 1984 and Graham et al, 1968). An increased incidence of chronic bronchitis, lung cancer, and acute respiratory infections has been attributed to cooking with biomass fuel (Bauer et al, 1984; Cooper and Malek, 1982). Malik (1984) from Chandigarh reported that exposure to fumes of biomass could result in impairment of ventilatory function. The amount and concentration of particulate matter and other toxic gases emitted during biomass combustion while cooking in houses are more than those emitted during LPG combustion (WHO, 1992).

Indoor Air pollution impact can be reduced by means of improved stoves, better housing, cleaner fuels

and behavioural changes. Cleaner fuels, especially liquefied petroleum gas, probably offer the best long-term option in terms of reducing pollution and protecting the environment, but most poor communities using biomass are unlikely to be able to make the transition to such fuels for many years

The health impacts of the use of bio-fuels are quite high for adults, as approximately 6 million people suffer from respiratory (Laxmi V et al 2003).

During the last two decades, there has been a gradual trend away from the usage of biomass fuel. No study has compared the lung functions in subjects using LPG and biomass for cooking, although studies suggest that using LPG is less hazardous. Malik, (1984) and Behera and Jindal, (1991) found that the lung functions of women using LPG and mixed fuel was not statistically significant, Symptoms of chronic bronchitis in women using chulha were significantly higher than in LPG users. Other studies (Jeffrey et al, 1983) have compared lung functions in non-smoking women using LPG and electric stoves and found no significant difference in $FEV_{1.0}$ and respiratory symptoms in both categories of women. Based on the previous observations made on biomass and LPG, researcher hypothesized that lung functions would be lower in women using biomass.

To limit any confounding variable in interpreting early changes in lung function, researcher included only healthy asymptomatic non-smoking women. Lung functions including FEV_1 were used to study any change in respiratory status.

Researcher feels that the reason for the absence of a significant difference in lung function in the two groups occurred because of low exposure to biomass fuel pollutants due to improved ventilation and outdoor cooking. On analyzing the type of ventilation in the kitchens of households using biomass for cooking, it was found that except for eight subject (whose kitchen had no windows), all the others had some form of ventilation in their kitchens. Also 15 out of 159 women in this group cooked outdoors and 23 subjects used verandahs for cooking. In the remaining households, the kitchens were well ventilated with at least one to two windows in the kitchen and the chulha used for cooking was situated close to or next to the windows. Proper ventilation and outdoor cooking will decrease the severity of exposure to smoke. All the women in LPG group had adequate ventilation in their kitchens. Researcher was unable to accurately reconstruct the degree of ventilation in earlier studies that have found adverse pulmonary effects from biomass combustion products.

Woolcock et al, (1970) in their report on chronic lung disease in the Papua New Guinea Highlands suggested that crowding around fires in unventilated thatched huts was responsible for chronic bronchitis. In the Gujjar community (Qureshi 1994), who usually live in single room huts and cook with wood, the prevalence of chronic bronchitis was 4.8% with good ventilation compared to 23.6% where ventilation was poor. The higher prevalence of chronic bronchitis in Gujjar females was attributed to domestic smoke, poor housing conditions, overcrowding and low socioeconomic status. Use of biomass fuel with poor ventilation contributes to chronic bronchitis. Good ventilation diminishes the adverse effect on lung functions.

In conclusion, there is a need for a coordinated set of community studies to develop and evaluate interventions in a variety of settings, together with policy and macroeconomic studies on issues at the national level, such as fuel pricing incentives and other ways of increasing access by the poor to cleaner fuels. Also required is a systematic, standardized approach to monitoring levels and trends of exposure in a representative range of poor rural and urban populations.

Finally, it is necessary to keep in mind the close interrelationship between poverty and dependence on polluting fuels, and consequently the importance of socioeconomic development, which should be at the core of efforts to achieve healthier household environments.

ACKNOWLEDGEMENTS

An author is thankful to present subject and their families for their cooperation. I am especially grateful for the assistance and encouragement of my supervisor Prof. A.K. Kapoor and Prof. Satwanti Kapoor and the medical professional of BHU for their help during research.

Conflict of Interest: None

Source of Funding: UGC (JRF and SRF)

Ethical Clearance: Department of anthropology ethical committee

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DOI Number: 10.5958/j.2320-608X.1.2.002

Serum Thyrotropin Level in Relation to Obesity Indicators in a Clinically Euthyroid Population

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ABSTRACT

Minor disturbances of thyroid function, not reaching overt dysfunction, may be associated with the possibility of weight disturbances and the development of obesity. To determine the relation of thyroid function to obesity, a cross-sectional study was carried out among 100 (50 male and 50 female) clinically euthyroid medical students, in the age-group of 18-20 years, at the Gauhati Medical College, Guwahati. The study found a significant positive correlation between serum levels of Thyroid Stimulating Hormone(Thyrotropin, TSH) and waist circumference, hip circumference and waist-hip ratio, both in males and in females.

Keywords: *TSH, Waist Circumference, Hip Circumference, Waist-Hip Ratio*

INTRODUCTION

Thyroid Stimulating Hormone (Thyrotropin, TSH) is a major regulator of the morphologic and functional states of the thyroid gland. Overt thyroid dysfunction is known to influence body weight. Overt hyperthyroidism is associated with weight loss[1] whereas overt hypothyroidism is associated with weight gain[2]. Several studies have probed the association between thyroid function and obesity in patients with thyroid disorders and in morbidly obese subjects. Jung CH et al [3] reported that patients with hypothyroidism had higher waist-hip ratios, an index of obesity. Rotondi M et al [4] evaluated the circulating thyroid function parameters in morbid obese patients. Compared with healthy, normal-weight subjects, obese patients, having thyroid function parameters in the normal range and negative thyroid auto-antibodies, showed significantly higher serum TSH.

The serum level of TSH is a reliable index of thyroid function. Waist-Hip Ratio(WHR) and Waist circumference(WC) are used as indicators of obesity, particularly abdominal obesity. WHO STEPS [5] states that abdominal obesity is defined as a WHR greater than 0.90 for males and greater than 0.85 for females.

The present study aims to determine the relation between serum levels of TSH and the indicators of obesity- WC, Hip circumference(HC) and WHR in a clinically euthyroid, healthy young adult population.

METHODOLOGY

The present study was conducted in the Department of Physiology, Gauhati Medical College, Guwahati. The study proposal was approved by the Institutional Ethics Committee, Gauhati Medical College & Hospital. The period of study was from August 2010 to July 2011. The study was conducted among the medical students attending classes in the Department of Physiology. The purpose of the study and the study procedure was explained to all participants. Detailed history was taken and general and systemic examination was done.

Exclusion criteria included

1. Present or past history of any thyroid disorder
2. Family history of any thyroid disorder
3. History of intake of any medication which may affect the thyroid hormone profile such as: glucocorticoids, anti-thyroid drugs, thyroid hormone replacement, Estrogen and progesterone preparations

4. History of or clinical examination suggestive of any signs or symptoms related to thyroid disorder such as:

Hypothyroidism: Cold intolerance, lethargy, weight gain, mental slowing, depression, dry skin, loss of hair, facial puffiness.

Hyperthyroidism: Exophthalmos, Heat intolerance, Weight loss, Fatigueability, Nervousness, warm moist skin, Palpitation Presence of any visible or palpable neck swelling.

In case of girls, history of any menstrual irregularities in the form of oligomennorrhoea, mennorrhagia etc.

After taking history and conducting general and systemic examination, a total of 100 students found to be clinically euthyroid were included in the study. Written informed consent was taken from all the subjects in the format prescribed by the Institution Ethics Committee, Gauhati Medical College, Guwahati. The subjects consisted of 50 males and 50 females.

For each subject, Waist circumference and Hip circumference was measured and recorded and blood samples were collected for the estimation of TSH. TSH was estimated by Immunoradiometric Assay (IRMA) at the RIA Laboratory, Department of Endocrinology, Gauhati Medical College, Guwahati.

The WHR was calculated using the following formula

$$\text{WHR} = \frac{\text{Waist circumference (in metres)}}{\text{Hip circumference (in metres)}}$$

STATISTICAL METHOD

The data collected was tabulated and subjected to statistical analysis. All data were expressed as Mean±SD. Correlation coefficients were calculated using MS Excel.

RESULTS

The normal range of TSH assay was 0.30 – 5.00m IU/ml. The mean TSH of the 100 subjects was 2.99±1.43 m IU/ml with 12 subjects (12%) having TSH value greater than 5.00 m IU/ml. The male subjects had a mean TSH value of 2.96±1.43 m IU/ml with 5 subjects (10%) having TSH value greater than 5.00 m IU/ml. The female subjects had a mean TSH value of 3.01±1.43 m IU/ml with 7 subjects (14%) having TSH value greater than 5.00 m IU/ml. None of the subjects had TSH value less than 0.30 m IU/ml. (Table 1)

In both males and females, TSH was found to have a strongly positive and significant correlation with WC and HC . The correlation of TSH with WHR was weakly positive and significant . (Table 2) (Figs. 1,2,3)

Table 1: Mean Values of the Anthropometric Parameters and TSH Values Among The Subjects

GROUP		MALES + FEMALES (100)	MALES (50)	FEMALES (50)
WC (metres)	MEAN ± SD	0.75±0.092	0.78±0.069	0.71±0.099
HC (metres)		0.93±0.079	0.94±0.066	0.92±0.092
WHR		0.81±0.064	0.84±0.059	0.77±0.048
TSH (m IU/ml)		2.99±1.425	2.96±1.432	3.01±1.433

Table 2: Correlation Coefficients of TSH with the Anthropometric Parameters.

	Males		Females		Males + Females	
	r	p	r	p	r	p
WC	0.673	0.01	0.723	0.01	0.633	0.01
HC	0.518	0.01	0.720	0.01	0.624	0.01
WHR	0.319	0.05	0.411	0.01	0.293	0.05

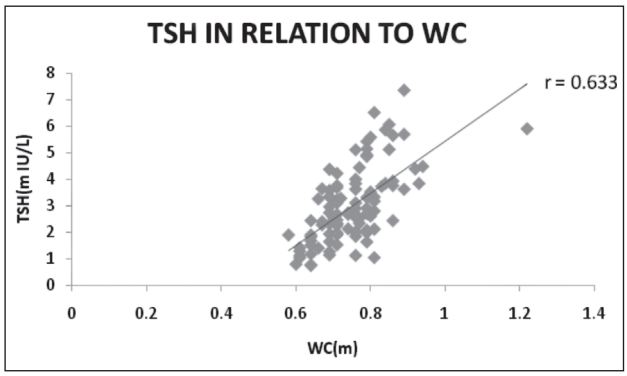

Fig. 1. Scatter Diagram Showing The Correlation of TSH With Waist Circumference(Wc)

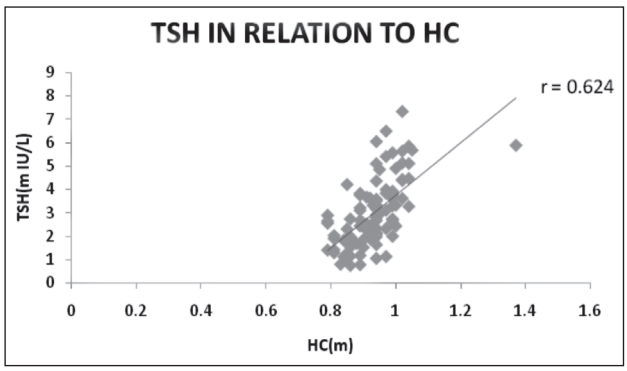

Fig. 2. Scatter Diagram Showing The Correlation of TSH With Hip Circumference(Hc)

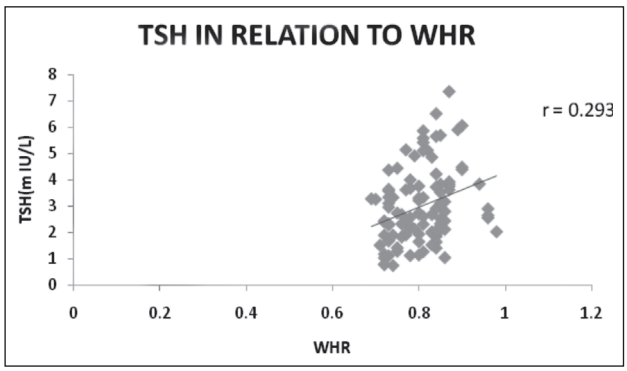

Fig. 3. Scatter Diagram Showing The Correlation of TSH With Waist-Hip Ratio(Whr)

DISCUSSION

The present study found a positive correlation of serum TSH levels with waist circumference, hip circumference and waist-hip ratio. Similar findings have been reported by other authors.

Bastemir M et al [6] found a significant positive correlation between serum TSH and waist circumference (r=0.219, p=0.01). De Pergola et al [7] found that TSH was positively correlated with waist circumference($p<0.05$). Riaz et al [8] found a significant correlation between TSH and waist circumference and a weak and non-significant correlation between TSH and WHR. Ambrosi B et al [9] found that TSH values were positively correlated with waist circumference (r=0.11, p-0.02). Anders Svare et al [10] showed that for each milliU/L increase in TSH, WC increased 0.6cm in women and 0.5cm in men. Jose de Jesus Garduño-Garcia [11] found that TSH values showed a positive correlation with waist circumference.

The following hypotheses have been put forward by various authors to explain the association between thyroid function and obesity.

One possible hypothesis is that the adipose tissue itself may influence thyroid function. Reinehr T [12] observed that a moderate elevation of TSH concentration is frequently found in obese humans and rapid weight loss is associated with a decrease of TSH. Anders Svare et al[10] showed that weight gain is accompanied by increasing TSH and weight loss is related to decreasing TSH. Petra Kok et al [13] reported that mean TSH concentration and secretion rate were enhanced in obesity. In a further study [14], the authors demonstrated that 24-hour TSH secretion rate was significantly higher in obese women than in normal weight controls and weight loss was accompanied by diminished TSH release.

Some authors suggest that Leptin may be the mediator via which adipose tissue influences thyroid function. Leptin regulates Thyrotropin Releasing Hormone(TRH) gene expression in the paraventricular nucleus of the hypothalamus and is thus an important regulator of the hypothalamic-pituitary-thyroid axis[15,16]. Leptin has been shown to stimulate the biosynthesis of TSH in-vitro [17]. Studies have revealed that there is a synchronicity between the secretion of Leptin and TSH, both in children [18] as well as in adults [19]. Also it has been shown that TSH itself stimulates Leptin secretion by the adipose tissue [16,20,21]. However, the relation between Leptin and TSH is not supported by all studies [22,23].

On the other hand, the association between thyroid function and obesity may be due to a direct action of TSH on its receptors present in the adipose tissue. Several studies have provided convincing evidence for the presence of TSH receptors on adipocytes and pre-adipocytes[24-27]. The action of TSH on its receptors leads to the differentiation of pre-adipocytes to adipocytes, causing adipogenesis[24, 28].

Another possible hypothesis regarding the association of thyroid function and obesity involves the role of thyroid hormones in the maintenance of the optimal level of metabolism in the cells. Decreased thyroid function causes a decrease in the basal metabolic rate, which, in turn, may lead to obesity[29,30]. In support of this, studies have shown that treatment of hyperthyroidism may lead to weight gain[31] and treatment of hypothyroidism may lead to weight reduction[32,33]. Studies have also revealed that hypothyroidism is associated with a decrease in metabolic rate [34,35].

CONCLUSION

The present study has lead to the conclusion that there is a significant positive correlation between serum levels of TSH, an index of thyroid function and the obesity indices waist and hip circumferences and waist-hip ratio. Having said so, the limitations of the present study need to be kept in mind. The present study was a time-bound, cross-sectional one with a limited number of subjects. Only TSH levels were estimated. Anders Svare et al [10] showed that for each milliU/L increase in TSH among women, weight increased 0.9kg, BMI 0.3kg/m^2 and WC 0.6cm. In men, the corresponding figures were 0.8kg, 0.2kg/m^2 and 0.5cm. Further, they found that a weight gain of more than 5kg was associated with a TSH increase of 0.08 milliU/L in women and 0.15 milliU/L in men. Weight loss of more than 5kg decreased TSH levels by 0.12 milliU/L in women and by 0.03 milliU/L in men. At the present time, it cannot be said with absolute certainty whether an increased TSH level favours the deposition of fat or on the contrary, the excessive accumulation of fatty tissue increases TSH secretion. A longitudinal follow-up study will be helpful to elucidate the exact nature of the association between thyroid function and obesity.

ACKNOWLEDGEMENTS

The authors acknowledge the help and support of the staff of the RIA Laboratory, Gauhati Medical College and the medical students who participated in the study.

Source of Funding: Self-funded study

Conflict of Interest: The authors declare that there is no conflict of interest that could prejudice the findings reported in the study.

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DOI Number: 10.5958/j.2320-608X.1.2.003

Electrophysiological Evaluation of the Peripheral Nerves of the Upper Extremities in Patients of Chronic Obstructive Pulmonary Disease

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ABSTRACT

Introduction: Chronic obstructive pulmonary disease (COPD), the fourth leading cause of death, is a major health problem. COPD has been implicated as one of the causes of peripheral neuropathy. The influence of COPD in the peripheral nervous system has been the subject of clinical investigation only in the recent years. This study aimed at evaluating the nerve conduction velocity (NCV) and amplitude of peripheral motor and sensory nerves of the median and ulnar nerves of the upper extremities in patients of COPD when compared to healthy normal subjects.

Material and Method: The subjects (COPD patients and healthy volunteers) were assessed for anthropometric measurements, the pulmonary function tests and SpO2 levels. They were subjected for the nerve conduction test, of the median and ulnar nerves of the upper extremities,

Results: A significant decrease in the NCV and amplitude for the median and ulnar nerves (both the components) at p value < 0.001was found in the COPD patients when compared to the control group, irrespective of the causative factor for COPD.

Conclusion: The presence of peripheral neuropathy was confirmed in COPD patients when compared to healthy control group, as the NCV and amplitudes of peripheral nerves (median and ulnar) of the upper extremities were found to be decreased in COPD patients.

Keywords: *Chronic Obstructive Pulmonary Disease, Peripheral Neuropathy, Nerve Conduction Studies*

INTRODUCTION

Chronic obstructive pulmonary disease (COPD), is a major health problem and a cause of chronic morbidity and mortality throughout the world. It is the fourth leading cause of death in the world. (1)

Based on current knowledge, the working definition is

"COPD is a preventable and treatable disease with some significant extra pulmonary effects that may contribute to the severity of the disease in the individual patients. Its pulmonary component is characterized by airflow limitation that is not fully reversible. This airflow limitation is usually both progressive and associated with abnormal inflammatory responses of the lungs to the noxious particles or gases. (1)

COPD affects lung functions, leading to airflow limitations and is also associated with significant effects in distant organs, the systemic effects of COPD.(2)

The effects of chronic respiratory insufficiency on the central nervous systems are well known, the influence of this condition in the peripheral nervous system has been the subject of clinical investigation in the recent years.(3)

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Peripheral neuropathy is the failure of the nerves that carry information to and fro from the brain, spinal cord and the somatic system. From the many cited examples of peripheral neuropathy, COPD also has been implicated as one of the causes.

The clinical manifestation of neuropathy in COPD is generally masked by the severity of COPD, thus asymptomatic or mildly symptomatic peripheral nerve disease in such patients remains undiagnosed.[4] The work regarding occurrence of peripheral neuropathies in patients with COPD has been much less inspite of the fact that COPD is quite prevalent in developing countries. [5]

Present study was therefore taken up to evaluate the presence of the peripheral neuropathy in the upper extremities of the COPD patients when compared to the normal healthy subjects.

MATERIAL AND METHOD

The study was done in Department of Physiology, Jawaharlal Nehru Medical College (JNMC) Wardha. The approval was taken by Institutional Ethical Committee of Datta Meghe Institute of Medical Sciences, Wardha. The study period was from August 2008 to June 2010. This was a case control study, sample size of 140 subjects (70 COPD and 70 controls).

For the study group patients diagnosed as cases of COPD according to GOLD criteria were recruited from the Department of TB & Chest and Department of Medicine. The control group was selected from medical, paramedical staff of the institute and healthy attendants of the patients. The written consent was obtained from all the subjects prior to the tests.

A questionnaire obtained information on demographic data, the history concerning the smoking and the use of biomass fuel as a mode of cooking from all the subjects. The smoking history, as in the unit of "pack-year" is defined as smoking of a pack of cigarettes (20 pieces) per day for one year.[6]

The biomass fuel history, as Exposure index, is calculated as the average number of hours spent daily for cooking multiplied by the number of years of cooking.[7]

The COPD patients were tested for Haemogram (Hb%), Chest X- Ray, and Pulmonary Function Testing, Pulse Oximetry and Electrophysiological studies. The other tests done were Electrocardiogram, serum electrolytes, fasting serum glucose and renal function test, of the patients in order to exclude concurrent risk factors for peripheral neuropathy.

Inclusion Criteria

1. Diagnosed patients of COPD, aged 40-60 yrs of either sex from Deptartment of TB & Chest and Dept. of Medicine, AVBRH, Sawangi.and are under treatment.

Exclusion Criteria

1. Unstable, unwilling, uncooperative patients of COPD.
2. Lung parenchyma pathology or infection due to Mycobacterium Tuberculosis.
3. Any decompensated cardiovascular, endocrinal (Diabetes mellitus) hepatic or renal functions.
4. Chronic alcoholics, malnourished, Anemic & Leprosy patients
5. Patients on neurotic drug abuse or any history of drugs e.g. almitrine etc

Pulmonary Function Tests (PFT) was performed in TB & Chest OPD (Out Patient Department). The Nerve Conduction Study (NCS) for the subjects were done in the Neurophysiology Research Laboratory, Department of Physiology, JNMC. The established methodology described by Mishra and Kalita [8] was adopted. Patients were relaxed on a couch in a soundproof and air-conditioned examination room, to avoid muscle artifacts while recording.

The motor and sensory nerve conduction was tested in the median nerve and ulnar nerve of both the upper extremities.

During the median and ulnar motor NCS, the nerves was stimulated at two sites. The compound muscle action potential was recorded from thenar and hypothenar muscles respectively. For the median nerve the active electrode was placed over the belly of abductor pollices brevis and the reference electrode was placed over the tendon 3 cm distal to the active electrode of both the hands of the subject.

While for the ulnar nerve the active electrode was placed over the belly of abductor digiti minimi and the reference electrode was placed over the tendon 3 cm distal to the active electrode of both the hands of the subject.

The median sensory nerve conduction and the ulnar sensory nerve conduction recording were made from the ring electrode placed at the interphalangeal joint of the index finger and little finger respectively, and the stimulation was given at the wrist.

Statistics

Descriptive test were used to describe average value of the study parameters like age, smoking history, exposure index, body mass index (BMI), Haemoglobin Hb%, saturation of Oxygen (SpO_2), & Force Expiratory Volume in first sec ($FEV_{1)}$. Unpaired "t" test were applied to the data to test the significant difference in the two groups for the motor and sensory component of the peripheral nerves of both the upper extremity namely the median and ulnar.

They were presented in the form of Mean ± SD. Standard error was also used to know the error in the average deviation of the sample. SPSS 13.0 version was used for the statistical analysis.

OBSERVATION AND RESULT

Table No 1: Characteristics of study groups

	COPD group	Control group	p-value
Age	53.90±7.79	46.24±5.75	0.00*
Smoking history in pack years	33.87±8.50	Nil	-
Exposure Index	31.52±9.59	Nil	-
Body mass Index	20.14±3.36	21.84±2.52	0.00*
SpO_2	94.71±1.50	97.94±0.29	0.00*
Hb%	13.23±0.93	13.43±0.75	0.16
FEV_1%	49.15±18.32	98.56±11.98	0.00*

FEV1 %: forced expiratory volume in first sec; **Hb%:** Hemoglobin; **SpO_2:** Saturation of oxygen. A *statistical significance with p value < 0.001 for SpO_2, FEV_1 %, BMI and age was observed when compared amongst the COPD and Control group

Table No. 2: Nerve Conduction Velocity (CV) And Amplitude (A) Of COPD Patients When Compared To The Control Group (Mean and Std Error) in the motor nerves

	MEDIAN MOTOR				ULNAR MOTOR			
	CV		A		CV		A	
	Mean	Std. Error	Mean	Std. Error	Mean	Std. Error	Mean	Std. Error
COPD group	49.87	0.54	11.52	0.55	54.35	0.69	7.90	0.41
Control group	59.22	0.43	12.85	0.48	61.44	0.48	8.27	0.24
p values	0.00*	-	0.07	-	0.00*	-	0.43	-

* Statistically significant (p<0.001)

Table 2 shows the comparison of NCV and A in the motor nerves of study group with the control group. As shown, decrease in NCV was observed in the study group when compared to its control group. A non significant difference was observed in the amplitude of motor nerves.

Table No 3: Nerve Conduction Velocity (CV) And Amplitude (A) Of COPD Patients When Compared To The Control Group (Mean and Std error) in the sensory nerves

	MEDIAN SENSORY				ULNAR SENSORY			
	CV		A		CV		A	
	Mean	Std. Error	Mean	Std. Error	Mean	Std. Error	Mean	Std. Error
COPD group	47.97	1.09	42.78	1.34	42.78	1.34	48.09	0.50
Control groups	63.88	2.66	66.19	6.50	64.52	0.69	63.88	2.15
p value	0.01*	-	0.00**	-	0.00**	-	0.00**	-

* Statistically significant (p<0.05). ** Statistically highly significant (p<0.001).

NCV in COPD patient, when compared with the control group, there was a decrease seen in the values of NCV of the both median sensory at p value <0.05 and for the ulnar sensory nerve at p value <0.001. However, there was also a significant p value for the amplitudes of MSN & USN at p value <0.001.

DISCUSSION

The association of peripheral neuropathy and COPD has been noted only in the past decades and has been recently rediscovered as a problem in patients with COPD. Inspite of the relationship between the two, the work over the presence of peripheral neuropathies associated with COPD has been much less.

Table 1 gives the demographic data details, which shows that the age of COPD group when compared with the control group was highly significant which is in accordance with the study done by Agrawal et al[9] Studies done previously showed there was a reduction in the nerve conduction values from the age of 30-40 years but notable change in values are seen only at the sixth decade or still later. [8]

The Body Mass Index (BMI) was also statistically significant value, $p < 0.001$, between the two groups. According to WHO classification of obesity (based on BMI)[10] these values are found to be within normal range. Our finding was consistent with findings of G Pieffer [11] who mentioned that Broca's index for malnutrition did not appear as a relevant risk factor for peripheral neuropathy. In contrast to our finding, Otto Appenzeller [12] in his study, reported, that 7 out of the 8 COPD cases, had associated wasting, and on electromyography examinations evidence of peripheral neuropathy was found.

The SpO_2 and the FEV_1 % values are seen to be highly statistically significant between the two groups. This finding is in line with the work of Agrawal et al,[9] Ozge et al. [4]

The Hb% values of the two groups show a non significant value at $p> 0.05$, rules out anemia as an independent risk factor in the development of the peripheral neuropathy. In contrast to the present study, McCombe et al,[13] in his study, performed the nerve conduction study on patients of Vitamin B_{12} deficiency and also did the sural nerve biopsy, where changes of axonal degeneration was found on biopsy.

Table 2 and 3 shows the decrease in the Median motor NCV in the COPD group when compared to the control. Narayan M, et al [14] also reported a similar finding, of slowing of the NCV in motor components of, median, ulnar, peroneal and tibial nerves and also in the median sensory nerve when compared in the COPD patients as compared to control group. O Kayacan et al [15] in their study after the electrophysiological testing, found that there is significant slowing of Median motor NCV in COPD group when compared to the Median motor NCV in control group. Ozge et al [4] on electrophysiological evaluation also found statistically higher prevalence of polyneuropathy in COPD patients, especially men.

Another study, by S.Jann et al [16] reported low amplitude compound action potentials and sensory action potential, with only slight reduction of the NVC in the chronic respiratory insufficient patients.

Agrawal et al [9] observed that 5 out of 30 COPD patients to have predominantly sensory axonal peripheral neuropathy.Moreover, it was found that there was decreased amplitude and NCV of median sensory, ulnar sensory, and sural sensory nerve in each of these five COPD patients. Median motor, ulnar motor and common peroneal motor nerve impairments were not significant in five COPD patients with peripheral neuropathy, in accordance with the present findings.

Faden et al [17] in their study of COPD cases with age matched controls showed the significant difference between the groups for each of the sensory nerves, with the amplitude of the sensory action potential being a better discriminator. In contrast the motor nerve conduction differed only slightly between the groups.

COPD arises from the interaction between the host and environmental factors. It is known to be caused by noxious particles and gases. Cigarette smoking is the most commonly encountered risk factor for COPD, which also have some neurotoxic effects.[18] In many countries, air pollution resulting from the burning of wood and other biomass fuels has also been identified as a COPD risk factor.[1] This leads to an increase incidence of the COPD in women.[7] Airways obstruction finally causes arterial hypoxaemia which ensues hypoxic tissue damage, which is implicated for the impairment in the nerve conduction and likely to be more frequent in the late stages of COPD. [4]

The hypoxic neuropathies are associated with nerve capillary endothelial cell hyperplasia and hypertrophy, predisposing to luminal occlusion. When combined with the thickening of the nerve perineurium, this phenomenon may impede the transport of nutrients and oxygen. These mechanisms seem to be applicable to peripheral nerve dysfunction and lesions, resulting from impaired axonal transport (an energy-requiring process) and causing axonal degeneration.[19]

CONCLUSION

To conclude, in this study it is found that there is a presence of motor–sensory polyneuropathy in the patients of COPD when compared with the control group irrespective of the factor responsible for COPD. The decrease in the NCV confirms the involvement of the peripheral nerves which can be due to the hypoxemia caused by the airflow obstruction in the COPD patients. The present study can be eye opener to the physicians about the occurrence of peripheral neuropathy in COPD.

ACKNOWLEDGEMENT

I acknowledge the subjects for their willing participation, the staff of the department of Physiology and the statistician who helped to complete the study.

Conflict of Interest

None and there has been no funding for the above study done.

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DOI Number: 10.5958/j.2320-608X.1.2.004

Eosinophil Count in High Altitude Natives of Nepal

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ABSTRACT

Normally eosinophil constitutes 1-7% with it's absolute count < 700 cells /dl of blood but while studying the Differential Leukocyte Count (DLC) of the medical students it is found that the percentage of eosinophils in DLC is much higher among a significant number of Nepalese students of hill region though they have no complains of any diseases. The present study is therefore undertaken to study whether the eosinophil count of normal high altitude natives is significantly higher than the normal low landers or not. Keeping this in view the MBBS students of Nepali and Indian origin are randomly selected and the Differential Leukocyte (Eosinophil) Count (DEC) and Absolute Eosinophil Count (AEC) are done by the standard hematological techniques along with the ESR value of individual subjects. It was found that the normal range of DEC is significantly high in Nepali students of high altitude natives along with the AEC than that of low landers . Therefore it can be opined that the normal range of eosinophil count among the high altitude natives may be higher than the standard reference value which might be physiological as suggested by their normal ESR values.

Keywords: *Eosinophilia, Eosinophil Count, High Altitude Natives*

INTRODUCTION

Normally eosinophil constitutes 1-7% [1] of the peripheral blood leukocytes at an absolute count of 450-500 per cu mm of blood [1,2,3,4] which are increased beyond 7% (Eosinophilia) in some pathological conditions like parasitic infections, allergic conditions and certain types of drug reaction [5,6] .Whereas while studying the DLC of the medical students in their practical classes it is found by the author that differential count of eosinophil is much higher among a significant number of Nepalese students of hill region though they have no complains of any diseases whereas the percentage of other leukocytes along with total leukocyte count remains within the normal reference range . The present study is therefore undertaken to study whether the eosinophil count of normal high altitude natives is significantly higher than the normal low landers and also than the standard reference value or not.

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MATERIALS AND METHOD

Selection of subjects: For this study total 128 MBBS students of both sexes having age group within 18 to 22 of Nepalgunj Medical College, Nepal were randomly selected and divided into three groups- GROUP-A comprising native students of Hill region (no of students 68) of Nepal, GROUP-B comprising Nepali residents of Tarai Anchal (no of students 31) , and, GROUP-C comprising resident Indians of non-hill region studying in Nepal (No of students 29), In all the cases students selected for this study are neither have any clinical signs and symptoms of eosinophilia due to any known infectious causes nor have any complain of cough, fever, wheezing, dyspnoea, chest pain [7]. The investigation was done after one month but within three month of migration of these students from their original residents to this medical college hostels in Nepalgunj, a tarai region to exclude the short term changes of physiological parameters. The study was approved by the Institutional review board.

Differential and Absolute Count of Eosinophil : For the differential leukocyte count the blood film is prepared from fresh blood collected directly by pricking the middle or ring finger aseptically with no anticoagulant added and stained with Leishman's stain. The stained blood film was then scanned under

oil immersion lens of light microscope from one end to another. As each WBC is encountered it is identified until 200 leukocytes have been examined and percentage of each leukocyte is calculated .

The absolute count of eosinophil is done by hemocytometry using Neubauer's chamber with freshly prepared Dunger's Diluting fluid [8].

Determination of ESR by Westergren's method : 2 ml of venous blood is drawn in aseptic condition and transferred it into a vial containing 0.5 ml of 3.8% sodium citrate solution. The contents was mixed by inverting or swirling the vial without shaking the tube. The blood citrate mixture is then filled in Westergren's pippete by sucking and ESR was noted at the end of one hour.

Statistical analysis: To find out the significant difference of obtained mean value of absolute eosinophil count, Student's 't ' test is done in between Group –A and Group-B and also in between Group-A and Group-C separately [9]. Whereas the obtained differential eosinophil count and ESR is compared with the standard reference value.

FINDINGS

It is found that among the studied group the DEC is significantly higher in 30 % individuals of Group A along with the concomitant rise of AEC, whereas in entire studied population of Group-B and C both the above mentioned parameters are within the normal range (Table-1). Table –1 also shows that in Group-A the normal range of DEC, is higher than the Group B and Group C . The mean value of AEC also is significantly higher in group-A than the Group-B and Group-C ($P<0.001$) whereas there is neither any significant difference of both the parameters between Group-B and Group-C nor any significant difference of the above mentioned parameters in Group –B and Group-C with the standard reference value. It is also found that the ESR value of the subjects in all the studied population under all the specified groups is within the normal range.

Table 1: Eosinophil count and ESR in high altitude Nepali Natives (Group A), Natives of Tarai Regions of Nepal (Group B) and Non High Altitude Indian Residents (Group C).

Studied Group	Range of DEC	Absolute eosinophil count (AEC)		Range of ESR (mm)	
	(%)	Range(No. of cells/dl)	Mean ± SD	Male	Female
Group A	3-13	212-1342	637± 327.4	3-8	4-10
Group B	1-8	118-742	428.4± 167.9	2-7	4-9
Group C	1-8	120-708	424.5± 171.6	3-7	5-10
Reference value	1-8 (William F.K, 2002)	100-700 (Holland SM et al, 2005)	400± 300	2-7	3-9

DISCUSSION & CONCLUSION

Eosinophils are produced in the bone marrow on an average around 1-7 % of white blood cells and increased number of eosinophils more than 7 % is often considered as eosinophilia [1] . However clinically eosinophilia is better defined as rise of eosinophils beyond 450 eosinophils/cumm of blood [1,2,] . In some other opinion it is considered as the rise of absolute eosinophil count more than 700 eosinophils /cu mm of blood which was produced to fight of allergic disease or parasitic infections [5,6] . But in the present study it is found that a significant number of Nepalese population of Hill region are having more than 7% of eosinophils with the concomitant rise of their absolute value without having any complains and clinical symptoms of eosinophilia like abdominal pain, diarrhea, fever, cough and skin rashes. So it can be opined that the increase in number of eosinophil (mild eosinophilia) in these population may not be pathological as the ESR of their blood is within the normal range which is generally raised during any acute or chronic infection [10] and individuals selected are off no complain and devoid off any clinical symptoms of eosinophilia. This rise of eosinophil count can also not be considered as tropical eosinophilia which is common among the travelers immediately returning from hill region [11,12,13] as the study was done in Tarai region (Flat river plain of Nepal that extends along the southern border with India) after one month of the migration of the entire studied populations to this area from their permanent residence . So it can be concluded that in the high altitude natives the eosinophil count may be physiologically mild high as that of the study of Lawrence et al.[14] which may help to make 1st line of defense of the persons highly effective in combating parasitic infections if any which

is very common there though more such study with large sample size may confirm this findings.

ACKNOWLEDGEMENT

The assistance rendered by the doctors of rural medical clinic under Dept. of General Medicine , Nepalgunj Medical College & Hospital is thankfully acknowledged. The technical assistance offered by Mr. Dhirendra Srivastav, Laboratory Technician, Dept. of Pathology, and Mr. Akhileswar Pandey, Laboratory Technician, Dept of Physiology, Nepalgunj Medical College is also thankfully acknowledged

Conflict of Interest: Nil

Source of Support: Institutional

Ethical Clearance: The study was approved by the ethical committee of Nepalgunj Medical College, Nepal as this work was conducted by the author in the abovementioned Institute.

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DOI Number: 10.5958/j.2320-608X.1.2.005

A Comparative Analysis of Non-invasive Cardiovascular Functions in Proficient and Non-proficient Healthy Subjects

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ABSTRACT

Cardiovascular disease (CVD) is associated with the development of atherosclerotic process that begins in the arteries, representing vascular pathology, can be measured in the form of reflection index (vascular tone) and other non invasive cardiovascular parameters, leads to cardiovascular morbidity and mortality. Previous reports have described significant reduction on arterial stiffness and alteration on other related cardiovascular parameters in atheletes as well as in proficient individuals. No report so far is available on comparative analysis of non invasive vascular parameters such as reflection index (vascular tone)termed as RI, Large artery stiffness index (SI), Dicrotic index (DI), Heart rate (HR), and cardiac parameters such as Left Ventricular ejection time (LEVT), Diastolic time, Ejection slope, dp/dt max in proficient and non proficient healthy subjects.

The present study has been undertaken to analyze the differences of non - invasive cardiovascular responses in both proficient and non proficient healthy subjects.

Various non invasive cardiovascular parameters like RI, SI, DI, dp/dt max, LVET, pulse duration, diastolic time, ejection slope and also systolic, diastolic, mean and pulse pressure were studied by using PC based PPG analysis system.

In the present study no statistical significant differences were found on body weight and age, dp/dt max and ejection slope. in two groups (proficient and non proficient), but statistical significant differences were found on RI,SI, pulse duration, diastolic time, systolic (SBP), diastolic (DBP), Pulse (PP) and mean (MABP) pressure that would be attributed to increased parasympathetic tone in proficient as compared to non proficient subjects.

Keywords: *Non Invasive Techniques, Cardiovascular Parameters, Large Artery Stiffness Index. Reflection Index, Left Ventricular Ejection Time*

INTRODUCTION

Over the years there has been mounting concern about the effects of exercise on the cardiovascular system of atheletes [1-2]. Several studies have been reported on effect of exercise on cardiorespiratory functions and more recently on arterial stiffness [3-6]. An arterial stiffness comes from the functional status of smooth muscle lying mainly in all the arteries leads to dictate the amount of atherosclerotic process which can be more common in both diabetic and hypertensive individuals as compared to proficient and non proficient individual [7-8]. If there is a development of atherosclerosis which comes from reduction of dispensability due to endothelial dysfunction [8] (disturbance on the functions of smooth muscles by altering autonomic nervous system), systolic, diastolic, pulse and mean pressure changes, pulse wave velocity increases [6-7].

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Aerobic exercise has been shown to reduce the age-related increase in arterial stiffness[1]. While a number of studies have shown that practicing yoga reduces blood pressure [2-5], there are different styles of yoga that vary in terms of exercise intensity. Hatha yoga is a common style of yoga that involves the use of inversion postures [6-9]. If inversion postures increase blood pressure in the carotid arteries, it is possible that this would be a stimulus to reduce arterial compliance. Resistance exercise has been shown to acutely reduce arterial compliance [9-13], and chronic resistance training is associated with reduced arterial compliance. Arterial stiffness describes the rigidity of the arterial walls which again can be explained by using the term "vascular tone". The vascular tone/rigidity of wall depends on many neurogenic, local and hormonal effects and is determined by the relationship between the vasoconstrictory and vasodilatory mechanisms. Arterial Stiffness Index (ASI) is another measure of arterial stiffness. It quantifies the shape of the Oscillometric envelop. As the arterial increases, it becomes harder to collapse the arteries by applying external pressure. Hence the Oscillometric envelop becomes flatter as the stiffness increases. The ASI value gives a clear indication of this flattening process. The higher the stiffness, the ASI value is also higher.

Pulse wave shape, was one of the parameters collected during the study [10-12]. Recently researchers have identified the finger volume pulse derived from a digital photoplethysmographic probe is directly related to the radial and brachial artery pressure pulse. The digital volume pulse (DVP) was recorded by measuring the transmission of infrared light absorbed through the finger. The amount of light is directly proportional to the volume of blood in the finger pulp. This similar technique was used to record noninvasive cardiovascular parameters like RI, SI, DI, dp/dt max, LVET, pulse duration, diastolic time, ejection slope and also systolic, diastolic, mean and pulse pressure, would signify the functional status of smooth muscle which leads to development of atherosclerosis processes to be seen in all the ages, did vary in both males and females, noted in both healthy and non healthy young subjects. Lacunae in the literature include the comparative analysis of non invasive cardiovascular parameters in proficient and non proficient subjects. Therefore, our aim was to analyze the differences if any on non invasive cardiovascular parameters in both proficient and non proficient individuals.

MATERIAL & METHOD

Study was done on 40 volunteers healthy subjects (20 proficient and 20 non proficient) attending research laboratory of Physiology department almost every day at 11 a.m. All healthy subjects were in the age group of 18-20 years. All proficient subjects under went yoga training, performed walking, jogging, running both in the morning and evening for a period of one hour.

The present study was conducted in the department of Physiology, U.P.Rural Institute of Medical Sciences and Research, Saifai, Etawah, U.P. A day prior to recording of invasive parameters, the subjects were familiarized with the Laboratory environment and procedure of recording all the non invasive parameters. They were given instructions about the experimental procedures and practice trials were administrated until we were satisfied that subjects performed the test as required of them.

The subjects for the study were selected based on the following criteria

Inclusion criteria of both proficient and non proficient groups

1. Males between 18-20 yrs of age
2. Leading sedentary life style means not taking exercise (non proficient group) and taking exercise daily both in the morning and evening for a minimum period of two hours and practicing since 2009 (proficient group)
3. Body weight is in between 60-70 kg .
4. No past and present history of any type of illness.

Exclusion criteria of both proficient and non proficient groups

1. Males above the age of 22 and below the age of 18 yrs
2. Presence of past illness, inadequate knowledge on taking exercise daily.
3. Did not take balanced diet.

Recording of non invasive cardiovascular parameters

Vascular parameters such as systolic, diastolic, pulse and mean pressure, reflection index (vascular tone), large artery stiffness index (SI) and dicrotic index (DI) were recorded. Cardiac parameters such as upstroke time (UT), left ventricular ejection time(LEVT), rise index, pulse duration, diastolic time(DT), ejection slope and dp/dt max were also recorded. The instrument was based on recording digital volume pulse (DVP) where there is a transmission of infra red light absorbed through the finger. The amount of light is directly proportional to the volume of blood in the

finger pulp. In this study we used a piezo-type pulse plethysmograph to record the pulse wave from the finger. During the recording, the pulse waves are transmitted to a waveform that is consistent with the pressure pulse. Measurements were taken from the pulse integral and were expressed as indices that would help to understand the implications of pulse contour analysis.

PPG analysis system was used to record both vascular and cardiac parameters. The Systolic, Diastolic, Mean and Pulse pressure were recorded in both the groups of healthy subjects. Vascular parameters such as reflection index ((vascular tone) RI), Large artery stiffness, Dicrotic index, Heart rate, Upstroke time, and cardiac parameters such as Left Ventricular ejection time, Diastolic time, Ejection slope. dp/dt max were recorded in both the groups

Experimental Protocol

Each healthy subject was invited for recording invasive parameters at 11 a.m. in the morning. Each subject was asked to sit on a chair. Tip of the finger was used for fixing the electrode/ sensor. Recording of all the invasive parameters were started when subject felt comfortable with the apparatus. Each subject was invited five times at particular time (11 a.m.) and recording of all the parameters done also five times. Result was analyzed by using statistics.

STATISTICAL ANALYSIS

The data was analyzed using student paired 't' test to compare the non invasive cardiovascular parameters in proficient as compared to non proficient healthy subjects. P value less than 0.05 was accepted as indicating significant difference between the compared values.

RESULTS

1) The bodyweight and age (Table-1) of both proficient and non proficient healthy subjects were almost same (P>0.05).

2) Significant reduction on HR rate, SBP, DBP. PP and MAP (P<0.05) in proficient as compared to non proficient healthy subjects (Figure-1 and Table-1).

3) Significant decrease on RI (Vascular tone), SI, DI (P<0.05) in proficient as compared to non proficient healthy subjects (Figure-2, Figure-3 and Table-1)

4) Significant increase on left ventricular ejection time. Pulse duration, diastolic time (P<0.05) in proficient as compared to non proficient healthy subjects (Figure-2)

5) No alterations on dp/dt max (Table-1) and on ejection slope (Figure-3) in proficient as compared to non proficient healthy subjects (Table-1).

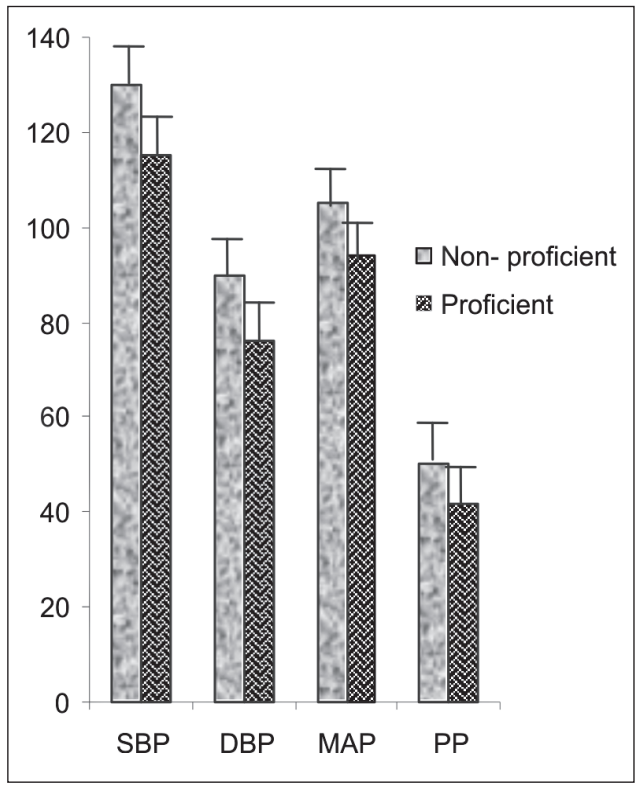

Fig. 1. Non-invasive cardiovascular responses (SBP, DBP, MAP, PP) in proficient, and non- proficient healthy subjects.

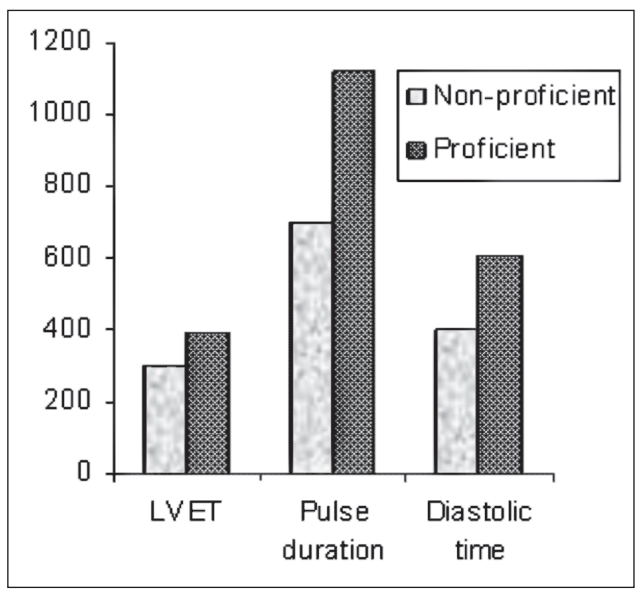

Fig. 2. Non-invasive cardiovascular responses (LVET, Pulse duration Diastolic time) in proficient and non- proficient healthy subjects.

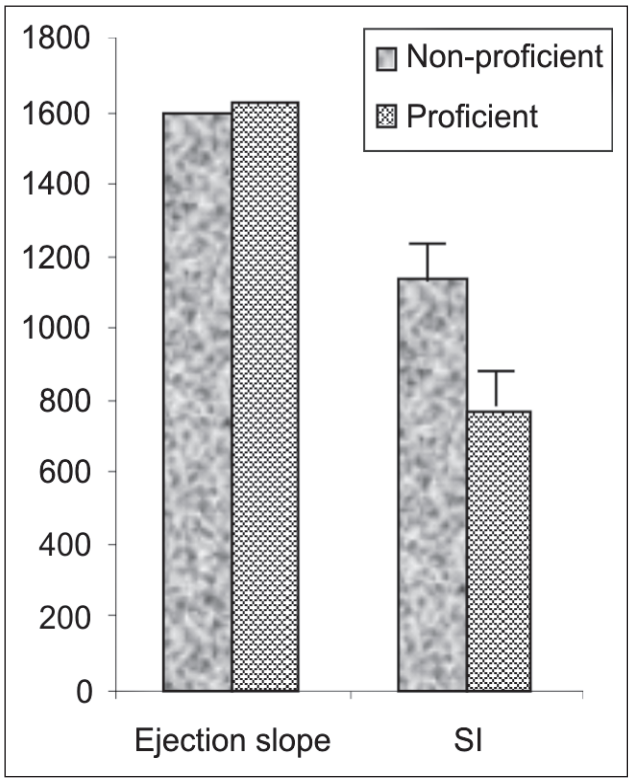

Fig. 3. Non-invasive cardiovascular responses (Ejection slope and SI) in proficient and non- proficient healthy subjects.

Table-1: Showing body weight, age, heart rate, dp/dt max and reflection index (RI) in proficient and non proficient healthy subjects.

Name of Parameters	Proficient N=20	Non Proficient N=20	P value	S.E.
Age (Years)	20 ± 1.24	19 ± 2.11	P>0.05	0.001
Body Weight (Kg)	68 ± 2.24	69 ± 3.26	P>0.05	0.004
HR (Beats/min)	69 ± 4.24	84 ± 4.04	P<0.05	0.022
dp/dt max (mm/sec)	1.0± 0.24	1.0± 0.23	P>0.05	0.004
RI (Reflection Index) (%)	61 ± 4.24	82 ± 4.24	P<0.05	0.022

DISCUSSION

Proficient subjects take exercise daily resulting acute increase on systolic pressure, buffering the oscillatory changes in blood pressure resulting from intermittent ventricular ejection and relaxation of smooth muscle, increased perfusion of tissues leads to decrease on arterial stiffness (significant reduction on RI, DI and SI). This action reduces pulse pressure, smoothes peripheral blood flow and improves the efficiency of this cardiovascular system as a whole. Stiffening of large arteries leads to a number of adverse haemodynamic consequences, including a widening of pulse pressure noted in non proficient subjects. Changes on heart rate (reduction) signifying vagal tone in proficient as compared to non proficient healthy subjects. Previous studies have shown that the efficiency of cardiovascular system is improved by following yoga, regular taking physical exercise [13-20] .

Significant reduction on reflection index and stiffness index signifying more parasympathetic involvement in proficient as compared to non proficient healthy subjects

Significant increase on reflection (Vascular tone) ($P<0.05$), decrease with heart rate would be attributed to more ventricular filling and increase with vagal tone respectively in proficient as compared to non proficient healthy subjects. Taking exercise daily both in the morning and evening increases parasympathetic drive, decreases heart rate, blood pressure and left ventricular ejection time which

Source of Funding

Instrument used in this study were provided by the department of Physiology, U.P. Rural Institute of Medical Sciences & Research, Saifai and was assisted by lecturer and technician in the department. Financial expenses was met by the investigator in completing this particular study.

ACKNOWLEDGEMENT

We thank the management of the Institute for providing us the equipments and lecturer, Mr Hyder, technician Mr Abrar Ahmed for their cooperation in conducting this study. I am thankful to my wife for her support in writing this manuscript.

Ethical clearance; obtained from Institutional Ethical committee

Conflict of Interest

This is to certify that contribution titled "A Comparative analysis of noninvasive cardiovascular function in proficient and non- proficient healthy subjects" is an original work conducted by Dr S Bhunia and Dr Nitesh Tripathi with approval taken from Institutional Ethical Committee and hereby considered for publication in International Journal of Physiology".This particular manuscript has not been sent to any other journal for publication or already accepted for publication anywhere.

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DOI Number: 10.5958/j.2320-608X.1.2.006

Effect of Normal Pregnancy on Pulmonary Function Tests in a Rural Setting

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ABSTRACT

Objective: This rural based cross sectional study was carried out to compare the Pulmonary Function test (PFT) parameters like FEV1 & PEFR between first, second and third trimester of pregnancy and to find out whether any correlation exists between hemoglobin % & pulmonary function tests in pregnant women.

Method: 126 subjects were enrolled in the study comprising 31 subjects each of first and second trimesters and 34 subjects in third trimester.30 subjects were included in control group. The selected subjects from said age groups were divided into following groups. Group A -31 subjects between 1st week to 13 weeks of gestation, from the rural population.Group B-31 subjects between 14th to 24th weeks of gestation, from the same rural population.Group C: -34 subjects between 24th to 36 weeks of gestation, from the same rural population.Group D: Control group-Normal non-pregnant women from the same rural population. Their Pulmonary Function like FEV1 and PEFR was tested in sitting position with computerized RMS Medspiror. The statistical analysis of the study was done using one way ANOVA, Dunnet T test and Tukey Test.

Result: There was a significant decrease in FEV1 % observed with p value at $p < 0.05$. There was also a decrease in PEFR with p value at $p < 0.05$.

Conclusion: This study gives an overall idea of normal lung function values in pregnant women of rural India. The values obtained may help in setting up of exercise protocols of Indian rural pregnant women.

Keywords: *PFT, Pregnant Women, Rural Area*

INTRODUCTION

Some conditions like chronic respiratory disease are present in about 10 cases per 1000 women in the childbearing years in rural population. (WHO criteria 1981). Pulmonary disorders are a leading cause of indirect obstetric deaths. The gradually growing fetus poses increasing metabolic demands on the mother requiring delicate physiological adjustments in the circulation and respiration. [2]

The changes in the respiratory system during pregnancy can affect the maternal mortality and morbidity and also the outcome of pregnancy. The major factor that alters respiratory functions is the mechanical and biochemical changes that routinely accompany the pregnant state [3]. Changes in lung volumes occur mostly during the last trimester. Though there is little change in vital capacity there is a considerable fall in expiratory reserve volume and residual volume(RV) and consequently in functional residual capacity (FRC)[4]. These changes are mainly due to the mechanical presence of a fetus tending to force the diaphragm into the chest. A better index of the function of the respiratory pump is the timed vital capacity volume (FEV1)[5]. More attention has been paid to states of pathologic stress upon pregnancy such as heart disease, tuberculosis and following chest surgery than to the physiologic norm. And very few data is available on respiratory changes in different trimester of pregnancy in normal pregnant women[5,6]. Anemia is one the important cause of producing morbidity in pregnant mothers in tropical countries like India where rural population is much more than the urban population. In this rural area, Iron deficiency anemia

and nutritional anemia is more common[7]. The studies that have been done on pulmonary function tests during pregnancy shows conflicting results . Many studies were done to see the effect of respiratory disease on the lung functions in pregnant mother, but the changes that occur in normal pregnancy on PFT are scarce. Therefore this is an attempt to see the effect of normal pregnancy on pulmonary function tests in all trimester of pregnancy in rural population.

MATERIAL & METHOD

The present study was conducted in the Department of Physiology in the Post-Graduate Research Laboratory in Co-ordination with Obstetrics & Gynecology Department of Jawaharlal Nehru Medical College (JNMC) and Acharya Vinobha Bhave Rural Hospital (AVBRH), Wardha.

This is a cross-sectional study & Institutional Ethical Committee clearance was obtained. 126subjects were enrolled in the study comprising 31 subjects each of first and second trimesters and 34 subjects in third trimester.30 subjects were included in control group.

RESEARCH METHODOLOGY

The selected subjects were explained about the purpose of the study. Around 5-6 subjects were examined per week in the Post-Graduate Research Laboratory of the Dept. of Physiology. They were brought from the Department of Obstetrics and Gynaecology, JNMC and AVBRH, Wardha, in the morning hours. On their arrival in the Laboratory, a detailed history and clinical evaluation was done.

The selected subjects from said age groups were divided into following groups.

Group A -31 subjects between 1st week to 13 weeks of gestation, from the rural population.

Group B-31 subjects between 14th to 24th weeks of gestation, from the same rural population.

Group C: -34 subjects between 24th to 36 weeks of gestation, from the same rural population.

Group D: Control group-Normal non-pregnant women from the same rural population.

Their Pulmonary Functions like FEV_1 and PEFR was tested in sitting position with computerized RMS Medspiror (Helios 401, PC Based, Windows Version, RMS Recorders and Medicare Systems).

The subjects were asked to place a mouthpiece attached to the computerized Helios 401 spirometer in their mouth. A clip was then placed over the nose and the subject was told to breathe through the mouth into a tube connected to a spirometer .After breathing normally, the subject was asked to slowly blow out until her lungs were empty. Then ,they were instructed to take a deep breath, filling up lungs completely. As soon as the lungs were full, they were told to blow out as hard and as fast as they could until they felt that their lungs are absolutely empty. Then immediately they were asked to inhale as deep and as fast as possible. They were asked to repeat the test until there were three good efforts. The test was terminated if the patient showed signs of significant head, chest, or abdominal pain while the procedure was in progress. Parameters of the PFT namely FEV_1 & PEFR were included in the study. Hemoglobin was estimated using Sahli's haemoglobinometer method

Statistical methods: The statistical analysis of the study was done using one –way ANOVA, Dunnet T test and Tukey Test.

FINDINGS

Table 1: Age wise distribution of pregnant and non

Pregnant women.

Age Group(yrs)	Group A	Group B	Group C	Group D	χ^2-value
18-24	18	19	28	4	31.90p<0.0001S
25-31	13	12	6	26	
Total	31	31	34	30	

S= Significant

Table number 1 shows number of cases distributed in three study group and control group. P value showed significant difference (p= <0.0001).

Table 2: Distribution of pregnant and non pregnant women and their Pulmonary function test values

Parameters		N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
						Lower Bound	Upper Bound		
FEV1%	A	31	88.45	21.95	3.94	80.39	96.50	12.00	114.00
	B	31	83.22	28.14	5.05	72.90	93.55	13.00	126.00
	C	34	73.73	27.73	4.75	64.05	83.41	7.00	126.00
	D	30	99.03	23.82	4.35	90.13	107.93	60.00	150.00
PEFR%	A	31	56.83	20.92	3.75	49.16	64.51	20.00	92.00
	B	31	53.06	25.41	4.56	43.74	62.38	9.00	123.00
	C	34	46.20	17.22	2.95	40.19	52.21	21.00	74.00
	D	30	60.90	19.60	3.57	53.57	68.22	40.00	104.00

In the above table FEV_1% decreased in study group than control group. While in group C, FEV_1 value was found less. PEFR% also showed a decreased value in study group than control group. It is found to be decreased more in group C (Third Trimester).

2a: Multiple Comparisons of mean difference between study group and control group.

Parameters	Study group	Control group	Mean Difference	Std. Error	p-value	95% Confidence Interval for Mean	
						Lower Bound	Upper Bound
FEV1%	1.00	4.00	-10.58	6.56	0.253 NS,p>0.05	-26.16	5.00
	2.00	4.00	-15.80	6.56	0.046 S,p<0.05	-31.39	-0.22
	3.00	4.00	-25.29	6.41	0.000 S,p<0.05	-40.54	-10.05
PEFR%	1.00	4.00	-4.06	5.36	0.787 NS,p>0.05	-16.79	8.67
	2.00	4.00	-7.83	5.36	0.327 NS,p>0.05	-20.56	4.89
	3.00	4.00	-14.69	5.24	0.016 S,p<0.05	-27.14	-2.24

• S-Significant. NS-not significant .

In FEV1% there is significant difference in group B and C P<0.05. Group A shows no significant difference at P>0.05 . In PEFR% there is significant difference in group C and no significant difference in other groups.

Table 3: Distribution of Hb% in different study groups.

Parameters	N	Mean Value of Hb%	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
				Bound	Lower Bound	Upper		
A	31	9.05	1.43	0.25	8.53	9.58	6.33	11.36
B	31	9.57	1.15	0.20	9.15	10.00	6.36	11.36
C	34	9.22	0.90	0.15	8.90	9.53	7.32	10.86
D	30	11.61	0.62	0.11	11.38	11.84	10.12	12.60

Table 3A: One way ANOVA

Source of variation	Sum of Squares	df	Mean Square	F	p-value
Between Groups	128.68	3	42.89	37.47	0.000S,p<0.05
Within Groups	139.65	122	1.14		
Total	268.34	125			

In the above Table, Hb% in between the group and within the group show significant differences by ANOVA test with P-value at <0.05

Dunnett t test was used in control group and study group for comparison.

Table 4: Correlation of Hb% with pulmonary function tests

Correlation		FEV1	PEFR
Group A	Pearson Correlation	-0.209	-0.198
	p-value	0.260 NS,p>0.05	0.286 NS,p>0.05
	n	31	31
Group B	Pearson Correlation	-0.304	-0.143
	p-value	0.096 NS,p>0.05	0.444 NS,p>0.05
	n	31	31
Group C	Pearson Correlation	-0.143	0.137
	p-value	0.419 NS,p>0.05	0.441 NS,p>0.05
	n	34	34
Group D	Pearson Correlation	0.267	0.235
	p-value	0.153 NS,p>0.05	0.211 NS,p>0.05
	n	30	30

In the above table there is no significant correlation found with Hb% and pulmonary function parameters in all groups.

DISCUSSION

In the present study the different parameters of pulmonary function tests studied are discussed in the following description.

I) Forced expiratory volume in 1st sec (FEV_1)

In the present study mean value of FEV1 (%) decreased from 88.45 ± 21.95 to 73.73 ± 27.73 with F = 5.396 (P<0.05). This result is significant in study group.

Author	Years	No. of Subject		Result
Mokkapatti et al	1991	119	DE	1.79 ± 0.47 to 1.73 ± 0.45Lit
R. M. Shaikh et al	1983	185	DE	94.69 ± 4.71% to 83.83 ± 15.28%
J. A. Milne et al	1979	30	DE	3.12 to 3.04Lit
Marlene eng et al	1975	12	NC	3.2 to 3.3Lit
Alaily A. B. et al	1978	38	NC	3.11 ± 0.57 to 308 ± 0.50Lit
K. D. Pandy et al	1984	75	NC	75.68 ± 19.39% to 75.29 ± 20.27%
Mrunal S. Pathak et al	2003	50	NC	76.6% to 77.37%
B.M. Puranik et al	1994	50	NC	2 ± 0.09 to 2.19 ± 0.18Lit
Pande et al	1973	49	IN	90 ± 1.95% to 83 ± 1.88

In 1991 Mokkapatti et al[8]., R. M. Shaikh (1983)[9] & J. A. Milne (1979)[10] found similar observation which coincides with the observation of the present study. The decrease in FEV_1 throughout pregnancy could be due to significant restrictive defects produced by the enlarging uterus.

R. M. Sheikh found decrease in FEV_1% during pregnancy as compared to non pregnancy which is statistically significant.

Alaily A. B. et al (1978)[11], K.D. Pandy (1984)[12,] B. M. Puranik (1994)[13] & Mrunal S. Pathak (2003)[14] found no change in forced vital capacity in the first sec.

Pandy et al (1973)[2] found an increase in FEV_1 in first trimester of pregnancy which they concluded could be due to improved air conductance through the dilated airway.

2) Peak Expiratory Flow Rate (PEFR)

In the present study mean value of PEFR decreased from 56.83 ± 20.92 to 46.20 ± 17.22 showing F value 2.869 (P <0.05).

Author	Year	No. of. Studies	NC/DE/In	Result
Present study		126	DE	56.83 ± 20.92 to 46.20 ± 17.22%
Ganeriwal et al	1984	120	DE as per author	289.00 ± 45.00 to 283.71 ± 35.66L/min
Singhal et al	1987	14	DE	352.5 ± 12.5(Normal)251.71 ± 12.8 L/min(Anemic)
Mokkapatti et al	1991	119	DE	335.00 ± 370.0 to 312.09 ± 60.6L/min
B.M. Puranic et al	1994	50	DE	325 ± 29.20 to 286 ± 26.66 L/min
Mrunal S. Phatak et al	2003	50	DE	348 to286L/min
Hassan M. Harirah et al	2005	38	DE	Mean rate of decline of 0.65 L/min per week
Savita Singh et al	1995	65	NC as per author	3.3 ± 0.2 ml to 3.5 ± 0.3 litls
Knuttgen et al	1974	13	NC	406 ± 12 to 403 ± 12L/min

• DE – Decreased. NC – No change

Complimentary results were obtained by Ganeriwal et al (1984)[15], Usha Singhal et al (1987)[7], Mokkapatti et al (1991)[8], B. M. Puranic et al (1994)[13], Mrunal S. Phatak et al (2003)[14] & Hassan M. Harirah(2005)et al[16].

Our study shows no Significant correlation of PEFR with low hemoglobin. Usha singhal et al (1987)[7] in a study of 14 pregnant women noted that PEFR was decreased in anemic than in normal subjects in IIIrd trimester of pregnancy.

No change in PEFR was reported by Knuttgen et al (1974)[17].According to Knuttgen this is thought to be due to effective force development at the same level of efferent nervous output which brought an increase in length and decrease in radius of curvature of abdomen.

The very highly significant decrease in PEFR may be attributed to a lesser force of contraction of main expiratory muscles like anterior abdominal muscles and internal intercostals muscles(B.M. Puranik)[17]. Peak flow studies can not replace FVC and FEV_1 studies but they add another important parameter of pulmonary function testing and since PEFR is considered as and overall test of lung function it can be used in places where such sophisticated instruments are not available.

CONCLUSION

The results obtained related to many Indian and foreign authors. This study gives an overall idea of normal lung function values in pregnant women of rural India.

Differences observed were mainly due to the basic criteria of subject selection i.e. the subjects were purely from the rural population. They were relatively anaemic, and were from low socioeconomic group. No correlation was found between Hb% & PFT. However,this study will help in assessment of fitness for anesthesia and the progress of pre-existing lung disease. The findings can be used as a guide for pre-pregnancy work ups (exercises), as during parturition as there is need of forceful inspiration and expiration. Also,the values obtained may help in setting up of exercise protocols of Indian rural pregnant women.However further and detailed study is needed in this regard.

ACKNOWLEDGEMENT

The authors thankfully acknowledge the help rendered by staffs of department of OBGY& Physiology at JNMC, & Civil hospital ,Wardha.

Conflict of Interest: Nil.

Source of Funding: Nil

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DOI Number: 10.5958/j.2320-608X.1.2.007

Computer Assisted Learning in Clinical Physiology Practical: Perception and Understanding by Ist year Medical Students, Advantages and Limitations

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ABSTRACT

Clinical examination of human subject in physiology clinical practicals is a part of MBBS curriculum. In present scenario; in most of the medical institutions clinical examination is conducted in physiology laboratory or demo room where patients are usually not available. Due to this Ist MBBS students may feel difficulty in assessing clinical signs, therefore in understanding applied physiology.

To overcome this problem in present study attempt has been made to teach different aspects of clinical physiology with the help of computer assisted learning (CAL). Aim and objective was to find out whether CAL enhances understanding of clinical physiology in Ist MBBS students and to assess their cognitive skills (knowledge acquired and perceptions). Advantages and limitations of CAL as a teaching tool were also assessed.

In this study hundred and seven Ist MBBS students participated voluntarily. Self designed and prestructured questionnaire on clinical examination was prepared after going through literature review. Non CAL-test conducted after traditional way of teaching and CAL-test conducted after teaching with traditional method plus use of computer. They also filled a survey questionnaire on the CAL outcomes, advantages and limitations of CAL. The data collected and statistically analyzed for proportion test using SPSS (version 16).

In present study 92% students perceived CAL better and 85% students claimed that their understanding improved which was reflected in the CAL-test as improvement in the knowledge.

It was found that along with traditional method of learning; CAL is useful in learning clinical physiology practical.

Keywords: *Computer Assisted Learning (CAL), Clinical Physiology Practical, Perception, Advantages And Limitations*

INTRODUCTION

Physiology is the basis of medicine which includes study of all mechanisms of normal body functioning. Practicals including hematology experiments and clinical examination of physiology are an integral and essential part of physiology teaching. Simpson B. defined computer assisted learning (CAL) as "learning that supplements regular classroom activities with computer activities during or surrounding classroom time"[1]

Now days under medical education technology various teaching learning methods are available to teach medical students. It is possible to use computers in medical education. It is becoming "a truth universally acknowledged" that the education of

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undergraduate medical students will be enhanced through the use of computer assisted learning.[2] Medical education research has been heavily concentrated on skills and competency assessment, and suggests that attention should rather be devoted to the development of clinical reasoning skills.[3,4] Some CAL studies affirms that use of CAL as an alternate or adjunct to traditional methodologies could improve efficiency and effectiveness of medical education future, future study should incorporate various student learning styles and expand to include higher order thought processing.[5] Likewise, the study of CAL application and the acquisition of psychomotor skills among students and the relationship to teaching methodologies is a relatively new area of research in medical education.[6,7] Study conducted by Brahler J concluded that CAL interventions can support small collaborative student groups and enhance CAL skills without taxing faculty.[8] However work in the area of CAL remained largely under-searched.[5]

This study is designed to investigate the outcome of CAL in clinical physiology practicals. The intent of the study is to supplement classroom teaching by creating a virtual clinical experience using computer.

AIMS AND OBJECTIVES

1. To investigate students' perception of CAL.
2. To investigate students' understanding of clinical physiology with CAL.
3. To find out advantages and limitations of CAL.
4. To enhance Ist MBBS students learning about clinical examination.

MATERIAL AND METHOD

Materials

Study group: All students of Ist MBBS from Sri Lakshmi Narayana Institute of Medical Sciences, Pondicherry who attended the physiology practical class on a randomly chosen day with their informed consent

Study material

a) Medical educational DVDs containing images and videos of clinical examination.

b) Images of clinical features downloaded from internet.

c) Images of clinical examination downloaded from internet.

d) Photographs and images of clinical signs in case of lesion of a particular cranial nerve downloaded from internet.

e) Computer, LCD projector.

METHOD

A hundred and seven students participated in the study. The procedures were explained to them and informed consent was taken from all participated students.

To test the outcome of study Non CAL-test and CAL-test was conducted as

a) After traditional way of teaching clinical examination of 12 cranial nerves (i.e. use of blackboard and demonstration of clinical examination in human subject) a set of MCQ questionnaire provided to Ist MBBS students to test learning and understanding of clinical physiology. This test was considered as Non CAL-test.

b) After computer assisted teaching (i.e. use of blackboard and demonstration of clinical examination in human subject plus computer assisted teaching) same test conducted in participated students to test and compare their learning and understanding of clinical physiology. This test was considered as CAL-test.

c) A set of questionnaire was provided to find out perception CAL by Ist MBBS students.

d) Two more sets of questionnaires were provided to Ist MBBS students to find out advantages and limitations of CAL.

e) Finally survey in the form of questionnaires will be studied and analyzed statistically with SPSS software version 16.

RESULTS

Results on knowledge assessment

Evaluation was done by the way of Non CAL-test and CAL-test comprising objective type 20 MCQs. Students will be considered as pass after scoring 50% marks that is after getting 10 correct MCQs. The number of students passed, percentage of pass, mean and standard deviation are shown in table 1. One

hundred and seven students participated in the study. In non CAL-test 59 students (55%) passed with a mean of 10.63. After CAL-test 92 students (86%) passed with a mean of 14.28. (Table 1.) Statistical analysis using proportion test for non CAL-test and CAL-test showed a p-value less than 0.001 which is highly significant indicating that there was a significant increase in the knowledge acquired after CAL practical session.

Table 1: Assessment of knowledge acquired (pre-test and post-test results). (n=107)

Score	No. of students passed	Percentage of pass(%)	Mean	Standard deviation
NonCAL-test	59	55.14	10.63	3.99
CAL-test	92	85.98	14.28	4.15

*P < 0.001 (Highly significant)

Results on perceptions of students on CAL

The results from the feedback questionnaire are shown in bar charts as in figures 1, 2 and 3.

The outcomes of CAL in physiology clinical practical reveal that, out of 107 students 99 (92.5%) students felt better perception and visual enhancement. 97 (90.6%) students felt that they had achieved the learning objectives. 95 (89%) students enjoyed CAL teaching. 93 (87%) students felt of retaining concepts better. 91(85%) students felt that written instructions for procedure and precautions were helpful. Nearly 88 (82%) students felt studying the topic with CAL was informative and helped in grasping concepts better. 75 (70%) felt that CAL increased the impact of the topic delivered.

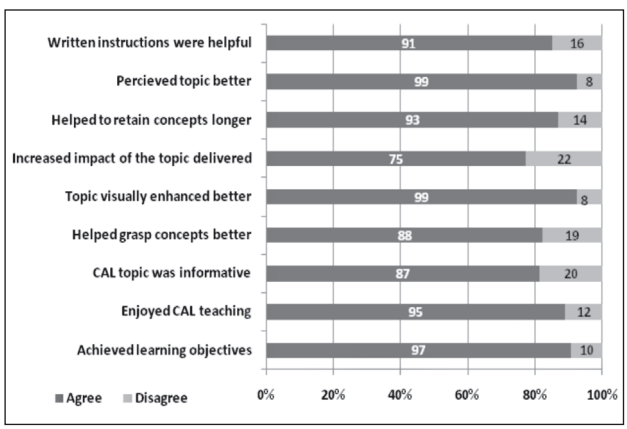

Fig. 1. Outcomes of CAL by students (n=107)

Advantages and Limitations of CAL

The outcomes of CAL – advantage and limitations as felt by the students are shown in figure 2 and 3 respectively. Most of the students felt better with CAL of clinical physiology practicals. They also felt that CAL cannot provide actual feel of clinical examination of human subject.

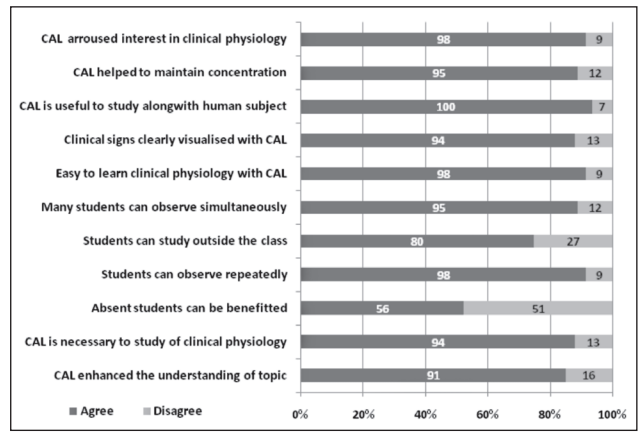

Fig. 2. Advantages of CAL (n=107)

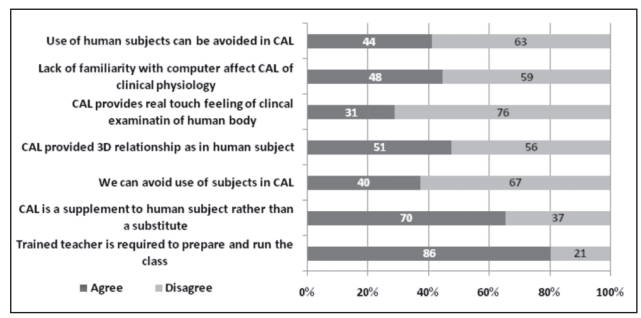

Fig. 3. Limitations of CAL (n= 107)

DISCUSSION

Computer-based methods in medical education are now so well defined and assessed at international level that their use is considered as the necessary goal for the coming years.

In the past several years, there has been an enormous increase in the number of computer assisted learning applications. Many medical educators and physicians have recognized the power and utility or hypertext/ hypermedia which are evolving as important new measures in the education of health sciences.[9]

In this study, the results of the questionnaire elucidate that I[st] MBBS students appreciate and support CAL in physiology clinical practicals. Students have indicated that CAL helped them to understand the clinical aspects of physiology better. Students also felt that CAL fulfilled their learning objectives

CAL facilitated the I[st] MBBS students to understand and study clinical signs better as they are not posted to clinical wards in hospital. In such case CAL is very helpful to I[st] MBBS students to learn the applied physiology. Students can repeatedly study the clinical signs even after the class. Students felt that they can maintain visual impression of clinical features longer time. This will definitely improve their performance during exam. In this study it was found that many students can observe simultaneously with clear visualization of images and pictures of clinical signs by using computer and LCD projector. This will enhance learning process in students.

Several studies have shown that groups of students who studied with CAL had better results than groups using traditional way of learning.[10, 11,12,13,14] Some studies even demonstrated that students studied with CAL need shorter time to reach the learning objectives, achieving better results than students who did not have access to CAL.[10, 15] Study done by Bajpai R. had explained the advantages of computer based education which includes local control over the topic, time, place and pace of instruction.[9] CAL study done by Govindaraja found that CAL makes undergraduate students understanding better in both theoretical as well practical aspects and helps them fulfill the learning outcomes.[16]

In this study majority of students expressed the limitation of CAL that trained teacher is required to prepare and run CAL class. Some medical teachers still they are teaching only with traditional methods, some of them are not interested in CAL and some are not competent in computer.[10] Therefore it is necessary to include in medical curriculum that medical teachers should undergo training of basic computer sciences and medical education technology. This will enhance teaching process among teachers. In this study many students mentioned the limitation of CAL that CAL cannot provide actual feel clinical examination of human subject. Another limitation raised by students in this study is CAL cannot replace traditional method of teaching also cannot avoid clinical examination human subject.

CONCLUSION

CAL in clinical physiology practicals plays a pivotal role in the scholastic achievement of students by helping them through various ways. In this study we found that student's interest concentration and understanding of topic is definitely increased. Our study explains that CAL stimulates teaching and learning in I[st] MBBS students. Worldwide studies on CAL in medical education showed that CAL helps to improve all the three domains of learning. Hence we suggest teaching clinical physiology with help of computer.

Though our study suggests use of computer while teaching clinical physiology but we never suggest replacing traditional method of teaching. Our study suggests following both the methods of teaching clinical physiology simultaneously. In this way we can help undergraduate medical students to have better knowledge of clinical physiology during their I[st] MBBS study. Our study suggests that CAL should be implemented in medical curriculum which will definitely improve teaching and learning process among medical students as well as medical teachers.

ACKNOWLEDGEMENTS

We would like to thank Dean Dr. S. I. Tolanur SLIMS, Pondicherry, Dr. R. R. Bagavathiraj, Professor and H.O.D. of Physiology SLIMS, Pondicherry, Dr R.S Bharatwaj, Miss R. Poovitha for statistical analysis and Dr. C. Kishore Kumar for assistance in data collection.

Conflict of Interest: None

Source of Funds: Nil

Ethical Clearance: Institutional ethical committee SLIMS, Pondicherry.

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DOI Number: 10.5958/j.2320-608X.1.2.008

Effect of Stress on Sleep in IT Individuals of Bangalore City

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ABSTRACT

The urban lifestyle aggravated by rat racing is a stressor, taking toll on the elixir of life, the sleep. In addition IT professionals are always under high work pressure, more achievement oriented and their long working hours lead to high stress. Hence the current study is undertaken to investigate the effect of stress on sleep architecture in IT professionals.

Objectives: To Evaluate the sleep architecture by using polysomnography in subjects having high stress score.

Methodology: The IT professionals of Bangalore city in the age group of 25-40 years were given State Trait Anxiety Inventory questionnaire. 44 subjects who scored above 40 in STAI were considered stressed and subjected to polysomnography recording in the sleep lab at Victoria hospital, BMCRI. The recording was scored manually by Kales method and statistically analysed..

Results: It was found that PSG parameters like sleep latency, wake after sleep onset, stage1% were prolonged and sleep efficiency reduced in the study group as compared to normative data for that age group given by American Academy of Sleep Medicine manual.

Interpretation & Conclusions: The increased activity in Locus-ceruleus and nor-epinephrine projections as well as increased levels of ephinephrine and cortisol during stress are responsible for the altered parameters on PSG.

Keywords: *IT Professionals, Sleep Architecture, Stress*

INTRODUCTION

Sleep is a periodical transient altered state of consciousness which is reversible spontaneously. Sleep appears to affect many processes in the body including energy metabolism, immune function, learning, memory, appetite regulation & gene expression. It has a rejuvenating effect on Physical & mental functions by accelerating homeostatic mechanisms [(1)].

The urban life style aggravated by rat racing is a stressor, taking toll on the elixir of life, the sleep. The stress not de-stressed is distressing with all its immense effects on sleep structure and its aftermath. Stress related anxiety neurosis, depression and HTN indirectly are precipitating sleep disorders day by day in the urban society. The altered sleep results in decreasing work efficiency, memory deficits and occupational hazards. Also sleep quality may affect functioning of metabolic & endocrine system, increasing likelihood of Diabetes mellitus & Hypertension [(2)].

The BPO industry in India is growing at a phenomenal rate of 70% with India emerging as key destination for outsourcing. These professionals are always under work pressure, more achievement oriented and their long working hours in front of the computer lead to high stress [(3)].

Hence, there is need to study effect of stress on sleep architecture. The current study intends to record sleep

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structure in stressed IT professionals using Polysomnography (PSG) & test the hypothesis that" stress will alter sleep structure."

OBJECTIVES

1) To evaluate sleep structures in subjects having high stress scores by using PSG.

2) To compare results with normative data for that age group as per American Academy of Sleep Medicine (AASM)

MATERIALS & METHOD

IT Professionals residing in and around Bangalore city were given STAI questionnaire and based on Inclusion & Exclusion criteria 44 of them were selected.

Inclusion Criteria

1. Healthy male subjects in the age group of 25 – 40 years.
2. Subjects with high stress scores (above 40) as per STAI (State Trait Anxiety Inventory) Questionnaire[4].

Exclusion Criteria

1. Subjects having any organic illness / Psychiatry / neurological illness.
2. Subjects with addictions of either alcohol / tobacco.
3. Subjects on any kind of drugs like antihistamines, anxiolytics, antipsychotics, antiepileptic.

METHODOLOGY

Subjects selected as per the Inclusion and Exclusion criteria were explained about the nature of the proposed study and written consent was obtained from each of them. Ethical clearance was obtained from Institutional ethical committee. Subjects were instructed to visit sleep lab at centenary building of Victoria Hospital for two consecutive nights. The first day was meant for habituation and the next day for actual sleep recording. Second night, when they arrived at the sleep lab, the temperature of the lab was maintained between 22 degree – 25 degree Celsius. They were asked to empty their bladder and sited in the sleeping room for electrode fixation.

Fixation of electrode is as follows

First grounding electrode was fixed over the glabella and the reference electrode is fixed medial to frontal eminence. Auditory references electrodes are fixed over both the mastoid process and other electrodes are fixed as shown in the table and figure

Active electrode	Reference electrode	Fixation site
C_3 and C_4	A_2 and A_1	20 Parts from Cz on either sides (according to the ten-twenty system)
EOG_1 and EOG_2	A_1 and A_1	One centimetre lateral to outer canthus of each eye (one above and one below).
EMG	Ref	Fixed over mentalis and sub-mentalis muscle.

C3 and C4 – Central Electro encephalo gram electrodes

EOG – Electro oculo gram

EMG – Electro myo gram

A1 and A2 – Auditory electrodes

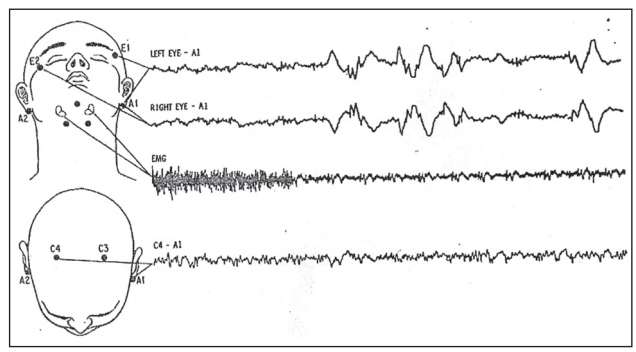

Fig. 1. Auditoryref, EOG, EMG, EEG Electrode Placement

After fixation and verifying the signal quality, lights will be switch off. The overnight PSG recording was done which is inclusive of EEG, EMG and EOG in a semi sound proof A/C sleep cabin during the subject's normal habitual sleeping hours, under video monitored supervision.

The sleep stages were scored manually epoch by epoch according to Retchschaffen and Kale's manual[5].

The data obtained after overnight PSG recording was tabulated in a Master chart and compared with normative data for the particular age group as per American Academy of Sleep Medicine (AASM) [6].

RESULTS

Table 1: Mean and Standard deviation of PSG Parameters in study subjects and normative data

Study variables	Min- Max	Mean ± SD	Normative Data as per AASM
Sleep Latency (min)	22.0 – 90.0	48.27 ± 14.22	10
Total sleep time (min)	269.5 – 438.5	367.18 ± 34.07	375.8
Wake after sleep onset (min)	0 – 105.0	33.32 ± 17.80	4.7
Stage 1%	5.1 – 26.4	20.72 ± 6.16	2.5
Stage 2%	20.6 – 49.8	39.50 ± 4.96	52.8
Stage 3%	3.3 – 6.3	4.78 ± 0.72	16.1
Stage 4%	9.1 – 16.8	13.38 ± 1.89	13
Sleep Efficiency %	70.0 – 92.8	81.97 ± 5.11	94.4

Table 1 shows mean values of PSG parameters in study group and also Normative data for each subject as per AASM. It is evident that in the study group mean sleep latency , mean wake after sleep onset, mean stage 1% are prolonged and reduction in mean total sleep time and sleep Efficiency as compared to normative sleep data across age groups according to AASM.

Table 2: Percentage of subjects with altered PSG Parameter

No. of subjects	Subjects with altered PSG Parameters	Subjects with normal PSG Parameters
44	40 (90.90%)	4(9.09%)

Table 2 shows the percentage of subjects with altered PSG parameters, with 40 subjects (90.90%) showing altered sleep architecture and only 4 subjects (9.09%) showing parameters within normal range.

This study is in agreement with Vgonlzers, Tsejos, Bixler O.E[7] and Geetanjali.B, Ananth.R[8] who have also found increased WASO, increased NREM Stage 1% and decreased sleep efficiency (<80%) in stressed subjects.

DISCUSSION

The sleep state does not result from mere withdrawal of alert state due to fatigue of reticular activating system (RAS), but is produced by an active process that is different for NREM and REM sleep. A group of GABAergic inhibitory neurons of sleep promoting centres in Diencephalon zone, Medullary synchronizing zone and preoptic area of basal forebrain inhibit histaminergic neurons of posterior hypothalamus, as well as nucleus of reticularis pontis oralis in the midbrain to initiate and maintain NREM stage of sleep[9].

GABA projections from Ventro lateral preoptic nucleus of anterior hypothalamus are sleep inducing [10]. There are also endogenous sleep promoting factors PGD and adenosine accumulating in the brain during wake fullness and produce sleep by activating sleep neurons in Tuberomamillary nucleus [11]. Neurotransmitters employed by neurons of sleep regulating centres forming neural substrate of sleep include Serotonin, Acetylcholine, Noradrenaline, GABA and Galantine [12].Noradrenergic from Locus ceruleus, Serotonergic from raphe nuclei, Dopaminergic from Ventral tegmental area and substantia nigra and cholinergic from various reticular sites are important in producing wakeful state [13].In addition Histamine from Tuberomamillary nucleus of Posterior hypothalamus and Orexin promote wakefulness.

The main components of the stress system are the locus ceruleus – norepinephrine autonomic system and corticotrophin-releasing hormone [14] Since locus ceruleus- norepinephrine projections are responsible for wakefulness, the increased activity in this circuit prolongs sleep latency, WASO and stage 1% and decreases sleep efficiency. The stress also increase epinephrine and cortisol levels through sympathoadrenal system and hypothalamo –pituitary-adrenal axis respectively which in turn increase the arousal to alter PSG parameters.

In normal subjects waking and stage 1 NREM sleep accompany increased cortisol level where as slow wave sleep accompany decreased plasma cortisol level and frequent arousals are associated with significant increased level of plasma cortisol [7]. Thus sleep architecture is often disturbed following stress with increased sleep latency; increased arousals and decreased sleep efficiency as an after effect of increased cortisol. Whereas sleep has an inhibitory influence on stress system, including its two major components the Hypothalamus Pituitary Axis and Sympathetic system.

In addition, the hippocampus, amygdale and prefrontal cortex undergo chronic stress induced remodeling which alters behavioral and physiological responses [14].

CONCLUSION

An evaluative study was conducted on 44 stressed IT professionals to know effect of stress on sleep architecture. Sleep recording was done using PSG and recorded parameters were compared with normative

data given by AASM. It was found that Sleep latency, WASO, Stage1% were increased, Sleep efficiency decreased in study group.Thus activation of stress system leads to arousal and sleeplessness as reflected on PSG parameters by influencing Nor-epinephrine Locus-ceruleus projections, Hypothalamo-pituitary-adrenal Axis and Sympathetic system. Whereas sleep has an inhibitory influence on stress system, including its two major components the Hypothalamo-pituitary axis and sympathetic system.

Conflict of Interest: None

Financial Disclosures: None

ACKNOWLEDGEMENT

The authors thankfully acknowledge the assistance provided by Dr.Suresh K.P during statistical treatment of data.

The logistic support to collect the data was provided by available infrastructure in the department of Physiology, Bangalore Medical College & Research Institute, Bangalore.

The services of external writing assistance was not taken other than the authors themselves.

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DOI Number: 10.5958/j.2320-608X.1.2.009

Effect of Shift Work on Oxidative Stress

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ABSTRACT

Shift workers due to altered circadian rhythm are more prone to various medical disorders when compared to others.This study was carried out to investigate whether shift work acts as an oxidative stressor.

The study was conducted in day workers (n = 50) and night shift workers (n = 50) at Burla. Blood samples were collected for the estimation of free radicals & lipid profile

Lipids, which undergo peroxidation are major targets of free radical attack. The production of MDA (malondialdehyde) was used as a biomarker to measure the level of oxidative stress.

Study revealed that night shift work was a significant risk factor for high free radicals level which cause many medical disorders. The free radical levels were significantly more in smokers when compared to non smokers among the night shift workers. Thus, shift work act as an oxidative stressor.

Keywords: *Shift Workers, Smokers, Oxidative Stress, Malondialdehyde*

INTRODUCTION

The present day life style in western Odisha is changing the circadian rhythm of the body especially in shift workers due to rapid industrialization.

Broadly defined, shift work involves work at times other than normal daylight hours of approximately 7:00 A.M to 6:00 P.M. The number of persons doing shift work appears to be increasing. [1] In normal individuals living on a day-oriented schedule, it is hypothesized that a harmonious relationship between homeostatic and circadian processes serves to promote uninterrupted bouts of 8 h of sleep and 16 h of wakefulness per day. When sleep is displaced, the normal phase relationship between the sleep/wake cycle and the endogenous circadian pacemaker is perturbed.[2]

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Shift work is accompanied by a greater incidence of many medical disorders, such as cardiovascular, gastro-intestinal, and neurological disorders [3,4]. The mechanism that induces cellular damage and results in such disorders is due to oxidative stress.

Impairment in the oxidant and antioxidant equilibrium provokes a situation of oxidative stress and generally results from hyper production of free radicals.[5] Free radical damages can accumulate over time and may thereby contribute to cell injury and development of human diseases. Free radicals have been implicated in the development of several diseases including atherosclerosis, diabetes, cancer, chronic inflammatory diseases and neurodegenerative disease as well as in the process of ageing [6,7]. If the oxidative stress is particularly severe, it can produce cell death[8]. Death can occur by necrosis, but in a number of cell types, such as neuronal cells, a mild oxidative stress can trigger the process of apoptosis, activating the intrinsic suicide pathway present within all cells [9,10]

Shift workers have altered lipid metabolism which leads to hyperlipidemia.[11,13]Increased lipid peroxidation may lead to increased free radical generation especially malondialdehyde.

so this present study was undertaken to see whether shift workers are prone to oxidative stress and also to examine the relation between oxidative stress and hyperlipidemia which would help us in identifying the probable cause of oxidative stress in shift workers.

MATERIAL AND METHOD

This cross sectional study was conducted on an outpatient basis at Department of Physiology, V.S.S Medical college, Burla with the help of Department of Biochemistry.

Industrial workers and security guards undergoing shift duties at Burla were involved in the study . 50 were night shift workers who shift worked for at least 6 months. 50 day workers were taken as control who did not undergo night shift for at least in last 2 years.

After getting institutional ethical clearance ,informed consent was obtained from all volunteers.

Subjects filled out a questionnaire with questions about working condition ,smoking habits, diet, family history of hypertension, diabetes mellitus, hyperlipidemia , hypothyroidism, exposure to ionizing radiations. Bloodpressure, height, weight, BMI of all subjects were recorded before the collection of blood.

Blood pressure was measured in the sitting position after 5 minutes rest. Hypertension was defined as having a systolic blood pressure of 140 mmHg or more, or a diastolic blood pressure of 90 mmHg or more and answering yes about being on antihypertensive medication. Body weight was measured in light indoor clothing and recorded to the nearest Kg. Height was measured to the nearest centimeter without shoes. Body mass index (BMI) was calculated as weight (Kg) divided by height (m2). Those with a BMI of 30 or more were classified as obese.

Exclusion Criteria

subjects suffering from any endocrine, hepatic, renal disease, hypertension, diabetes, cardiopulmonary disease, history of drug intake-beta blockers, lipid lowering drugs, antioxidant vitamin supplements, alcohol intake, obese were excluded from the study.

SELECTED CASES

Only males within the age group of 25-40 yrs were involved in the study.

BIOCHEMICAL ANALYSIS

Estimation of free radical

MDA is the by-product of the arachidonate cycle and a principle aldehyde product of lipid peroxidation in vivo, that is being widely used as an indicator of oxidative stress in biological systems [14].

The method adopted by Philpot [15] was performed to measure the amount of MDA present in the sample.MDA levels were expressed as n mol/ml.

Estimation of serum lipid

The serum was analysed for lipid profile.Serum Total cholesterol, Triglycerides, LDL, VLDL and HDL-cholesterol concentration were estimated after 12-hours fasting by using auto analyzer. Triglyceride value >150 mg/dl, HDL-cholesterol <45 mg/dl, Cholesterol >200 mg/dl, LDL>130 mg/dl were defined as lipid disturbances.

Statistical Analysis

Analysis of data was done with the help of SPSS version 16 soft ware package. Datas were presented as Mean ± Standard Deviation.

UnPaired student's t test was done to compare the means between two groups. Multiple linear regression analysis was done to show that night shift worker is an independent risk factor for elevated MDA levels. Pearson correlation analysis was done between lipid profile & MDA. P value < 0.05 was considered significant.

RESULTS

The demographic characteristics of all subjects are shown in Table: 1.

All of them were male. There was no significant difference in mean age, and BMI among the groups.

Table :2 represents MDA levels in shift & day workers. There was significant difference in the MDA levels between the groups. Shift workers had significantly increased MDA levels. Table :3 indicates that among shift workers those who smoke had significantly higher MDA levels than the non smokers.

Multiple linear regression analysis was done and found that MDA level was 1.36 times higher in shift workers when compared to day workers. Shift work was found to be an independent risk factor for

increased MDA levels and thus it can act as oxidative stressor.

Table: 4 represents estimation of serum lipid . Unpaired Students t test was done between the groups & found to have highly significant difference (p=0.000). Total Cholesterol, Very Low Density Lipoprotein, Low Density Lipoprotein level increased significantly but High Density Lipoprotein level decreased significantly and Triglyceride level showed no significant change among shift workers in comparison to day workers.

Pearson correlation analysis was done & there was significant positive correlation($p<0.05$) between lipid profile & MDA.84% variation in MDA levels were found to be due to variation in lipid profile especially in total cholesterol levels in shift workers. Graphical representation of this data is shown in Fig:1

Table 1: Demographic characteristics of Shift workers & Day workers

	Shift workers	Day workers
MEAN AGE	30.56 ± 4.28	31.30 ± 4.08
MEAN BMI	22.69 ± 1.06	22.83 ± 1.04

Table 2: Estimation of free radical MDA levels in shift workers & Day Workers

	Shift Workers	Day Workers	P Value
Serum MDA level(nmol/ml)	3.67 ± 0.50	1.76 ± 0.40	<0.05 Significant

MDA – Malondialdehyde

Table 3: Estimation of free radical MDA levels in Smokers & Non Smokers

	Shift Workers		P value
	Smokers	Non Smokers	
MDA Level (nmol/ml)	4.05 ± 0.39	3.27 ± 0.24	<0.05

Table 4: Estimation of serum lipid

Serum lipid (mg/dl)	Shift workers	Day workers	P Value
TC	239.76 ± 18.96	180.10 ± 6.3	< 0.05
TG	135.96 ± 12.81	133.20 ± 13.73	< 0.05
VLDL	41.26 ± 6.45	30.6 ± 5.07	<0.05
LDL	133.38 ± 37.80	100.4 ± 32.30	<0.05
HDL	36.10 ± 2.54	44.36 ± 2.55	<0.05

TC –Total cholesterol , TG – Triglyceride , VLDL- very low density lipoprotein , LDL – Low density lipoprotein , HDL – High density lipoprotein

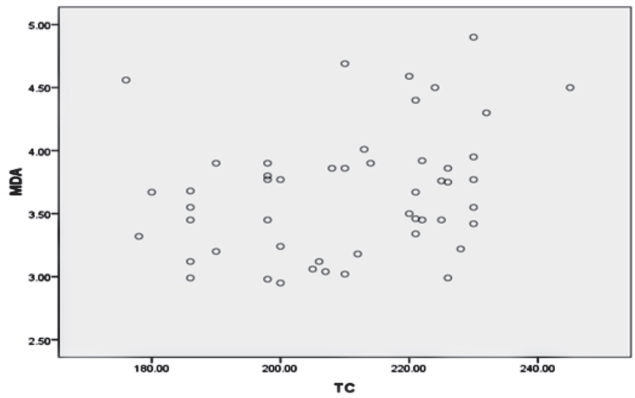

Fig. 1. Pearson Correlation between Total cholesterol & MDA in Shift workers.

DISCUSSION

This present study was done to investigate if shift work acts as an oxidative stressor. Oxidative stress occurs when balance between free radicals &antioxidant mechanism is impaired. . Either increased production of free radicals or depletion of antioxidants can result in oxidative stress. Previous studies suggests oxidative stress in shift workers due to decrease in plasma antioxidant level. No studies have been carried out to see the levels of free radicals among night shift workers that might lead to oxidative stress. so,in this study the levels of free radicals & possible source for its production is identified in shift workers.

Only male individuals with age group from 25- 40 yrs were involved in the study. Individuals with BMI < 30 were involved in the study. obese individuals were not involved as they induce increased free radical generation.[12]

According to this study ,free radical malondialdehyde(MDA) level was found to be significantly increased in night shift workers when compared to day workers. This could be due to altered lipid metabolism leading to hyperlipidemia in night shift workers [13] and thus correlating oxidative stress with hyperlipidemia.

We observed significant increase in total cholesterol levels in night shift workers than the day workers. Hypercholesterolemia is associated with oxidative modification of LDL, protein glycation, glucose- autooxidation, thus leading to excess production of lipid peroxidation products mainly MDA which may cause oxidative stress in night shift workers.[14,15]

We observed that LDL-C level was significantly increased & HDL –C level was significantly decreased in night shift workers when compared to day workers. Clinical and epidemiological studies have proven that individuals with elevated LDL show an increased risk for cardiovascular diseases [16]. HDL may be protective by reversing cholesterol transport, inhibiting the oxidation of LDL and by neutralizing the atherogenic effects of oxidized LDL [17]. Decreased HDL and increased LDL in night shift workers may contribute to the development of various diseases. It is known that hyperlipidemic states are associated with altered physical properties of cellular membranes [18], leading to increased lipid peroxidation products like MDA which contributes for oxidative stress.

Concentration of MDA is higher in night shift workers . This indicates overproduction of free radicals leading to cell oxidative injury ,which is considered by some authors to be related to the development of hyperlipidemia complications [19].

Numerous studies have been done to compare the level of lipid peroxidation products MDA among smokers and non-smokers, [20] . None of the studies which we have reviewed, have compared the effect of smoking on MDA levels in night shift workers. In this study it was observed that in night shift workers , MDA levels were significantly higher in smokers than the non smokers. Among day workers all were non smokers. Cigarette smokers have higher levels of lipid peroxidation suggesting that the pro atherogenic effects of smoking are mediated in part by oxidative damage induced by lipid peroxidation [21] .

CONCLUSION

Thus it can be concluded that shift work acts as an oxidative stressor. Hyperlipidemia leading to increased production of lipid peroxidation product MDA could be the probable cause for oxidative stress among night shift workers.

Establishment of chrono clinic in the working place for detecting intolerant shift workers & to provide them with antioxidant vitamin supplements, to combat the increased free radicals level. This may improve the coping ability of shift workers thus minimizing the occupational health hazards

ACKNOWLEDGEMENT

I wish to thank all volunteers who participated in the study & also the staffs of Physiology & Biochemistry departments, Burla for their cooperation.

Conflicts of Interest: None

Source of Funding: Nil

Ethical clearance: Approval from Institutional Ethics Committee

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DOI Number: 10.5958/j.2320-608X.1.2.010

Effect of Yogic Exercises on Aerobic Capacity (VO_2 max)

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ABSTRACT

Background: Yoga is considered to be a very good exercise for maintaining proper health. It produces consistent physiological changes and have sound scientific basis. It is claimed that yoga practices improve various cardiorespiratory fitness parameters.

Aim: To find the effect of short term Yoga practice on aerobic capacity (VO2 max.)

Objective: To measure aerobic capacity (VO2 max.) before and after Yoga practice.

Material and Method: The present study was conducted on 160 M.B.B.S. students (140 males and 120 females) within the age group of 18-20 years. VO2 max was measured using bicycle Ergometer in our 'Exercise & Sports Physiology' laboratory. It was recorded at start of study (baseline) and then after 12 weeks of yoga therapy.

Results: For both the genders VO2 max was found to be increased after yoga therapy for 12 weeks.

Conclusion: the present study concludes that yoga practice can be used to perk up cardio-respiratory fitness.

Keywords: *Yoga, VO2 Max, Cycle Ergometer*

INTRODUCTION

Now-a-days, more persons are interested in 'physical fitness' than any time before. Physical fitness depend mainly on cardio-respiratory endurance of an individual. VO_2 max (maximal oxygen uptake / maximal aerobic power/ aerobic capacity) is widely accepted as the best measure of cardio-respiratory endurance. VO_2 max refers to the level of oxygen consumption beyond which no further increase in oxygen consumption occurs with further increase in the severity of exercise. It is expressed as 'milliliters of oxygen used in one minute per kilogram of body weight'(ml/kg/min). VO_2 max is probably the best physiological indicator of a person's capacity to continue severe work. In sports, where endurance is an important component in performance, such as cycling, rowing, cross-country skiing, swimming and running, world class athletes typically have high VO_2 max.[1]

In recent times, medical fraternity is much attracted towards beneficial effects of Yoga. It is claimed that yoga practices improve various cardio-respiratory fitness parameters. In view of this, the present study was undertaken to see whether yoga has any effect on VO_2 max. Also, to note the difference, if any, in the values of VO2 max obtained before and after yoga practice and to discuss the results in view of the results obtained by other workers.

MATERIAL AND METHOD

In the present study, a total of 160 M.B.B.S. students (140 male and 120 female) in the age group of 18-24 participated voluntarily. All the volunteers were fully informed about the study and written informed consent was obtained. The volunteers with past or present history suggestive of cardiovascular or respiratory illness or any other systemic illness, history of major surgery in the recent past, family history of

asthma or allergic diseases, history of cigarette smoking, tobacco chewing, alcohol intake etc, subjects with previous experience of YOGA training or any other active sports training were excluded from the present work.

After being selected in the study, detail history was noted from each volunteer. All the participants were instructed not to do any other physical exercises like sports, athletics or resistance training during the present study. Then height, weight and BMI were recorded.

VO_2 max was measured using Astrand-Rhyming cycle ergo meter test in our 'Exercise & Sports Physiology' laboratory. The subject is asked to pedal at 50 revolutions per minute and try to keep it constant for at least 6 minutes. The continuous monitoring of heart rate by counting the pulse for the last 10 seconds of each minute of ride was done. Load was adjusted such that heart rate should rise to a level in the target range (125 to 170 beats /min) and then this level was maintained relatively constant during last few minute of ride. Final count was made during last 10 seconds of the sixth minute of ride. Estimation of VO_2 max was done by using modified Astrand Rhyming nomogram.[2]

After measuring baseline VO_2 max, students were trained by experts from Yoga Kendra. Then they performed the Yoga Practice (Asanas & Pranayama) in the evening for one hour, six days in a week, for 12 weeks under expert's observation. Yoga practice consisted of - Prayer & Omkar Recitation (5 minutes) followed by in sequence Asanas like Naukasana, Matsyasana, Bhujangasana, Shalabhasana, Dhanurasana, Shavasana (for next 30 minutes), then breathing exercises like Kapalbhati and Yogic Shwasan (for next 10 minutes), then followed by Pranayama like Nadi Shuddhi, Bhastrika and Bhramari (for last 15 minutes).

After 12 weeks VO2 max was measured again and Data was analyzed statistically using 'z' test separately for males and females using SPSS software.

RESULTS

Table 1. Effect of Yogic Exercises on VO_2 max.(ml/kg/min) in males

Test	n	Before Yoga Mean ± S.D.	After Yoga Mean ± S.D.	P value
VO2 max	40	30.33 ± 3.50	33.1 ± 4.38	* P < 0.001

(n= No. of subjects, * = highly significant)

Table 2. Effect of Yogic Exercises on VO_2 max (ml/kg/min) in females

Test	n	Before Yoga Mean ± S.D.	After Yoga Mean ± S.D.	P value
VO_2 max	20	27.75 ± 2.27	30.43 ± 2.23	* P < 0.001

(n= No. of subjects, * = highly significant)

Table 1 shows change in VO_2 max in male subjects whereas Table 2 represents change in VO_2 max in female subjects. Both the groups show statistically significant increase in VO2 max after Yogic Exercises.

DISCUSSION

VO_2 max. is very importance for physical performance as well as for the health in general. It has been used as an index of cardio respiratory fitness. VO_2 max can be determined using variety of exercises that activate the body's large muscle groups, provided the intensity and duration of effort are sufficient to maximize aerobic energy transfer. The usual exercises modes include treadmill running, bench stepping and stationary cycling. High VO_2 max requires integration of high levels of pulmonary, cardiovascular and neuromuscular function. So, VO_2 max is a fundamental measure of physiologic functional capacity for exercise.[1]

Ray U.S. et al (2001)[3] observed significant improvement in VO_2 max after Yogic training. Raju P.S. et al (1997)[4] have found a significant increase in oxygen consumption per unit work after yoga training.. Bera T.K and Rajapurkar M.V in 1993[5] reported significant improvement in cardiovascular endurance as a result of yoga training. Balasubramanian B and Pansare MS in 1991[6] observed significant increase in aerobic power (VO_2 max) of muscles after yoga training.

In our study, as shown in table 1 and 2, VO_2max in males and females show statistically significant improvement with regular practice of yoga.

These effects can be explained on the following basis

I. Increase in Oxygen Consumption by the muscles[7], which in turn suggest increase in muscle blood flow. This may be due to a generalized decrease in vascular tone resulting from stimulation of parasympathetic activity during Yogic Training.[8]

II. Conversion of some of the Fast Twitch muscle fibers into Slow Twitch muscle fibers during yogic

training. Slow twitch fibers have high aerobic power.[6]

III. Yoga postures (asanas) involve isometric contraction which is known to increase skeletal muscle strength.[9]

IV. Greater involvement of active muscle mass from different parts of the body[10]

V. Increase in muscular endurance and delay in onset of fatigue[11]

VI. Improvement in lung functions and better utilization of oxygen at cellular level. Improvement in both lung functions as well as cellular machinery explain raised VO_2 max after regular practice of yoga.[12]

The yoga training regime used in the present study was of sufficient intensity and duration to produce significant changes in VO_2 max. The number of subjects used was 60 and all the volunteers were of similar age(17-20years). These points enhance the reliability of observations.

Thus our study suggests that regular yoga practice improves aerobic capacity in both males and females. Research on particular set of Yogic exercises like only selected asanas or pranayama is required and also further research with large sample size and for varied age groups is required for applying these results to population in general.

ACKNOWLEDGEMENTS

Authors acknowledge the immense help received from the scholars whose articles are cited and included in reference of this manuscript. The authors are also grateful to editors and publishers of all those articles, journals and books from where the literature for this article has been reviewed and discussed.

Conflict of Interest: Nil

Source of Funding: Nil

Ethical Clearance: obtained from Ethics committee, Dr. V.M.G.M.C., Solapur on 09/03/2012.

CONCLUSION

1. Yogic Exercises done for one hour daily including asanas, breathing exercises and pranayamas seems to improve VO_2 max.
2. In spite of Yogic Exercises being not very vigorous, VO_2 max was found to increase.
3. Yogic Exercises can be of value in conditions of low cardio respiratory reserves, especially in patients in whom heavy exercises are contraindicated.
4. Yogic Exercises may be incorporated as a part of 'Physical Fitness Program' to improve cardio-respiratory efficiency in sport persons.

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DOI Number: 10.5958/j.2320-608X.1.2.011

Reaction Time in Television Watching School Children

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ABSTRACT

Study was done to find out whether Auditory and Visual reaction time (ART, VRT) is affected in school children who watch television (TV) daily. 56 school children of both gender aged between 10-14 years were included and informed consent was obtained. Children watching TV for less than 1 hour per day were taken as controls and those watching for more than 2 hours per day were included in study group. Daily hours of physical activity, academic performances were enquired. ART and VRT was measured using Portable Reaction Time Response Apparatus supplied by Inco Instrumentation. Student t test was applied for two groups to find out significant difference. VRT was significant with p value = 0.008. Hours of daily TV watching was significant with p value= 0.000. Academic performance was significant for boys with p value= 0.033. Physical activity was significantly affected in study group with p value = 0.004. VRT was prolonged in children watching TV for more than 2 hours. TV watching causes memory and concentration problems leading to decreased academic performance, replaces activities like sports, outdoor games which are essential for growing children.

Keywords: *School Children Television Watching Auditory Reaction Time Visual Reaction Time Academic Performance Physical Activity*

INTRODUCTION

Television (TV) watching among children has increased during recent years. School children are getting addicted to TV and sit for long hours in front of TV watching serials, movies which are not required for them. Physical activities like playing outdoor games, sports activities like cricket, football suffers. Because of watching TV children spend less time for studying the academic subjects. Time spent on reading story books & general knowledge books also has reduced.

Reaction time is the interval time between the presentation of stimulus which can be visual or auditory and subsequent voluntary response given by the subject who has been instructed to respond as quickly as possible.[1] There are many situations in life where we have to react instantly to an external stimulus response to attendance in school, to run away from danger. Reaction time is one measure of information processing & it is used to judge concentration and coordination ability of a person. It provides an indirect index of integrity & processing ability of central nervous system.[2] A simple non-invasive method of determining sensorimotor co-ordination & performance of an individual.[3]

The purpose of the study was to find whether Auditory and Visual reaction time is affected in school children who watch television for more than 2 hours daily.

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MATERIALS AND METHOD

The study was carried out in the SS Institute of Medical Sciences & Research Centre, Davangere with prior approval from HOD of Physiology and Institutional Ethics Committee. The study was carried during June- September 2012.

Subjects were 56 school children aged between 10-14 years both girls and boys. Control group consisted of 32 subjects (12 girls & 20 boys) who watch television for less than 1 hour daily. Study group included 24 subjects (12 girls & 12 boys) who watched television for more than 2 hours daily. Subjects less than 10 years were excluded as they could not answer the number of hours they watch TV exactly. Subjects more than 14 years were excluded as they started using mobile phones which affects the reaction time. The purpose, procedure and non invasive nature of the study were explained and informed written consent was taken from the parents or guardian of subjects.

General physical examination was carried out to on the subjects. Tests for hearing, vision and motor system examination were carried out to rule out any visual, auditory and neuromuscular disorders. Age (years), gender, anthropometric parameters like height (meters) and weight (kilograms) were noted for each subject. Subjects were enquired about time they spend on watching television daily in hours and the time was noted down in the proforma. Academic performance in the previous 3 months (June- August) I term examination results was taken in terms of grades and percentage. Time spent daily in physical activity like playing outdoor games, exercise in hours was included.

Visual & Auditory Reaction time was measured using Portable Reaction Time Response Apparatus by Inco Instrumentation (Chennai). Before measuring Visual reaction time (VRT) and Auditory reaction time (ART), subjects were made familiar with the apparatus. All the readings were taken between 9-11 am in the morning in a quiet room. While performing the test, all the subjects were made to sit comfortably in a chair and were motivated for better results. Visual stimulus consisted of shooting red light, auditory stimulus consists of low frequency sound. As soon as stimuli were perceived by subject, he/she responds by pressing the response switch by the index finger of the dominant hand. The display indicates response time in seconds. 5 trials were given and after repeated practice, three readings were taken for each parameter, lowest of three readings was taken as the value for reaction time.

Statistical analysis of data

In the present study, all the data collected were analyzed using MS excel sheet. Mean and Standard deviation was calculated for each group. The recorded values were expressed as Mean±SD. Student t test was applied to compare study and control group. P value below 0.05 was considered statistically significant.

RESULTS

(Table I) depicts Mean and Standard deviation values of different parameters: Age, Body Mass Index (BMI), Academic performance, Physical activity, Visual Reaction Time (VRT), Auditory Reaction Time (ART) and Television watching (Hours), for study and control group including both girls and boys with comparison of significance. As shown in (Table I) Physical activity was significantly reduced in study group (P=0.002). VRT were significantly higher in study group when compared to controls (P=0.008) as shown in (Figure 1). Academic performance were significantly reduced in boys who watched TV for more than 2 hours daily when compared to boys who watched TV for less than 1 hour daily (P= 0.033).

Table I: Comparison of Age, BMI, Academic performance, Physical activity, TV watching, VRT and ART in control and study group.

Parameters	Control group (n=32)	Study group (n=22)	P-value
Age (years)	12.43±0.71	12.20±0.77	0.265
BMI (kg/m^2)	17.06±2.51	16.89±2.52	0.8
Academic performance	3.63±1.48	3.25±1.39	0.34
Physical activity(Hours)	3.78±2.17	2.40±0.87	0.002*
VRT (msecs)	163.12±43.39	191.20±33.45	0.008*
ART (msecs)	185.25±32.61	198.54±45.92	0.234
TV watching (Hours)	0.75±0.25	2.33±0.46	0.000*

Data presented are mean±SD. Analysis of data was done by student t test.

* depicts P<0.05 statistically significant.

DISCUSSION

In the present study VRT increased significantly in study group suggests that response time is slower in TV watching children. Physical activity was significantly reduced due to television watching in school children. Academic performance reduced in boys significantly. Television viewing has become pandemic all over the world affecting all the age groups specially children and adolescents.

Viewing TV for more than 2 hours per day causes memory & concentration problems which get worse with time, behaviour problems like anxiety, nightmares on watching horror programmes. There is decrease in

school performance. TV viewing replaces activities like reading, homework, hobbies, sports and leads to obesity & sleep problems.

A prospective epidemiological study found out that youths watched 1 or more hours of TV per day were at elevated risk for poor homework completion, negative attitude towards school, poor grades & long term academic failure, attention problems.[4]

Another study in which individuals were assessed at regular intervals up to 26 years showed that 17% of overweight, 15% of raised serum cholesterol, 17% of smoking & 15% was attributed to watching TV for more than 2 hours a day during childhood & adolescence.[5]

In a study where both children & adults were tested for Simple Reaction Time & 4 Choice Reaction Time found that men often have faster Simple Reaction Time & less variable reaction times than women, these differences do not occur in children.[6] A study in which educational achievement of individuals were measured by 26 years of age. The mean time spent watching TV during childhood & adolescence were significantly seen to be school drop outs without qualifications & negatively associated with attaining a university degree.[7]

ACKNOWLEDGMENTS

We are extremely thankful to the school children and their parents for their participation. We thank Dr Ravi Kiran Kisan Assistant Professor, Department of Physiology, SSIMS & RC for his immense help in completing the statistical analysis. We are thankful to the staff of Department of Physiology for their support in providing the instruments.

Conflict of Interest: None

Source of Funding: Self support

Ethical Clearance: Institutional Ethics Committee

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DOI Number: 10.5958/j.2320-608X.1.2.012

Gender Differences in the Association of Anthropometric Indices of Obesity and Blood Pressure in Hypertensive Subjects

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ABSTRACT

Background: Obesity and hypertension are two major interrelated cardiovascular risk factors [1]. Data accrued during the past twenty years confirmed that SBP and DBP have a continuous, graded, strong, independent etiological relationship to Coronary Artery Disease (CAD). These relationships are documented for young, middle aged and older men [2]. Most of the persons aged 35 years or more have SBP or DBP above optimal (<120/<80) mmHg); hence, they are at increased cardiovascular risk. What this means is that the blood pressure problem involves most of the population, not only the substantial minorities with clinical hypertension. This cross sectional study measured the effects of various Anthropometric indices and Blood pressure in Hypertensive subjects.

Materials and Method: Human subjects of both sexes were grouped into Group 'A' included Hypertensive male patients of age group 36 and above n=50 and Group B included Hypertensive female patients of age group 36 and above n=50. Anthropometric indices of the individuals were recorded as per protocol. Two Blood Pressure readings were taken with a standard Mercury Sphygmomanometer [3] at an interval of half an hour and a third reading was obtained after one week interval and Average of these three readings was considered as the Blood Pressure of the Individual [4].

Results: The statistical analysis was done between males Group 'A' and females Group 'B' with their individual parameters. The Mean SBP of Group 'A' Males was 151.3mm Hg and that of the Females was 149.5mm Hg. Although the mean value of SBP in males was slightly higher in males compared to females as depicted in the 'p' value obtained is >0.10 and was Not Significant. The DBP in Group 'A' males had a Mean value of 97.4 mmHg and Females has a mean value of DBP 97.19 mm Hg. The resultant 'p' value obtained is '0.8' it is Not Significant. The mean values of Weight in males although was higher in males 68.3 Kilograms with SD ± 10.1 as compared to females 58.2 Kilograms and SD ± 9.6 the resulting 'p' value was 0.002 and was found to be Significant. There was no significant difference as far as the two groups are concerned in values comparing the BMI, WHpR (waist Hip Ratio) and WHtR (Waist Height Ratio) the values of 'p' in both the groups was >0.10 and therefore Not Significant.

Pearson correlation coefficient calculation and shows strongest correlation was shown by Waist Girth and WHpR in males of this group and BMI in females of this group with SBP. While WG, BMI, WHpR, WHtR were also associated with increased DBP did not show a significant correlation with the anthropometric indices.

Conclusion: In conclusion we found Waist Girth and Waist-Hip Ratio (WHpR) in males and BMI in females are the important predictors of SBP in Hypertensive subjects. Elevated WG, BMI, WHpR, WHtR were also associated with increased DBP but varied with age and gender.

Keywords: *SBP - Systolic Blood Pressure, DBP - Diastolic Blood Pressure, BMI - Body Mass Index, WG - Waist Girth, WHpR - Waist-Hip Ratio, WHtR - Waist Height Ratio*

INTRODUCTION

Obesity to a large extent is the result of reduced physical activity and frequently observed to be associated with abundant as well as irregular Diet. It may lead to occurrence of heart diseases with poor Cardio-Respiratory Fitness [5]. The American Heart Association has recently added obesity to its list of Major risk factors for Heart disease [6]. Android obesity is associated with cardiovascular abnormalities (Coronary Heart Diseases, Myocardial infarction, Cardiac hypertrophy, and Cerebrovascular and thromboembolic diseases)[7, 8]. It is estimated that 20-30% of hypertension can be attributed to Over Weight [9] Obesity, a sedentary life style, stress, smoking and excessive amounts of alcohol or salt in diet all can play role in development of high blood pressures in people who have an inherited tendency to develop it [10]. In hypertensive patients, weight reduction reduces the blood pressure and weight regain raises the blood pressure. The fall of blood pressure with weight reduction is associated with decreased blood volume, cardiac output and sympathetic activity [11]. Thus the association between body weight and blood pressure and changes in weight and variation in blood pressure over time period indicates that weight reduction in over weight individuals and avoidance of obesity should be key strategies for both prevention and treatment of Hypertension [9].

AIMS

(1) The general objective of this study was to determine the proportion of obese hypertensive patients.

(2) To study the relationship of Body Mass Index waist circumference, Waist-to-Hip Ratio (WHpR), Waist-to-Height Ratio (WHtR) and Blood Pressure Profiles in the Hypertensive Males and Female OPD visitors in General Medicine Dept of PIMS Hospital Nagunur, Karimnagar AP.

(3) To determine the severity and type of obesity in men and women by using the criteria of Body Mass Index (BMI).

MATERIALS AND METHOD

STUDY LOCATION: This study was conducted in the Prathima Institute of Medical Science Hospital Nagunur, Karimnagar District AP in the Dept of General Medicine OPD between 9A.M to 12 P.M.

SAMPLE POPULATION: All subjects were known Hypertensive and selected randomly who attended the General Medicine OPD.

Inclusion Criteria

1. Known Hypertensive males and females
2. all patient's aged 36 years and below 55 years
3. OPD visitors of Gen Medicine Dept of PIMS Hospital

Exclusion Criteria

1. pregnant females
2. patients with clinically significant diseases such as

(a) Cancer

(b) Tuberculosis

(c) Hyperthyroidism

(d) Hypothyroidism

(e) Cushing's syndrome

(f) Secondary hypertension

SAMPLE SIZE: About one Hundred individuals were included in the study. Which were divided into 2 groups A, and B. the group 'A' Hypertensive males n=50 and Group 'B' included Hypertensive females n=50.

PROCEDURE: Permission from Hospital Ethics Committee was obtained. A prior informed consent was also obtained from each subject for participation in the study and was briefed about the procedure to achieve full cooperation.

RECORDING OF BLOOD PRESSURE: Blood pressure measurements were done in the morning hours between 9.00 A.M and 12.00 P.M. The Standard Mercury Sphygmomanometer was used for all subjects and BP was measured using first the palpatory Method and followed by Auscultatory Method (Littman stethoscope). The equipment was checked and calibrated for its accuracy as per the recommendations by British Hypertension Society[3].

Measurements were taken in the sitting position. Tight fitting clothing was removed subjects were seated comfortably with back supported legs

uncrossed and not talking. The cuff was applied on bare skin, firmly on the right arm, which was supported at the level of the heart. A standard protocol was followed as per previous studies on hypertension, which had shown that the average value of measurements done at different visits would take into account the BP variability of the subject [4]. Both SBP and DBP were measured. The first appearance of the sound (Phase I) was used to define the SBP. The disappearance of the sound (Phase V) was used to define DBP [12].

PULSE PRESSURE (PP): Pulse Pressure was calculated as the Difference between the SBP and DBP. Therefore PP= (SBP-DBP).

MEAN ARTERIAL PRESSURE (MAP): MAP was calculated as it has been found that if one third of Pulse Pressure is added to Diastolic Pressure, we get a value close to the Mean Pressure determined by graphical method [13].

Mean Arterial Pressure was calculated using the PP and DBP as

$MAP = DBP + \frac{1}{3} PP$

BODY WEIGHT: This was measured in the erect position without footwear with the subject lightly clothed. Measurements were taken with the same instrument and were done in kilograms which were rounded off to the nearest half a kilogram.

HEIGHT: After removing the shoes subject was asked to stand upright on the flat floor keeping the feet parallel to heels, buttocks, and shoulder and back of the head touching a hard surface. The head was held comfortably erect with the lower border of the orbit in the same horizontal plane as the External Auditory Meatus. The arms were positioned by the side of the body. Measurements were taken to an accuracy of half a centimetre.

BODY MASS INDEX (BMI): This was calculated as weight (in kilograms) divided by (height in meters)^2.

WAIST GIRTH (WG): Waist circumference is measured at the mid point between the Lower border of ribcage and iliac crest while the subject is in standing position and breathing normally nearest to half centimetre. It is an approximate index of Intra abdominal fat mass and total body fat. There is an increased risk of metabolic complication for men with a waist circumference e"102cm and women with a waist circumference e" 88cm[14].

HIP GIRTH: The Hip Circumference was measured at the level of Greater Trochanter, by measuring to nearest half centimeter, at the point where the buttocks extended maximum, when viewed from side in standing position using a flexible non elastic tape.

WAIST HIP RATIO (WHpR): The ratio of waist circumference to hip obtained from the above two physical parameters were calculated and it was rounded of to the nearest two decimal.

$$\text{WAIST HIP RATIO (WHpR)} = \frac{\text{Waist Girth in cms}}{\text{Hip Girth in cms}}$$

WAIST HEIGHT RATIO (WHtR): The ratio of waist circumference and the Height obtained was calculated as waist height ratio and was rounded of to the nearest two decimal.

$$\text{WAIST HIP RATIO (WHpR)} = \frac{\text{Waist Girth in cms}}{\text{Hip Girth in cms}}$$

STATISTICAL ANALYSIS: Computer software of Microsoft Excel 2007 on window XP platform was used. The parameters between male and female subjects were compared using Chi square test. The Correlation between various Anthropometric Indices and Blood Pressure (SBP, DBP) was done using Pearson's Correlation coefficient. The correlation coefficient values 'r' was compared with the table of coefficient correlation in Biostatistics [15].

RESULTS

Table 1 shows Analysis of the mean values of parameters and standard deviation recorded in both the Hypertensive Males and Females. The mean values of weight in males although was higher in males 68.3 with Standard Deviation of 10.1 as compared to females 58.2 and Standard Deviation of 9.6 the resulting 'p' value was 0.002 and was found to be Significant.

Table 1: Shows the mean values of parameters and standard deviation recorded in both the Hypertensive Males and Females.

Variable	Group 'A' Males (N=50)	Group 'B' Females (N=50)	P-value
	Mean±Sd	Mean ±Sd	
SBP	151.3±14.6	149.5±13.39	0.6
DBP	97.4±5.26	97.19±6.27	0.8
MAP	115.4±7.26	114.6±7.37	0.7
WEIGHT	68.3±10.1	58.2±9.6	0.002*
BMI	25.8±4.16	25.4±4.24	0.7
WHpR	0.97±0.11	0.89±0.045	0.09
WHtR	0.57±0.04	0.63±0.15	0.09

Table 2: Shows the correlation between SBP and other parameters in Males and Females.

Parameter	Systolic Blood Pressure [Sbp]	Systolic Blood Pressure [Sbp]
	Hypertensive males Group 'A'(r)	Hypertensive females Group 'B'(r)
AGE	0.26	0.019
WEIGHT	0.09	0.05
WAIST GIRTH	0.80	0.69
BMI	0.11	0.7
WHpR	0.80	0.6
WHtR	0.79	0.53

Table 2: Summarizes the results of this calculation and shows the correlation between SBP and other parameters in Males and Females. There was a positive correlation between Systolic Blood Pressure and age (r = 0.26) for Males, and (r = 0.019) for Females although it is Not Significant in both. Strongest correlation was shown by Waist Girth and WHpR in males of this group and BMI in females of this group with SBP.

Table 3: Shows the correlation between DBP and other parameters.

Parameter	Diastolic Blood Pressure	Diastolic Blood Pressure
	Hypertensive males Group 'A'(r)	Hypertensive females Group 'B'(r)
AGE	-0.12	0.42
WEIGHT	0.14	0.36
WAIST GIRTH	0.46	-0.22
BMI	0.22	0.4
WHpR	0.33	0.44
WHtR	0.5	0.26

Table 3: Summarizes the results of the calculation and shows the correlation between DBP and other parameters.

DISCUSSION

The present study was done with an aim to identify which of the anthropometric parameter is the best predictor of Hypertension when comparison was done between the Males and Females hypertensive individuals. The subjects were inhabitants of Karimnagar District. When anthropometric indices of obesity were correlated with SBP in males although all the indices were positively and significantly correlated with SBP in males. For females only the Waist Girth and BMI had positive significant correlation and BMI shows strong positive correlation with SBP in Females and Waist Hip Ratio and Waist Height Ratio shows the strong positive correlation with SBP in males. This is in accordance with Sayeed MA et al 2003 [16] who reported that Waist Height Ratio is the better predictor of diabetes and hypertension and lipidemia. While Dalton M et al 2003 [17], showed that Waist Hip Ratio had strongest correlation with CVD risk factors and WHpR is the most useful measure of obesity to use to identify individuals with CVD risk factors.

This shows that prevalence of elevated blood pressure (SBP) was associated with quintiles of BMI, waist girth, WHpR, WHtR and weight. With waist girth and WHtR are having highest odds ratio in males and BMI having odds ratio in females. This was in accordance with findings of CoxBD, et al (1997) [18] and Kotchen TA (2008) [19], all have shown positive relationship of anthropometric indices and hypertension.

For the Diastolic Blood Pressure (DBP) of all the anthropometric parameters measured in males only Waist Hip Ratio (WHpR) shows strongest positive correlation to DBP. For females of all anthropometric parameters, only Waist Girth was Significantly Positively correlated with the (DBP).

This study has shown that the Waist Girth and Waist Hip Ratio was an important parameter in prediction of SBP in Males and BMI was important in prediction of SBP in females both groups. When mean values of waist girth was analyzed in comparison to Blood Pressure it is clear that values of Waist Girth > 90cm poses increased risk of developing hypertension and WHpR > 0.93 poses increased risk and >0.97 poses substantial risk for developing hypertension in Males of this group.

When values of BMI were analyzed in comparison to blood pressure in females it is clear that values of

BMI > 23.0 poses increased risk and those with BMI >25 are at substantial risk for developing hypertension. Therefore IOTF Proposed classification of obesity [20] has better sensitivity in predicting hypertension in this group.

SUMMARY AND CONCLUSION: within the limitation of this study, we recommend that a Waist Girth of > 90cms be considered as at increased risk of developing hypertension in this group of population as compared to Waist Circumference >102cm recommended by WHO as increased risk of developing metabolic complication [14]. Waist-Hip ratio (WHpR) of > 0.93 should be considered as indicator of intra abdominal fat accumulation, as compared to > 1.0 value used currently [21].

Conflict of Interest: None

Source of Funding: None

ACKNOWLEDGEMENT

Authors wishes to thank Dept of General Medicine Prathima Institute of Medical Sciences Karimnagar, for allowing conducting the study in their department.

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DOI Number: 10.5958/j.2320-608X.1.2.013

Comparative Study of Cardiovascular Risk Factors in Smokeless Tobacco Users and Smokers

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ABSTRACT

Tobacco use is the leading preventable cause of death in developing countries. Study was carried out in 400 males to evaluate & compare the cardio vascular disease risk factors in smokers & smokeless tobacco users- tobacco chewers & kharra chewers. Tobacco users had significantly higher cardiovascular disease risk factors- C reactive protein & lipid profile (except HDL) than non users. The C reactive protein & lipid profile differences between smokers & tobacco chewers were found to be non significant while kharra chewers had significantly lower values than smokers & tobacco chewers. The deleterious cardiovascular risk factors are considerably less in kharra chewers than cigarette smokers & tobacco chewers. Excessive risk in tobacco users than non users gives cause for preventive action.

Keywords: *C Reactive Protein, Lipid Profile, Cardio Vascular Disease, Tobacco, Kharra*

INTRODUCTION

Coronary heart disease is a leading cause of morbidity & mortality in developed countries & is emerging as an epidemic in developing countries [1]. A substantial proportion of population in India is exhibiting increasing prevalence of cardio-vascular disease and associated risk factors. Trends are believed to be due to influence of life style habits like sedentary life style, dietary patterns, alcohol abuse and tobacco use. Both the smoking and the nonsmoking forms of tobacco use are common in India. 30% of population, 15 years or older - 47% men & 14 % of women either smoke or chew tobacco [2]. Prevalence of smokeless tobacco consumption in India is 20%. [3] According to recent reports, by year 2030 the developing world is expected to have 7 million deaths annually from tobacco use [5]. Previous studies have found the association of tobacco with the increased rates of traditional cardiovascular risk factors like hypercholesterolemia, hypertension, obesity, In addition, novel nontraditional cardiovascular risk factors related to chronic subclinical inflammation like C-Reactive protein was further contributing to burden of cardiovascular diseases [5,6]. Increased serum concentrations of C-reactive protein, considered as an independent predictor of ischemic heart disease, have been documented in adult Oji-Cree of the sandy lake First national community in northwestern Ontario [7].

The increased appeal and use of smokeless tobacco has generated considerable public health concern because research indicates that chewing tobacco can be significant health hazards. Detrimental cardio vascular effects of smoking are well documented, possible health hazards of smokeless tobacco remain controversial Tucker, Benowitz , russel have studies the effect of smokeless form of tobacco association with cardio vascular risk factors [8,9,10]

In India very few studies were done to gauge the effects of smokeless form of tobacco use on cardio-vascular risk factors and comparison with tobacco smoking. So we under took the cross sectional study to explore and compare cardio vascular risk factors in young men with different pattern of tobacco use like smokeless tobacco use and smoking.

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MATERIAL & METHOD

A total four hundred male volunteers of age group 20-30 yrs were studied during January 09 to December 09. The study groups were selected from the employee of Indira Gandhi Govt. Medical College, Nagpur and community dwellers from the Nagpur & periphery of Nagpur in India. Considering the objectives of study selection criterion for the study was defined the groups of the study. They were as follows:

All the subjects were not suffering from any known cardio-vascular and medical problems, not taking hypolipidemic drugs, no acute illness symptoms at the point of entry. Then the study groups were divided into four groups according to following criterion:

Group I: Smokers (100 subjects)

Those who smoke e" 10 cigarettes per day, regularly at least for last 10 years were selected & included in the study

Group II: Tobacco chewers (100 subjects)

Those who chew tobacco regularly two packets (10gm) per day for last 10 years were selected & included in study. Tobacco is dried crushed leaves powder mixed with lime

Group III: Kharra chewers (100 subjects)

Those who chew Kharra regularly, 5 packets (10 gm) per day, for last 10 years were selected and included in the study. Kharra is homogenous mixture of dried crushed leaves with areca nut and slacked lime.

Group IV: Controls (100 subjects)

Those who do not chew or smoke tobacco, not even in the past were selected for the study.

The institutional ethics committee approved the study. Experimental protocol was fully explained to all subjects and written consent obtained. Detailed medical history, family history and personal history with special reference to the history of tobacco use at present and past was recorded. Height weight was recorded. BMI was calculated. Pulse rate & BP was recorded.

Under all the aseptic conditions, 5ml fasting blood sample was obtained from each subject with the help of disposable syringe and needle. Serum was separated. Lipid profile estimation was done by enzyme kit method. Readings were taken on semi auto analyzer. C-reactive protein estimation was done by turbimetric method.

Statistical Analysis

All the data were expressed in mean ± SD format. The groups were compared by using ANOVA test. Post hoc comparison by Bonferroni's multiple comparison tests using Graph Pad 5.1 software.

FINDINGS

The anthropometric parameters of various groups are given in Table I. the mean age of smokers (Group I), Tobacco chewers (Group II), Kharra chewers (Group III), and Controls (Group IV) were 25.34,25.39,25.3, & 25.04 years respectively and the statistical difference was found to be not significant. The prevalence of tobacco use is more in early to middle age groups, so we selected this age group.

No significant difference in age, height or BMI was found among the various groups studied, indicating that the samples were homogenous in this respect. (Table I).

Table 1: Anthropometric data- Age,Height,Weight and Body Mass Index

Variables	Group I Smokers	Group II Tobacco Chewers	Group III Kharra Chewers	Group IV Controls	P Value
Age(years)	25.34±5.45	25.39±3.53	25.3±8.04	25.04±6.47	NS
Height(m)	1.63±0.08	1.66±0.04	1.64±0.04	1.63±0.02	NS
Weight(kg)	56.21±14.1	58.04±0.7	55.2±6.28	55.73±4.91	NS
BMI(kg/m^2)	20.86±4.09	20.82±0.5	20.55±2.13	20.79±1.8	NS

BMI :Body Mass Index; NS : Not Significant ; Significance act at P <0.05: Variables be expressed in mean and standard deviations.

Table 2: Various Cardio Pulmonary Risk Parameters.

Variables	Group I Smokers	Group II Tobacco	Group III Kharra	Group IV Controls
Sr.Cho(mg/dl)	228.2±38.6	215±18.3	185.1±38.8	145.7±23.6
Sr.TG(mg/dl)	113.4±18.7	102.8±2.8	96.8±10.1	72.3±7.5
Sr.VLDL(mg/dl)	22.68±3.4	20.56±0.5	19.36±2	14.45±1.5
Sr.LDL(mg/dl)	159.26±31.41	152.31±14.1	128.72±31.3	102.13±19
Sr.HDL(mg/dl)	29.14±4.7	37.02±7.7	43.17±3.6	46.26±6.7
CRP(mg/dl)	16.33±12.74	13±1.4	11.25±2.3	3.56±1.3

Sr: Serum ; Cho : Cholestrol ; TG:Triglyceride; VLDL : Very Low Density Lipoprotein ; LDL : Low density Lipoprotein; HDL : High Density Lipoprotein; CRP : C-Reactive Protein Variables expressed in mean and standard deviation.

Table 3: Results of comparison between groups using ANOVA test & post hoc Bonferroni's multiple comparison test

Variables	Group I vs. Group IV	Group II vs. Group IV	Group III vs. Group IV	Group I vs. Group II	Group I vs. Group III	Group II vs. Group III
Sr.Cho(mg/dl)	t-10.37S***	t-8.82S***	t-5.16S***	t-1.553NS	t-5.206S***	t-3.65S**
Sr.TG(mg/dl)	t-9.77S***	t-7.25S***	t-5.88S***	t-2.517NS	t-3.889S***	t-3.59S**
Sr.VLDL(mg/dl)	t-9.77S***	t-7.25S***	t-5.88S***	t-2.517NS	t-3.889S***	t-3.61S**
Sr.LDL(mg/dl)	t-11.46S***	t-9.39S***	t-5.503S***	t-2.067NS	t-4.542S***	t-3.89S**
Sr.HDL(mg/dl)	t-8.88S***	t-7.77S***	t-4.34S***	t-1.11NS	t-4.542S***	t-3.432S**
CRP(mg/dl)	t-6.45S***	t-4.76S***	t-3.976S***	t-1.687NS	t-2.478S**	t-3.54S**

t:T value,S***:Highly significant; S** :Moderate significant;NS:Not significant;significance set at P<0.05

However, the lipid profile parameters - serum cholesterol, Triglyceride (TG), Very Low Density Lipoprotein (VLDL), Low Density Lipoprotein (LDL) showed increasing trends in their means from controls → Kharra chewer → Tobacco chewer → smokers. Highest values were found in the smokers and lowest for the controls.

Similar trend had been observed for the C reactive protein (CRP) values. Highest values were found in the smokers (16.33 ± 12.74 mg/dl) and lowest for the controls (3.56 ±1.3 mg/dl).While, for the High Density Lipoprotein (HDL) values trend was found to be reverse i.e.; Smokers had the lowest values (29.14±4.7 mg/dl) and controls had highest values (46.26±6.7 mg/dl) and decreasing trend was observed from Control → Kharra chewer → Tobacco chewer → Smoker.

These trends were found to be statistically significant in the comparison among various groups, except for the Group I vs. Group II (smoker and tobacco chewer), the difference was found to be statistically non significant.

The findings of our study were

1. Tobacco users (smoker & smokeless tobacco users) had significantly higher lipid profile (except HDL) values than Controls.
2. Tobacco users (smoker & smokeless form of tobacco users) had significantly higher C- reactive protein levels than Controls
3. The lipid profile & CRP differences between smokers & tobacco group was found to be non significant

DISCUSSION

Many of The Health Problems associated with Tobacco use are a consequence of nicotine. Smokeless Tobacco acts as a vehicle to deliver nicotine to system. Blood nicotine level which result from smokeless tobacco use are similar to smoking. [10,11,12]. Nicotine increases risk of cardio Vascular disease by affecting lipid metabolism, coagulation, hemodynamic status or all the three [12]

As stated earlier, tobacco users had significantly higher lipid profile (Serum Cholesterol, TG, LDL, VLDL) values than controls. While, Serum HDL were significantly lower in tobacco users than controls. In support to these clinical observations Brischetto et al [13] proposed a mechanism to explain the link between smoking and some of the observed changes in serum lipid profile and lipoprotein concentration. (a) Nicotine stimulates release of adrenaline by the adrenal cortex, leading to the increased serum concentrations of free fatty acids (FFAs) observed in smokers. [14,15,16] Free fatty

acids are well known stimulants of hepatic secretion of VLDL and hence TG. HDL concentration varies inversely with VLDL concentration in serum. [17] Complementary to these mechanisms is the finding that Free Fatty Acids (FFAs) also stimulates hepatic synthesis and secretion of cholesterol[18].

Tobacco users had significantly higher C-reactive protein than control. Recent studies provide evidence that inflammation plays role in pathogenesis of cardio vascular disease. circulating level of C-reactive protein may constitute an independent risk factor for cardio vascular disease. [19-21] C- reactive protein may directly interact with atherosclerotic vessels of ischemic myocardium by activation of complement system , there by promoting inflammation & thrombosis. [22-25] Acute phase responses are induced by cytokines released from jeopardized tissue [26,27]. The cytokines stimulate liver to synthesize acute phase protein including C- reactive protein[28].

Tobacco users- smokers & smokeless Tobacco users (Tobacco chewer & Kharra chewers) face significantly higher risk of cardiovascular disease than non users. G Bolinder et al, F Huhlasaari, k Asplund [12,29,30] reported higher risk of death from cardio vascular disease in smokers & smokeless tobacco users than non users. Statistically no significant difference was found in lipid profile parameters (Serum Cholesterol, TG, LDL,VLDL) C- reactive protein in Smokers & Tobacco chewers while kharra chewers had significantly lower lipid profile parameters & C-reactive protein than Smokers & Tobacco chewers

D Siegel, Benowitz NL suggested the similar cardio vascular hazards in Smokers & smokeless tobacco users.[9,31] They reported maximum level of nicotine achieved because of prolonged absorption by single exposure to smokeless tobacco was twice as large compared to cigarette smoking .

G Bolinder et al , F Huhtassari, K Asplund suggested lower risk in smokeless Tobacco users than smokers. Smokeless tobacco is associated with less serious health hazards than cigarette smoking. Carbon monoxide or aromatic hydrocarbon toxicity induce damage to vessels wall or enhance the probability of coronary thrombosis by inducing hyper coagulable state. [12,29,30] .

Smokers & tobacco chewers were exposed to equal cardio vascular risk while Kharra chewers had less deleterious cardio vascular risk .Overall goal to improve the public health should addresses the issue of tobacco use. Prevention of tobacco consumption both in smoking and smokeless form could be an important intervention in preventing ongoing upswing in prevalence of coronary heart disease that is throttling to engulf every region of the world.

ACKNOWLEDGEMENT

Authors are Thankful to the Institution IGGMC, Nagpur & All the subjects for their contribution and support in completion of work.

Conflict of Interest: None

Source of Funding: Nil

Ethical Clearance: Permission was taken from Institutional Research and Ethical Committee.

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DOI Number: 10.5958/j.2320-608X.1.2.014

Yogasana - A Spirotherapy

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ABSTRACT

In the management of patients with CAL (Chronic airway limitation), assessment of the airway obstruction, its quantification for prognosis with medical treatment alone (though essential and life saving) does not complete the course of treatment as the problem recur intermittently and worsen the condition of the patient in day to day life for normal physical activities.

This prompted the initiation of an adjunct therapy for rehabilitating these patients with CAL. The major problem in COPD (Chronic obstructive pulmonary disease) is labored breathing and dyspnoea which decreases the physical activity. Simple Yogic exercises combined with breathing exercises practiced traditionally in India as a rule of ancient oriental healing for training the Respiratory muscles were chosen for management of chest patients in our study and the restoration of these individuals to almost normalcy and back to their routine life assessed by varying ventilatory parameters are presented over here.

Keywords: *Yogasana, Pranayama, COPD*

INTRODUCTION

In patients with Chronic airflow limitation (CAL) multiple extrinsic and intrinsic problems are responsible for generalized airway obstruction. Clinical management of COPD is with 3 different goals

1. Actual complaint to be eliminated.
2. Complication to be prevented.
3. Future damage to the lung to be avoided. .

1. Actual problem is labored breathing due to narrowing of airways and weakening of respiratory muscles.
2. Complications are- hypersensitivity of airways leading to the problem of airway obstruction— accumulation of secretions resulting in infections– recurrent infections leading onto Chronic Bronchitis – later on purulent sputum with inflammation of bronchi and obliteration and dilation of bronchial walls leading to Bronchiectasis- adding on to these complications, further involvement of parenchyma- reduces the elastic recoiling force of the lung and brings about emphysematous changes and involve cardiovascular system secondary to diseases of lung , thereby making the patient a Cor Pulmonale in future.

Therefore it is necessary for the physician to have a good personal knowledge of the complete personal/ family history of patient and equally knowledge of the multifocal approach of therapeutic regimens. Treatment failure may be due to insufficient analysis of reversibility of bronchial obstruction and causative factors such as negligence of psychosomatic factors and insufficient instructions to the patient.[1]

A comprehensive approach of long term therapy for patient to enhance the efficacy of respiratory muscles by careful instruction and supervision and measurements of lung function are additional prerequisite for success.[2]

Major problem in COPD is decreased respiratory muscle reserve in addition to the increased cost of breathing leading to dyspnoea which decreases the physical activity.[1]

Reconditioning exercises to the lung permit the patient to function at a level commensurate with his cardiopulmonary reserve. Respiratory muscle training

is a Rehabilitation medicine to COPD as it offers potential solution to the problem and should not be missed in the overall management of COPD.[3]

The main clinical problem of COPD is to expend many times more energy to breathe, than normal subjects. Even at rest their diaphragm must work much harder than normal in order to compensate for obstruction[4] and with minimal activity the respiratory muscles get fatigued and therefore become short of breath even at rest[5]

Respiratory muscles like any other skeletal muscle can be weakened by malnutrition[6] fatigue[5] and detraining[7, 8] and their strength and endurance can be improved only by appropriate training regimens[9, 10]. Improved diaphragmatic endurance by training in COPD has been documented.[9, 11]

MODERN TREATMENT includes

Antibiotics—to remove infection

Bronchodilators—to dilate airways and

Exercises—to improve the efficiency of respiratory system

Standard treatment of therapeutics are directed at reducing the degree of obstruction but insufficient to improve exercise tolerance and respiratory muscle endurance which can be done with only exercising the respiratory muscles. When exercises become the solution for COPD the question arises on:

What type of exercises to be selected?

Whole body exercises like running, jogging, swimming etc, which improve the absolute endurance of the person and strengthening of muscles there by the cardiovascular fitness ,cannot be advocated for patients with COPD as they are active exercises, therefore , more stressful, consumes lot of energy and much exhaustive and therefore cannot be advocated.

Exercises more oriented to improve the relative endurance of respiratory muscles only to be advocated for COPD.

The exercises oriented to improve the relative endurance of respiratory muscle are to be non-stressful, non-fatigable with no panting and puffing with no/minimum consumption of energy and should not excite the patient and bring about tachypnoea are to be advocated.

On principle such isolated groups of muscles are to be exercised by mild fatiguing exercises alternating with periods of rest.[12] Even exercises of very short duration (3-4mins) can result in large gains in endurance.[13] Efficacy of training depends more upon the number of times a muscle is fatigued than upon the total amount of work performed[14].

The types of exercises advocated in western countries are

A. Inspiratory muscle resistive training using digitometer[12] and

B. Isocapnoeic exercises[7, 9].

1. In inspiratory muscle endurance training, patients are trained to breathe to their maximum through resistive load using digitometers intermittently.
2. In isocapnoeic exercises the subject has to breathe to his maximum for a sustained period of 15 minutes under isocapnoic conditions (ie retaining CO_2 levels normal in blood.)

These principles are naturally available in Yogic pranayamic breathing exercises, traditionally practiced in India as a "Biotherapy "and therefore patients were taught these exercises and their subjective improvement and objective improvement assessed by ventilator parameters and blood gas analyses after training were estimated.

MATERIALS AND METHOD

Patients were divided into 2 groups. 1st group comprised of 10 male subjects. The demographic profile of these 10 male subjects is- age varying from 35-47 years, height from 162-175cms and weight from 55-81 kgs. All subjects were clinically stable during the period of study and had the following characteristics;

1. They suffered from dyspnoea on mild exertion.
2. They were free from other disabling diseases.
3. They were clinically stable during the course of study.
4. They demonstrated minimal reversibility of airway obstruction by history and pulmonary function tests (PFT).
5. They were able to exercise to their maximal capabilities without adverse cardiovascular effects.

The 2nd group comprised of 50 patients out of whom 20 were asthmatics (8 males and 12 females) with their ages ranging from 12-26 years with a mean of 55 years. The duration of asthma varied from 02-40 years with a mean of 24 years.

The rest of the 30 patients who volunteered for the study are 20 males and 10 females with their age ranging from 18-72 years. Their diagnosis is as follows.

Etiology	Number of Subjects
Chronic Bronchitis	16
Emphysema	6
Tuberculosis	4
Cystic Fibrosis	1
Bronchiectasis	3

Routine pulmonary function tests were performed before and 2-3 weeks after the course of training of yogasanas and pranayamic breathing exercises. Asanas were grouped according to their stance as sitting, standing, lying down position etc. Some of the asanas in sitting, standing and lying down postures were taught to patients. Selection and administration of asanas vary from individual to individual. Not all asanas are taught to every individual. Different asanas create different effects. Each patient has to be treated with specific group of asanas.

Selecton of Asanas: From number of asanas in standing, sitting, prone, supine, forward and backward bending of body positions, postures are selected combined, formulated according to the need of the person, compliance of the body, age, time availability, physical/ physiological derangement of underlying disease (i.e. whether chronic, reversible/ irreversible) whether postural drainage needed, and also whether patient had associated problems like hernia, hypertension, obesity, arthritis etc, in addition psychosocial aspects of family environment, and perseverance etc, were also taken into consideration. Props, bolsters were used to relieve the strain of breathing for emphysematous patients.

FORMULATION OF THERAPY

One exercise pack designed for a patient may have a forward bending/backward bending/lateral stretching in sitting/standing/ prone/supine positions with a combination of simple breathing exercise to be done for 15-20 minutes daily, 2-3 times a day for one week to 10 days which is to be practiced at home after learning in the Ist sitting.

The patients were reviewed at the end of one week to 10 days in the IInd sitting and exercises were altered/ added/ modified (as each asana has got multitude of variations) according to the changes observed while repeating all ventilatory parameters and advised to come for IIIrd sitting after practicing the corrected exercises at home.

Not more than three sittings required for patients. The type of breathing exercises coupled with yogic exercises were Kapalabati, Basthrika, Digital alternate nostril breathing, yogendra pranayama and anuloma/ viloma pranayama.

Ventilatory parameters such as Forced vital capacity (FVC), forced expiratory volume for first second (FEV_1), forced expiratory flow rate for 25-75% ($FEFR_{25-75\%}$) were obtained to evaluate their functional disability and improvement before and after training, maximum voluntary ventilation (MVV) was also measured for 15 seconds, and ventilatory equivalent for O_2 ($VeqO_2$) was also determined. The effort tolerance was estimated by duration of time walked by the subjects without distress at a speed of 180 steps/ min.

Blood samples were withdrawn from the 1st group of 10 male patients to estimate PO_2, PCo_2 and pH levels and percentage saturation of O_2 for the pre and post training period. The subjective improvement of sense of wellbeing was assessed by close conversation and questionnaire with patients before and after training.

RESULTS AND OBSERVATION

All patients showed subjective improvement and increase in effort tolerance after exercise (Table.1). The significant improvement in all ventilatory parameters such as FVC, FEV_1, PEFR, $FEFR_{25-75\%}$, MVV and forced inspiratory flow rate for 25-75% ($FIF_{25-75\%}$) after training with yogic exercises is shown in (Fig.1).

Table 1: Subjective Improvement After Yoga Therapy

S. No	Pre-training	No of subjects	Post-training	No of subjects
1	Dyspnoea at rest- on exertion	 28 62	 Nil Nil	 27 53
2	Worry	10	Sense of well being	07
3	Confusion of thoughts	36	Clear mind	32
4	Feeling heavy	49	Feeling light	40
5	Dull	24	Active	23
6	Loss of memory	13	Improvement in memory	11
7	Effort tolerance (2-4 mins)	58	Effort tolerance (4-12 mins)	71

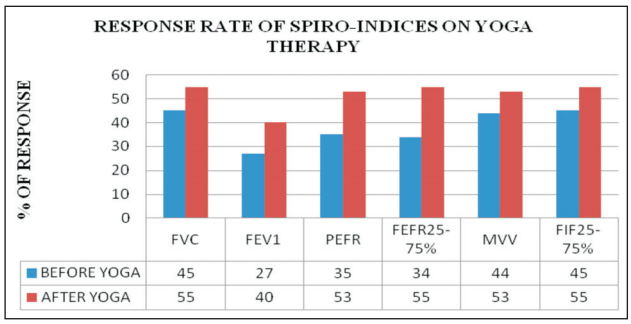

Fig. 1. Response Rate of Spiro-indices on Yoga Therapy

All parameters in the post training group is significantly elevated ($p<0.001$). Drug score evaluation proves minimum administration of drugs after training unlike patients who are with Bronchodilator (BD) alone and not subjected to yogic exercises (Table. 2).

Table 2: Drug Score with Pranayama

S. No	Pre-training			Post-training		
	Drugs	Dose		Drugs	Dose	
1	Steroid Derriphylin	5mg/OD 100mg/ TDS	13	Derriphylin	100mg/OD SOS	11
2	Salbutamol Derriphylin	4mg/BD 100mg/ TDS	13	Salbutamol	2mg/OD SOS	9
3	Meta proteronol Salbutamol MMD	150mg/QID 200mcg/QID	12	Salbutamol	200mcg/SOS	12
4	Salbutamol Inhaler Beclate	200mcg/TDS 50mcg/QID	11	Salbutamol	200mcg/OD	6
5	Disodium cromoglycate Terbutalin	20mg/QID 250mcg/TDS	6	Disodium cromoglycate	20mg/QID	6

Number in Dose Column Denotes the Response Obtained in Number of Subjects

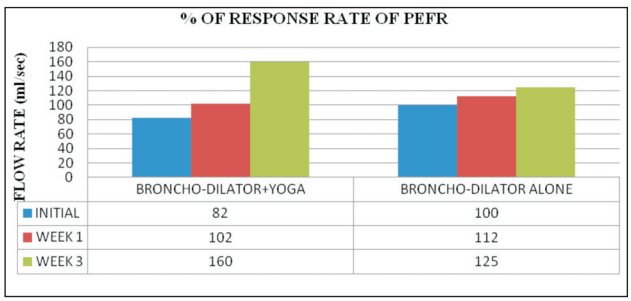

Fig. 2. Response Rate of Pefr

Gradual improvement in the patency of major airways after training for a period of 1-3 weeks is confirmed by PEFR measurement for these patients (Fig.2). BD alone has not improved the patency of major airways. It is the rehabilitative exercises which has improved the patency of all airways. Thus the relief from exertional dyspnoea for these patients (COPD) may be attributed to the rehabilitative exercises which has relieved them from broncho-constriction and improved the patency of bronchial tubes.

Just to prove that the normalcy is brought out to the blood chemistry by these rehabilitative exercises arterial blood samples for a small group of 10 subjects were analyzed (Table.3), associating with the improvement in the lung function parameters (Table. 4).

Table 3: Blood Gas Indices Before and After Pranayama

Indices	No. of patients studied																			
	1		2		3		4		5		6		7		8		9		10	
Pranayama	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A
PaO_2mmHg	70	79	73	82	65	80	79	83	80	84	81	87	79	83	77	86	76	87	80	88
$PaCo_2$mmHg	46	40	45	40	49	39	46	40	48	40	45	39	44	40	41	40	47	41	42	40
Ph decimal	40	44	39	40	38	42	39	40	31	41	36	42	39	44	40	41	47	42	40	42
Saturation %	78	88	69	89	72	89	77	85	77	81	79	83	81	88	82	88	79	87	80	88

B= Before Training, A= After Training

Table 4: Ventilatory Indices Before and After Pranayamic Training in Copd

S. No	Age/sex	B/A	PEFRlit/min	FVC/ lit	FEV_1/lit	FEV_1%	$FEFR_{(25-75\%)}$ lit/min	MVV lit/min	VEO_2 lit/min
1	35/M	BA	104255	3.203.95	2.43 3.48	7688	102192	62100	0.690.81
2	38/M	BA	125124	3.303.85	2.11 3.43	6489	98152	3297	0.690.81
3	36/M	BA	160410	4.104.20	2.303.36	5680	96148	30110	0.840.66
4	40/M	BA	100330	3.003.65	1.472.52	4969	100122	4283	0.680.73
5	42/M	BA	85155	1.952.34	0.861.60	4468	96195	85120	0.720.81
6	43/M	BA	90230	2.443.65	1.463.21	6088	103220	86134	0.700.83
7	39/M	BA	220410	1.992.99	0.9952.23	5077	88138	67110	0.710.82
8	44/M	BA	200395	3.713.85	2.302.96	6277	115234	80110	0.700.80
9	47/M	BA	60200	1.802.93	0.862.08	4871	97185	78120	0.750.85
10	46/M	BA	130380	2.213.21	1.592.82	7288	120220	55135	0.720.83

B= Before Training, A= After Training

DISCUSSION

Patients with COPD have their ventilatory capacity decreases in proportion to their degree of airway obstruction[15]. Their respiratory strength is characteristically reduced[7]. Their respiratory muscles show atrophy[16] and metabolite depletion[8]. Inspiratory muscle can be strengthened and their endurance improved by appropriate training regimen either naturally occurring[9, 17, 18] or prescribed[10, 19.]

Therefore the functional abilities of patients with COPD can be improved by respiratory muscle training[20,14,5]. Pranayama becomes one such respiratory muscle training programme.

Prana means "Breath", "Respiration "life "vitality" or energy", Ayama means "stretch, "extension "expansion". Pranayama thus means "prolongation of breath and its restraint" [21]. BHASTHRIKA PRANAYAMA and the phases of PURAKA (deep inspiration) exercises inspiratory muscles, especially strengthen the diaphragm, so also the phase of RECHAKA (prolonged expiration) exercises expiratory muscles adequately. The phase of KUMBHAKA (breath holding) in Pranayama improves the muscle endurance as the muscle contracts isometrotonically against resistance. Bhasthrika pranayama corresponds to the diaphragmatic breathing exercises seen in inspiratory muscle resistive training practiced in western countries[22].

The Alternate nostril breathing, pranayama bring about mild fatiguing respiratory exertion alternated with short secessions of resting period, following the principle observed by Aldrich et al[23], for effective training programme of inspiratory muscle endurance technique for respiratory muscles.

Increase in MVV observed in the present study due to training of pranayamic breathing corresponds to the results of MVV obtained by Leith et al[10] and Aldrich et al[24] with isocapnic hyperventilation studies.

Sonne et al[12] performed inspiratory muscle resistive training to patients using digit meters which has inspiratory orifices of varying diameters and proved the technique to be effective for COPD. Digital pranayama by adjusting the diameter of alternate nostrils with digits is similar to and even superior as this is naturally occurring and improves exercise performance tremendously in COPD than shown by previous authors[9, 14].

Pranayama is a vast subject with illimitable potentialities. The subjective and objective improvement seen with pranayamic breathing exercises is due to the fact that it explores the intimate relationship between" Body and Mind". It opens a new and broad horizon to medicine and therapeutics and teaches the Science of Breathing[21]. Yoga is a Science which exhibits "Mind over Body". Yoga is derived from the Sanskrit word "Yuj "which means to "unite, to link. "Yoga unites the Body and Mind. It teaches the progressive control of Body and Mind which leads to Physiological harmony, mental poise and positive outlook[25].

The effect of posture on respiratory function, PO_2, PCo_2 in COPD has been reported[26] and well correlates with our results. Asanas teaches steady and complete postures. But this is not merely physical poses but brings awareness of oneself in relation to physical position and movement of breath and relaxation of muscles[27].

Hatha yoga teaches various asanas which are postures to stretch the spine, relax the joints, tone the muscles, with minimum of motion, as these exercises are done at very slow tempo[27]. So these asanas are not stressful, non fatigable, with no puffing and panting with no/ minimum consumption of energy [28].

Yogasanas integrate the phases of respiration to different postures obtained by the body while performing various physical activities. It teaches how to organize the inspiratory/ expiratory phases of respiration with the body movements while occupying different postures (asanas) thereby it coordinates the phases of respiration to body movements so that the patient can do his normal day to day activities with minimal utilization of ventilatory reserve with no panting and puffing. The tone of gamma motor neurons of intercostals muscles influenced by posture has been documented[29]. So yogasanas with yogic breathing exercises (ie different types of Pranayama) tonify the respiratory muscles thereby increasing all spirometric values.

SUMMARY

The effect of Yoga is not illusionary. The improvement with yogasanas is slow, but steady, long lasting, and permanent with no side effect. Even if the asanas are not done in perfection, the attempt towards reaching perfection gives the same effect as it involves the concentration of mind. Yogasana is a science which harmonizes the body and mind. It is not a physical therapy but a physiological therapy, a "Spiro therapy "to be included as an" Adjunct therapy" for rehabilitating COPDS.

ACKNOWLEDGEMENT

Management & Dean, Tagore medical college & hospital, Rathinamangalam, Vandaloor post, Chennai-127.

Source of Funds: Self funded

Conflict of Interest: None

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DOI Number: 10.5958/j.2320-608X.1.2.015

Auditory and Neurological Correlation in Auditory and Peripheral Neuropathy in Type II Diabetes Mellitus

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ABSTRACT

Background: Diabetes mellitus is metabolic disorder of multiple etiologies characterized by chronic hyperglycemia with disturbances of carbohydrate, fat and protein metabolism resulting from defects of insulin secretion, insulin action or both. The study was conducted with an aim to evaluate the effect of type II Diabetes mellitus on auditory brainstem response and conduction velocity of median nerve(motor component) and sural nerve (sensory component) and to correlate between auditory neuropathy and peripheral neuropathy due to type II Diabetes mellitus.

The present study was undertaken in the Neurophysiology Laboratory, Department of Physiology, Jawaharlal Nehru Medical College Sawangi(Meghe) Wardha. It was a cross sectional case control study and a total of 100 subjects were studied out of which 50 were diabetics and 50 were age and sex matched controls. Effective nerve stimulation was obtained by the stimulus duration of 50μs to 1000μs and 0-100mA. Supramaximal stimulation (10-30% more than the current)was given. Electrode impedence was kept below 5k.

BAEPs were recorded with the help of a computerized evoked potential recording system by monoaural stimulation and all the parameters have been compared at 70dBnHL stimulus intensityThe duration of diabetes in the study group with mean+S.D. is 6.92+2.08 years. There was no statistical significant difference in mean age and gender between the control group andstudygroup

We founded increase in latency of waveV and interpeak latency III-V. There was decreased conduction velocity in median nerve and sural nerve of upper limb and lower limbfor motor nerve and sensory nerve respectively

Keywords: *Diabetes Mellitus, Brainstem Auditory Evoked Potential, Nerve Conduction Velocity*

INTRODUCTION

Diabetes mellitus is metabolic disorder of multiple etiologies characterized by chronic hyperglycemia with disturbances of carbohydrate, fat and protein metabolism resulting from defects of insulin secretion, insulin action or both[1]. The prevalence of diabetes mellitus has reached epidemic proportions. 2011 National Diabetes factsheet released on 26January 2011 estimates about 246million diabetics worldwide in the year 2010 with prevalence rates of 11.3% among the adults of 20-65 age groups.[2] In India alone, diabetes is expected to increase from 40.6million in 2006 to 79.4million by 2030.[3] Type2 diabetes mellitus constitutes about 85-95% of all the diabetes in developed countries accounting for an even higher percentage in developing countries.[4,5]

Extensive neurophysiological documentation exists on the occurrence of complex neurological abnormalities at a peripheral level during the course of diabetes. John Rollo is credited with having first recorded this association in 1798 and until the middle of 19th century diabetes itself was ascribed to a disorder of the central nervous system[6,7]. The study was

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conducted with an aim to evaluate the effect of type IIDiabetes mellitus on auditory brainstem response and conduction velocity of median nerve(motor component) and sural nerve (sensory component) and to correlate between auditory neuropathy and peripheral neuropathy due to type II Diabetes mellitus.

MATERIAL AND METHOD

The present study was undertaken in the Neurophysiology Laboratory, Department of Physiology, Jawaharlal Nehru Medical College Sawangi(Meghe) Wardha. It was a cross sectional case control study and a total of 100 subjects were studied out of which 50 were diabetics and 50 were age and sex matched controls. The patients were selected and studied after obtaining the approval from the Institutional Ethical Committee to carry out the research work.The diabetic patients visiting diabetic OPD and admitted in medicine ward were accommodated in the study. The diagnosis of the diabetic patients was confirmed by fasting and postprandial serum glucose as per the WHO criteria[1].The Diabetes Mellitus(TypeII) with hypertension(under medication) and without hypertension in the age group of 30-60 years were accommodated in the study. Those having any occupational history of working in noisy environment,,use of ototoxic drugs(amikacin, streptomycin),any past history of ear disease ,alcohol usage ,head trauma, meningitis ,allergy ,family history of ear diseases and systemic diseases were excluded from the study. All the patients selected for study were subjected to a detailed history and clinical examination. This includes special enquiries into complaints as hearing loss, tingling, paraesthesia etc. Patients underwent careful systemic examination for the clinical evidence of peripheral neuropathy. Blood pressure estimation of all the patients was done. Blood sugar estimation- fasting and 2 hour post prandial were done. Fasting and postprandial glucose estimation was done from venous blood by Glucose oxidase method.

Neurophysiological tests were performed as per prescribed standards on RMS EMG EP Mark II, Recorders and Medicare Systems, Chandigarh India. Nerve conduction velocity tests were done for motor component in median nerve and sensory component in sural nerve.

Effective nerve stimulation was obtained by the stimulus duration of 50µs to 1000µs and 0-100mA. Supramaximal stimulation (10-30% more than the current)was given. Electrode impedence was kept below 5k.

BAEPs were recorded with the help of a computerized evoked potential recording system by monoaural stimulation and all the parameters have been compared at 70dBnHL stimulus intensity.[8]

Results:Results were analysed by Statistical Package for Social Sciences (SPSS) software, version 17.0, Graphead Prism Store.Z test was applied for testing the significance of difference of each parameter between the study and control groups. Results were tested at 5% level of significance.Student's paired 't'test was applied for testing the significance of difference of each parameter between the right and left ears. The duration of diabetes in the study group with mean+S.D. is 6.92+2.08 years. There was no statistical significant difference in mean age and gender between the control group and study group.

Table 1: Demographic profile of patients in both the groups (age:30-60years)

Gender	Control Group	Study Group	x^2-value	p-value
Male	35(75%)	32(72%)	0.21	0.63NS,p>0.05
Female	15(25%)	18(28%)		

Table 2: Comparison of Fasting blood sugar and Postprandial blood sugar in control and study groups

	Group	Mean	Std. Deviation	Std. Error Mean	p-value
FBS (mg/dl)	Control	97.62	9.62	1.36	0.000S, p<0.05
	Study	216.86	103.79	14.67	
PPBS (mg/dl)	Control	161.68	17.62	2.49	0.000S, p<0.05
	Study	271.74	104.97	14.84	

Table 3: Comparison of absolute latencies in Brainstem Evoked response audiometry in control and study groups (Right Ear&Left Ear)

Absolute Latencies (ms)	RIGHT EAR				LEFT EAR		
	Group	Mean	Std. Deviation	p-value	Mean	Std. Deviation	p-value
I	Control	1.65	0.30	0.114NS,p>0.05	1.80	0.35	0.006NS, p>0.05
	Study	1.75	0.29		1.69	0.21	
II	Control	2.57	0.31	0.386NS,p>0.05	2.57	0.31	0.121NS, p>0.05
	Study	2.61	0.20		2.65	0.18	
III	Control	3.74	0.40	0.526S,p<0.05	3.72	0.37	0.809NS, p<0.05
	Study	3.79	0.41		3.73	0.28	
IV	Control	4.65	0.19	0.282NS,p>0.05	4.65	0.19	0.150NS, p<0.05
	Study	4.69	0.15		4.70	0.18	
V	Control	5.63	0.41	0.002S,p<0.05	5.62	0.27	0.005S, p<0.05
	Study	5.88	0.36		5.82	0.39	

Table 4: Comparison of Interpeak latencies in Brainstem Evoked response audiometry control and study groups (RightEar&LeftEar)

Interpeak Latencies (ms)	RIGHT EAR				LEFT EAR		
	Group	Mean	Std. Deviation	p-value	Mean	Std. Deviation	p-value
I-III	Control	1.97	0.51	0.357NS,p>0.05	1.92	0.36	0.183NS,p>0.05
	Study	2.05	0.29		2.02	0.40	
I-V	Control	3.97	0.45	0.098NS,p>0.05	4.07	0.38	0.148NS,p>0.05
	Study	4.11	0.36		4.18	0.34	
III-V	Control	1.85	0.20	0.000S,p<0.05	1.88	0.29	0.002S,p<0.05
	Study	2.26	0.45		2.12	0.43	

Table5:Comparison of Motor Nerve Conduction Velocity and Sensory Nerve Conduction Velocity in Control and study groups(n=50)

	Group	Mean	Std. Deviation	p-value
MNCV(m/s)	Control	57.52	3.65	0.000S,p<0.05
	Study	45.63	1.83	
SNCV(m/s)	Control	58.53	14.11	0.000 S,p<0.05
	Study	44.57	1.80	

DISCUSSION

The primary diabetic neuropathy may be due to the accumulation of sorbitol within the nerve tissue. The secondary neuropathy is due to a decrease in the blood flow of the vasa nervorum. The neurons show a thickened basement membrane of the Schwann cells, segments of demyelinization, and changes in the biochemistry of the lipids[9]. The well established complications of diabetes as retinopathy, nephropathy and peripheral neuropathy involve pathogenic changes in the microvasculature and sensory nerve of the inner ear .Grazyna Lisowsky et al 2001[10] suspected the microvasculature changes in the inner ear to be directly dependent on the long lasting diabetes causing degenerative changes in capillaries and small vessels of the whole body.

Lucian L et al 2003[11] studied the genesis of diabetes mellitus and reported a direct association between diabetes and hearing loss and stated that the hearing loss is of sensorineural progressive in nature. Type of hearing loss as sensorineural progressive. Many authors also suggest that there is evidence of inflammatory demyelinating neuropathic changes of the vestibular, auditory, and facial nerves and a concomitant degeneration of the vestibular and cochlear sensory structures and the increased risk of hearing loss which ranges from mild to moderate. [12]. It has been shown by numerous investigators, that a

reduction or impaired blood flow and the resultant endoneurial hypoxia are important factors underlying nerve conduction deficits. Studies have demonstrated that there is a good correlation between the degree of microangiopathy and measures of neuropathic severity in diabetics. It has also been shown that with a return of more normal blood flow, there is a normalization of nerve conduction. [13,14,15,16]

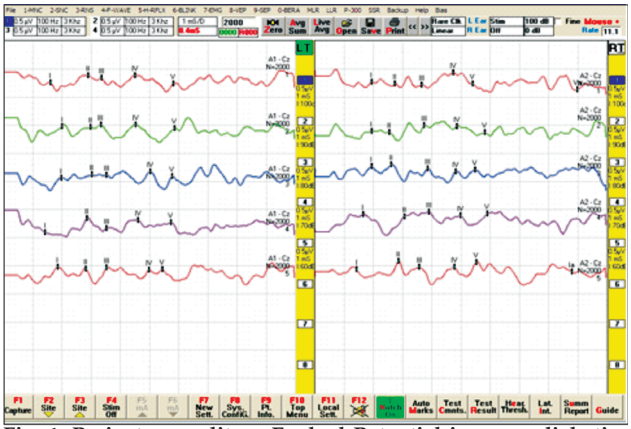

Fig. 1. Brainstem auditory Evoked Potential in non - diabetics control

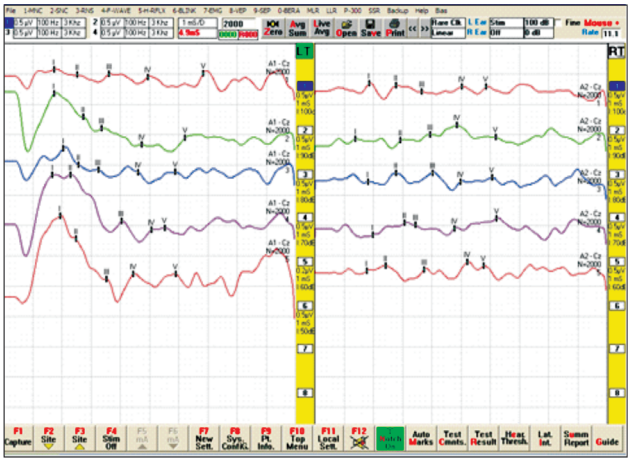

Fig. 2. Brainstem Auditory Evoked Potential in diabetics

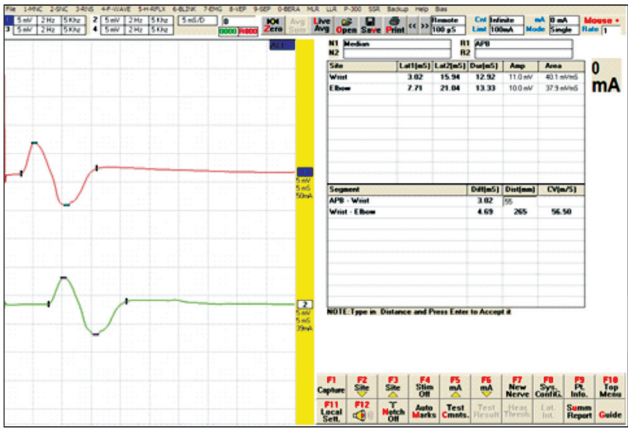

Fig. 3. Median Nerve Conduction Velocity in Non Diabetic Control

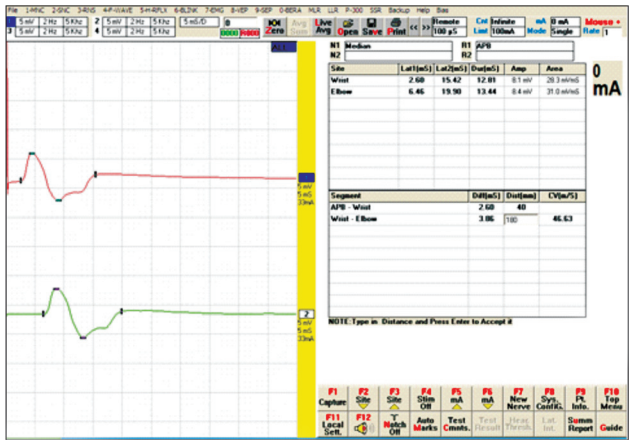

Fig. 4. Median Nerve Conduction Velocity in Diabetic Patient

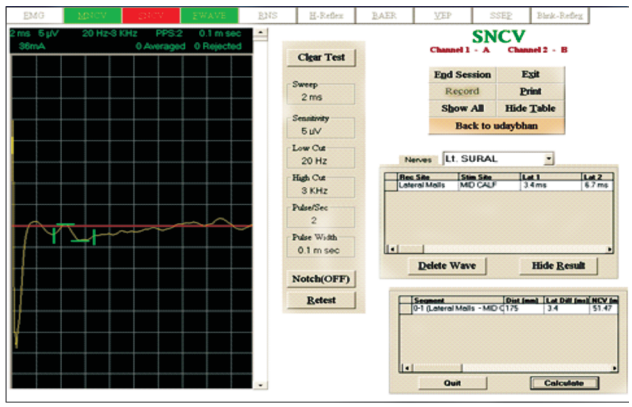

Fig. 5. Sural Nerve Conduction Velocity in Non Diabetic Patient

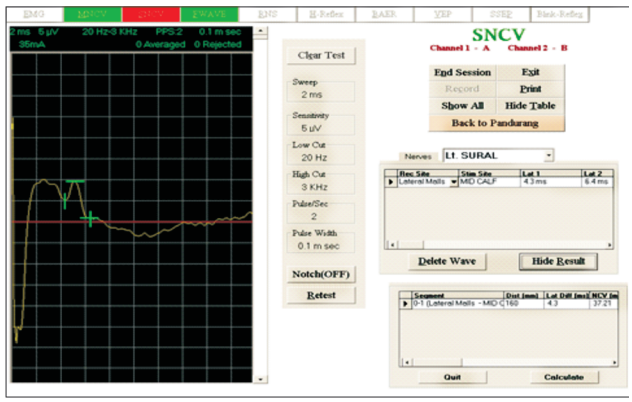

Fig. 6. Sural Nerve Conduction Velocity in Diabetic Patient

Auditory neuropathy (AN) is a specific hearing disorder with abnormal auditory neural responses in the presence of normal cochlear function. Affection of vestibular portion of cochleo-vestibular (VIII) nerve as well as other peripheral nerves was reported in the previous study.[17] A positive sensorineural hearing loss was reported in Peripheral Neuropathy patients of different etiologies e.g.Type II Diabetes Mellitus, hereditary motor and sensory ataxia as well as toxic neuropathies. [18]

Fujikawa & Starr[19] reported that despite the affection of vestibular nerve in AN patients, they did not experience any vestibular symptoms. This was attributed to the slow and gradual affection of the vestibular nerve that would provide efficient time for central compensation mechanisms to operate. The present study reflected the mild and subtle affection of peripheral nerves in auditory neuropathy patients. The prolonged latencies and slowing of nerve conduction velocity reflect that the underlying pathology would be demyelinating neuropathy.

In this study, affection of central auditory pathway pathways together with other peripheral nerves affection (by NCS) may reflect that there is demyelinating process affecting both peripheral and central myelinNCS would indicate that affection of peripheral nerves occurs later in the disease and is present more frequent in patients with extensive vestibular dysfunction. Hence, this would reveal that peripheral neuropathy even though mild but it is late manifestation; hence, NCS could be a useful sign of the disease severity. This agrees with previous findings reported by Starr et al[19] who documented development of peripheral neuropathy several years later in eight AN patients It also agrees with Fujikawa and Starr[19] who reported that severe vestibular dysfunction was more concomitant with older patients who had peripheral neuropathy as well.

From the anatomical point of view acoustic nerve fibers have relative small diameters (3-11 ìm), vestibular fibers are somewhat larger (3-15 ìm), whereas large axons of peripheral nerves exceed 20 ìm [18]. This would explain why the auditory symptoms appear first regardless the underlying pathophysiology (axonal, demyelinating or both). The relatively larger diameter vestibular nerve fibers manifest later as the gradual process gives time for central compensation mechanisms and patients do not complain unless there is extensive vestibular lesion especially if other additional modalities like visual or sensory-motor system or both become affected. The quite larger peripheral nerves would take much longer time to give an overt manifestation especially if the disease process is inherently very slow. However, other factors as genetic determinant of the pathological process should be highly considered. Acoustic nerve is a pure sensory nerve and is early affected.[20] The results of IPL of BAEP studies showed the best correlation with tibial motor NC velocity following median motor and sural NCV studies. The abnormality in nerve conduction velocity was more significantly found in lower limb (such as the tibial and sural nerve studies) than upper limb nerve studies in patients with length-dependent diabetic polyneuropathy. Central–peripheral distal axonopathy plays an important role in development of diabetic polyneuropathy[21]. Peripheral nerves affection in AN patients is suggestive of a generalized process rather than isolated auditory nerve pathology. Results of NCS pointed to that nerve demyelination could be the possible underlying pathological process. Also, it would be related to the underlying genetic factors responsible for the disease expression.[18] The lack of vestibular symptomatology in our patients reflects both the bilateral distribution of the disorder and the slow rate of vestibular nerve degeneration, which were characteristics of their accompanying hereditary and degenerative peripheral neuropathies.[20]

We conclude that brainstem evoked response audiometry parameters, motor nerve conduction velocity and sensory nerve conduction velocity were deranged in the diabetic subjects with or without hypertension. As the wave V absolute latency and III-V interpeak latency is increased in the type II diabetic group, it is suggestive of affection in the auditory pathway from superior olivary nucleus to the brainstem. Thereby concluding with the fact that diabetes is responsible for central neuropathy in the auditory pathway.

The motor nerve conduction velocity and sensory nerve conduction velocity are greatly reduced in the diabetics as compared to the controls thereby suggesting peripheral neuropathy.

Thus diabates causes both the auditory neuropathy and peripheral neuropathy. Owing to the existence of the conflicting data from the past, regarding the relationship of the auditory neuropathy and peripheral neuropathy in the hyperglycemic subjects with the glycemic control and duration of the disease, the present concluded that there does exist a correlation in the prevalence of peripheral neuropathy in the patients with auditory neuropathy. Hearing loss in diabetics is bilateral, subclinical, sensorineural and progressive in nature which is first to manifest than the peripheral neuropathy symptoms start to appear. Thus, with auditory brainstem response testing the hearing loss can be assessed at early stages and its further progression to peripheral neuropathy can be delayed or prevented depending upon the glycemic control and the duration. However, more extensive work and further studies will help to achieve a better insight into the problem.

ACKNOWLEDGEMENT

I would like to acknowledge the institution, the staff and the subjects without whose support this work would not have been possible.

Conflict of Interest: None

Source of Support: Institutional

Ethical Clearance: The patients were selected and studied after obtaining the approval from the Institutional Ethical Committee.

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DOI Number: 10.5958/j.2320-608X.1.2.016

Effects of Active Smoking on Heart Rate Variability, Heart Rate & Various Other Cardiac Risk Events in Chronic Smokers

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ABSTRACT

Background: Smoking increases the risk of vasospasm and arrhythmias, and may decrease heart rate variability (HRV). Shown to increase the risk for cardiovascular diseases and autonomic dysfunction specifically, reduced heart rate variability (HRV)) is a predictor of increased cardiac risk however, no study has till now has evaluated the time onset of these electrophysiological changes following smoking.

Method: Male smokers with atypical chest pain were screened with TMT. A total of 31 patients in whom TMT was either negative or mildly positive, underwent a 24-hour holter monitoring and were asked to note down the time of smoking.

Results: Heart rate increased significantly during smoking and came back to normal after 30 minutes. Smoking is also associated with an increased risk of ectopics (mean of 5.28 prior to smoking to 9.81 per hour during smoking to 11.29 during the next hour after smoking p 0.001). 3 patients had significant ST-T changes after smoking that lasted for half to two hours. HRV index is significantly decreased in smokers but spectral parameters- SDNN, RMSSD and SDANN remained normal.

Conclusion: Smoking increases heart rate and ectopic significantly. Ischemic ST-T changes were also detected during smoking. Spectral parameters of HRV analysis of smoker remained with normal limits but more important geometrical parameter -HRV index showed significant abnormality.

Keywords: *HRV Heart Rate Variability, TMT Treadmill Test*

INTRODUCTION

Cigarette smoking is associated with an increased cardiovascular risk. It is the strongest risk factor for the coronary artery disease. Cigarette smoking increases the relative risk of coronary artery disease by 2.8 to 3.1 fold in young (35 - 64 years) males and females respectively[1]. This increase is dose dependent, but a consumption of as few as 4 to 5 cigarette per day also significantly increases the risk. In addition to myocardial infarction, cigarette smoking is directly related to an increased risk of sudden death, aortic aneurysm, symptomatic peripheral vascular disease and ischemic stroke[2] It also increases the risk of hemorrhagic stroke[3]Smoking has acute unfavorable effects on the blood pressure and sympathetic tone and it reduces the myocardial oxygen supply. Additionally, smoking is associated with spontaneous platelet aggregation, increased monocyte adhesion to endothelial cells and adverse alterations in endothelial derived fibrinilytic and anti thrombotic factors, including tissue type plasminogen activator and tissue pathway factor inhibitor[4,5] Compared to nonsmokers, smokers had an increased incidence of coronary spasm and reduced threshold for ventricular arrhythmias[5, 6,7] Smoking also decreases exercise capacity and chronotopic competence [8, 9,10] Smoking is also associated with increased ventricular premature beats, and it is a strong risk factor for sudden cardiac death. There has been a growing recognition of the importance of the autonomic nervous system in cardiovascular disease. Various measures of heart rate variability (HRV) evaluate changes in beat-to-beat

interval durations using ambulatory electrocardiography (ECG). The objective of this study was to evaluate the potential effects of smoking on heart rate; ST segment changes, arrhythmias and cardiac autonomic function as measured by HRV using ambulatory ECG (Holter) monitoring.

MATERIAL AND METHOD

Current smokers among patients presenting with atypical chest pain to cardiology OPD in saraswathi institute of medical sciences were screened. After a baseline examination and investigations, all the patients underwent a treadmill exercise test. If test was negative or mildly positive, the patient was included in the study.

Inclusion Criteria

35 to 65 years of age who are current smokers with negative or mild/moderate positive TMT

Exclusion Criteria

1) Diagnosed case CAD
2) Unstable coronary syndromes
3) Strongly positive TMT
4) Unable to exercise
5) Baseline ECG changes like LBBB, ST depression >1 mm that preclude interpretation of TMT and Holter
6) Significant arrhythmias

The patients underwent a 24-hour Holter test, after taking an informed consent. Institute's ethical committee approves the study. The patients were hooked up to ambulatory ECG monitors by a trained technician. Electrocardiograms were recorded digitally..The signal was recorded continuously throughout the study period. The ECG digital recordings were processed using PC-based software (life card). Only normal-to-normal beat (NN) intervals were included in the analysis. The holters were analyzed for the minimum, maximum and average heart rate and arrhythmias. Heart rate and ischemic changes are specifically noted ten minutes prior to the smoking and after that every 10 minutes for next 60 minutes. Heart rate variability analysis was also done. Changes during chest pain or dyspnea or palpitation, syncope were also noted.HRV measures were calculated using time-domain measures. The measures included are presented in Table 1. The normal values of these measures are presented in Table 2.

Table 1: Definitions of HRV parameters

Parameter	Unit	Normal values
SDDN	ms	Standard deviation of all NN intervals
SDANN	ms	Standard deviation of average NN intervals during 5minute monitoring
RMSSD	ms	Root mean square value of square difference between neighboring NN intervals
SDNN index	ms	Mean standard deviation of neighboring all NN intervals from 5segment minute
SDSD ms	ms	Standard deviation of neighboring NN intervals difference
NN50	ms	Count of coupled neighboring NN differing more then 50ms in length
pNN50	%	NN 50 divided by total count of NN interval

Table 2: Normal values of HRV-time domain

Parameter	Unit	Normal value
SSDN	ms	141+_39
SDANN	ms	127+_35
RMSSD	ms	27+_12
HRV INDEX	ms	37+_15

We had analyzed HRV data of 10 age matched normal subjects, to compare it with smoker. After the completion of Holter, the patients were strongly counseled to quit smoking Results: We had enrolled a total of 31 patients. All were male with an average age of 49 yrs and approximately one fourth of them are bidi smokers. The baseline characteristics are presented in table 3.

Table 3: Baseline characteristics

	Mean ± SD	Range/ Percentage
Male	31	100%
AGE	49.8 ± 10.51	Range Pl
SYMPTOMS		
Angina	5	16
Dyspnea	5	16
Hypertension	5	16
Diabetes Mellitus	1	3
Dyslipidemia	2	6
Syncope	2	6
Presyncope	1	3
Smoking		
Quantity/ day	5.08 ± 2.79	Range Pl

Table 4. TMT Result

TMT results	Unit	Normal value
Exercise duration	7.84 ± 2.16	Range Pl
METS	8.67 ± 2.61	Range Pl
Stage	3.34 ± 0.84	Range Pl
Duke score	7.84 ± 2.16	Range Pl
Reason for termination	THR achieved	30(96%)
	Dyspnea	1(4%)

All the 31 patients underwent a 24 hour holter monitoring during which heart rate, ischemic changes, and HRV and arrhythmias are monitored. Average heart rate was 80/min and maximum and minimum heart rates were 57 and 119 per minute. An overview of Holter findings are presented in Table 4.

Table 5: Overview of Holter data

	Heart rate			Supraventricular ectopics			Ventricular ectopics			
	MinHR	maxHR	avgHR	sves	SVE %	SVT	VPC	nsvt	vt	forms
mean	57.52	119.32	80.25	110.16	0.115	0.548	356.32	0.0323	0.0323	3.98
sd	8.861	15.716	9.349	359.085	0.4029	1.963	1332.301	0.1796	0.1796	10.995

Heart rate changes

Heart rate was monitored 10 minutes before smoking and during smoking and during next 10 minutes, for up to 30 minutes. The results are presented in Table 5.

Table 6: changes in heart rate during and after smoking

Heart Rate	Mean	Std.deviation
10 min before smoking	83.80	13.689
During smoking	90.46	16.427
10 min after smoking	88.16	15.274
20 min after smoking	85.57	14.616
30 min after smoking	84.52	14.435

Pair wise comparisons of heart rate showed that heart rate rises within 10 minutes of smoking and it was significantly remain elevated for next 20 minutes and came to baseline after 30 minutes (Table 6).

Table 7. Increase in heart rate from the baseline

	Mean ↑ in HR	Std. error	P
During smoking	6.67	1.062	<0.0001
10 min after smk	4.36	0.748	<0.0001
20 min after smk	1.77	0.726	0.15
30 min after	0.72	0.721	0.315

Arrhythmias

Arrhythmias per hour were analyzed and were correlated with smoking episodes. Six (19.36 %) patients did not have even a single ectopic. We tried to correlate all these arrhythmic episodes with smoking. There was significant increase in arrhythmias in the hour during which cigarette smoked and in the next hour after that.

Smoking significantly increased the total no of supraventricular ectopic (SVEs) and ventricular premature complexes (VPCS), from a mean of 5.28 to 9.81 per hour during smoking to 11.29 during the next hour after smoking. When arrhythmias were analyzed individually, there was significant increase in SVEs after smoking (Table 7). But the increase in VPCs did not reach statistical significance.

Table 8: Mean number of SVEs

Prior to smoking	4.13
During hour of smoking	7.07
Next hour after smoking	6.88

P < 0.0001

Table 9: VPCS

Prior to smoking	1.15
During hour of smoking	2.74
Next hour after smoking	4.30

P=0.17

A run of non-sustained ventricular tachycardia (NSVT) is recorded in one patient and a run of ventricular tachycardia (VT) in one patient. None of these episodes were symptomatic. The NSVT developed within 20 minutes of smoking; this might be related to the smoking.

ST –T changes

Ischemic changes were monitored during holter recording and tried to correlate with smoking. Out of 31, three patients had significant ST and T changes during and after smoking. No other episode of ST/T changes was noted unrelated to smoking.

Table 10: ST-T changes

Patient No	Changes	Onset	duration
5	1 mm ST ↓ T ↓ in III,	10	28
6	2 mm ST ↓ T ↓ in III, aVF	12	120
19	1 mm ST ↓ T ↓ in II,III, aVF	8 min	50 min

Heart rate variability

HRV analysis done on time domain method

Table 11: HRV analysis in smoker and in control

Mean	SDNN	RMSSD	HRV index	SDANN
smoker	116.65±41.2	36.054±16.90	15.23±5.26	109.54±42.54
control	126.98±23.29	34.911±19.93	19.38±3.56	116.03±17.70
P value	0.182	0.671	0.015	0.272

HRV analysis was within normal range, except HRV index.

When results in smoker were compared with normal subjects, HRV index was significantly less (Give numbers with p value).

DISCUSSION

Smoking is an important risk factor for the coronary artery disease. Smoking also increases the thrombotic risk. [14,] Smokers are prone to coronary vasospasm. Many smokers were presented with atypical chest pain, in which TMT may be normal or mild positive. We had studied particularly this group of patients with 24 hours ECG monitoring. Our data showed that that smoker is at increased risk of arrhythmias. Smoking increased supraventricular arrhythmias significantly. Smoking also increased ventricular arrhythmias, but this increase did not reached statistical significance. Reason might be due to very few patients had ventricular arrhythmias in this study.

Table 12: percentage of patients having SVE and VPCs

	Prior to smoking	During hour of smoking	Next hour after smoking
SVE	10.2%	20.4%	25.3%
VPC	5.3%	7.6%	5.7%

One of our patient developed NSVT within 20 minutes of smoking. There is difficult to define cause and effect relationship, as we had observed only one episode of NSVT that occurred in close association with smoking. One patient developed short run of VT, but it was not immediately associated with smoking.

Significant ST-T changed were observed in three of our patients, each episode started within 20 minutes of smoking and lasted for half an hour to two hour. One patient had dynamic ST-T changes during each time he had smoked. None of these three patients developed chest pain, during ischemic episodes. Ischemic episodes during smoking frequently remained silent.[16,]Our heart rate analysis in smoker showed that, heart rate tend to raise within 10 minutes of smoking and remained elevated for up to 20 minutes and came to baseline after 30 minutes. From this we can ascertain that, effect of smoking on sympathetic nervous system last for 20 to 30 minutes.

HRV analysis

Basic definitions and normal values were shown in table 1 and table 2. [17,18,19] As shown in table 9, SDNN, SDANN, RMSSD were within normal range, but HRV index was less. HRV index was more sensitive and specific method for HRV, as it uses geometrical method.

Importance of different HRV parameters[16]

- SDNN and HRV index- expressing the overall HRV.
- SDANN- a marker of spectral components with a long period.
- RMSSD-a marker of components with a short period.

These methods do not substitute each other, but supplant each other mutually.

Autonomic nervous system may play an important role in cardiovascular disease. HRV is useful in noninvasive quantification of autonomic nervous system [18] Large epidemiologic studies have also linked an increased risk of coronary heart disease, death, and cardiac mortality with decreased HRV in general populations [19-21]. Although it is clear that low HRV has a negative prognostic impact, it is important to point out that causality and mechanisms have not been established. A study of acute tobacco smoke exposure to small numbers of volunteers is associated with significant HRV changes [21].

CONCLUSIONS

Smoking increases heart rate significantly, which remains elevated for 20 minutes and touched baseline at 30 minutes. Smoking increased combined supraventricular and ventricular arrhythmias significantly. Ischemic ST-T changes were also detected during smoking and these changes lasted for half to

two hours. Spectral parameters of HRV analysis of smoker remained wiith normal limits but more important geometrical parameter –HRV index showed significant abnormality.

ACKNOWLEDGEMENT

I have the proud privilege and honour of having worked under excellence supervision of Dr.K Prasad ,professor & HOD medicine SIMS, Hapur.

Conflict of Interest: None

Funding: None

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DOI Number: 10.5958/j.2320-608X.1.2.017

Disruption of Menstrual Cyclicity in Underweight Female Medical Students

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ABSTRACT

Menstrual cycle is normal physiological phenomenon in females which is also a marker of reproductive functions. It is influenced by number of factors but body fat has observable impact on it. Women with low body mass index (BMI) have irregular and long cycles, infertility problems, and often have a delayed age of menarche. In this context the present study was carried out to evaluate any possible association between body fat and menstrual cycle abnormalities. Study group comprises of 260 healthy female medical students of age 18 to 25yrs. Menstrual history was obtained, its cyclicity was recorded as short (<25days), long (>35days), and normal (26-34 days) cycles. BMI was calculated and subjects were divided into underweight (BMI <18.5) and normal weight (BMI between 18.5 to 24.9). On analysis prevalence of cycle irregularities was more (54%) in underweight girls which is statistically significant (chi square value 53.09, p= <0.0001). A significant (p=<0.001) difference between cycle duration and BMI was observed for longer cycles. However no significant relationship (p=>0.05) was observed for age of menarche (13.58±0.97 vs 13.67 ± 0.87) and BMI.

Our finding suggests a significant positive association of menstrual cyclicity with body mass index (BMI). This may attributed to low sex hormones synthesis and storage in the body fat layers of low BMI girls.

Keywords: *Body Fat, BMI, Menstrual Cycle, Menstrual Cycle Irregularities*

INTRODUCTION

Menstrual cyclicity is one of the physiological challenges in a normal individual, and is also considered as a non invasive clinical marker of reproductive functions. Number of host and environmental factors influence menstrual patterns. Its abnormalities may be associated with all kind of causes such as strenuous physical exercise, psychosocial stress, low body fat, endocrine disturbances, and lifestyle factors such as increase fat intake, smoking etc. All these factors may perturb menstruation and affect woman's reproductive health culminating into risk of infertility[1]. It was reported in the studies[2,3,4,5] in the past that body fat plays a significant role in reproduction, and both the extremes of the weight distribution have deleterious effects on menstrual cyclicity and fertility.

Studies have shown repeatedly that women, who have a low body mass index (BMI), have a difficult time starting a family[6]. This low BMI often translates into fertility problems, approximately 12% of infertility cases are due to being underweight or having a low BMI [6,7,8.].

On the contrary a high BMI have also been demonstrated to reduce fertility substantially producing menstrual abnormalities including cycles longer than 36 days, irregular cycles, and virile hair growth with facial hair etc.[9,10]. Reduction in weight has been found to improve outcomes significantly for obese subjects[11].

To add further, various studies[6,7,8] have reported that reduced body fat and weight loss as seen in anorexia nervosa, excessive athletic training, poor diet, etc are accompanied by, menstrual cycle disorders and problems with conception and their age of menarche may also gets affected. This may be attributed to the reduction of sex-specific body fat[6,7].

Because of various reasons the population of underweight girls in India is substantial, and as mentioned above these girls are prone for cycle irregularities, infertility problems etc. With this background the present study was carried out to evaluate any possible association between abnormalities of menstrual cyclicity in underweight (low BMI) normal weight (normal BMI) girls.

MATERIAL AND METHOD

The study group comprised of 260 healthy female medical students of age 18 to 25 years. After obtaining ethical clearance from Institutional Ethical Committee and explaining the purpose of the study in detail, informed written consent was obtained from all the participants of the study. A proforma was given to the participants to obtain menstrual history, age at menarche, duration of the menstrual cycle, and duration of longest and shortest cycles.

BMI was calculated with the formula, BMI = Weight (Kgs)/Height (meters)^2. On the basis of WHO Classification of BMI[12], the subjects were divided into two groups, underweight (BMI <18.5) and normal weight (BMI between 18.5 to 24.9). In order to get normal reference population obese (BMI ≥25), medically unfit girls and those using hormonal medications, were eliminated from the study (n=12).

Menstrual cyclicity was noted for three consecutive cycles and according to the duration they were classified into short (<25days), long (>35days), and normal (26-34 days) cycles. Cycles were considered as irregular if there is ≥15 days difference between the longest and shortest cycle in the past 12 months[13].

Body weight and height were measured to the nearest 0.1 kg and 0.1 cm, respectively as per standard protocol.

Statistical analysis

Data collected and stored in Microsoft Excel, mean standard deviation of all the variables were calculated. T-test was performed in both the groups. Chi-square test was applied to compare cyclical irregularity/ regularity amongst the groups.

OBSERVATIONS

Table 1: Values of anthropometric parameters in underweight & overweight girls

Parameter	Underweight Girls (Mean ± SD)	Normal weight Girls(Mean ± SD)	Test of Significance	
			t- value	p-value
Age (yrs)	18.4±0.85	18.16 ± 0.88	1.17	>0.05
Weight (Kgs)	41.08±4.48	51.99 ± 5.49	14.139	<.0001
Height (cms)	156.58±5.36	157.68 ± 6.25	1.24	> 0.05
BMI (kg/m^2)	16.73±13.58	20.90 ± 1.58	4.25	<.0001
Age of menarche	13.58±0.97	13.67 ± 0.87	0.68	> 0.05
Number (n)	61(23.4%)	199(76.5%)		

Table 2: Comparison of Menstrual cyclicity in between the groups:

Menstrual cyclicity	Number of cases (n)		Test of significance		
	Under Weight Girls (n)	Normal Weight Girls (n)	Chi-square value	df	p-value
Regular	28 (46)	177 (89)	53.09	01	<0.0001
Irregular	33 (54)	22 (11)			
Total	61	199			

Figures in the parenthesis indicate percentage.

Table 3. Comparison of Menstrual cycle duration in between the groups

Cycle duration(Days)	Girls		Test of significance	
	Under weight (Mean ± SD)	Normal Weight (Mean ± SD)	t-value	p-value
Longest cycle	42.89 ± 5.67	35.42 ± 5.67	3.39	<0.001
Shortest cycle	24.36 ± 6.2	20.95 ± 5.4	1.85	>0.05

RESULTS

Table 1 gives the basic anthropometric characteristics of the underweight females and the control group of normal females.

The mean values of the two groups for Body weight are respectively (41.08±4.48 vs. 51.99 ± 5.49kg, p = 0.00001), Body height (156.58±5.36 vs. 157.68 ± 6.25cm, p = >0.05) and BMI (16.73±13.58 vs. 20.90 ± 1.58 kg/ m^2, p = 0.00001). Body weight and BMI were significantly lower in underweight girls than in the control group. However, no significant relationship (p=>0.05) was observed for age of menarche (13.58±0.97 vs 13.67 ± 0.87).

Analysis of menstrual cyclicity is presented in Table-2. After applying the criteria for defining regular and irregular cycles, it was found that Cycle irregularities were present in both the groups, but its prevalence was more (54%) in underweight girls as compared to normal weight (11%). This difference is statistically highly significant (chi square value 53.09, p= <0.0001).

Cycle durations in underweight and normal weight girls are given in Table-3. Mean of longest cycle duration in underweight is 42.89 ± 5.67 days as compared to 35.42 ± 5.67 days of normal group, similarly shortest cycle duration in the two groups are 24.36 ± 6.2 days and 20.95 ± 5.4 days respectively. On comparison a significant (p=<0.001) difference between cycle duration and BMI was observed for longer cycles but not for short cycles (p=>0.05).

DISCUSSION

Data for this project was collected and analyzed from 260 healthy female medical students medical students during the year 2012-13.

The study subjects were divided into two groups on the basis of their BMI. As per WHO Classification of BMI[12] 61(23.4%) girls were found to be underweight, while 199 (76.5%) girls were in the normal range of BMI, serving as control. On comparing these groups, a significant difference was noted in body weight and BMI (p=<0.0001) which is in accordance to the findings of other studies[3.5.6,14]

Mean age of menarche in present study is 13.58±0.97 & 13.67 ± 0.87 years respectively in the two groups, no significant relationship (p=>0.05) was found between age of menarche and BMI(Table-1). This is in contrast to findings obtained from the other studies[1,14] carried out on ballet dancers and athlete girls in which delayed appearance of menarche ,i.e at the age 14 to 16 yrs was observed.

Prevalence of cycle irregularities in the present study is 21.15% which is in accordance with reported prevalence of 3.4 to 66 % from different studies[10,11] . On further analysis it was found that prevalence of irregular cycles is more in underweight girls as compared to normal weight (Table-2),this difference was statistically highly significant (chi-squarevalue-53.09 & p=0.0001) .Similar were the findings of the other studies [6,7,8]. However higher prevalence of cycle irregularities was observed on both the extremes of weight distributin[12,14,18].

On comparing underweight and normal weight girls for mean durations of longest and shortest cycles (Table-3), a significant (p=<0.001) difference between cycle duration and BMI was observed for longer cycles, however no such relationship was found for short cycles (p=>0.05). These findings are in accordance with the findings of other studies[12,14,18] in which longer cycle length was noted at the lowest levels of BMI and body fat mass.

The association of cycle irregularities in girls having less body fat may be due to low hormones synthesis and storage in the body's fat layers. Since adipose tissue converts androgens to oestrogen by aromatization thus acts as a significant extragonadal source of oestrogen. Thus women having a low body fat produce a reduced amount of estrogen which can lead to an abnormal menstrual cycle pattern and amenorrhea[6,7,8]

This view is further supported by the findings of the studies[4] carried on the ballet dancers, known for having less body fat and low BMI, in which a delayed menarche and menstrual cycles of longer duration were observed. The association between body fat and cycle abnormalities has been further strengthen by the discovery of the adipose tissue hormone, Leptin. It further provided a possible connection between fat stores and the reproductive axis, since in amenorrheic athletes a typical diurnal pattern of leptin secretion is absent[19,20]

Despite having a small sample size as the limitation of the study, our findings suggests a significant positive association of menstrual cyclicity with body mass index (BMI).In the present study no relation between low BMI and delayed age of menarche was observed. It is the body fat and BMI which has most observable impacts on menstrual patterns and has long term

effects on the reproductive health of girls. In our country the number of underweight girls is substantial, similarly the number of overweight and obese population is also on the rise, therefore, our population is more prone for the risk of menstrual abnormalities, reproductive problems, and infertility. Since the risk of irregular cycles are seen on both the extremes of weight distribution, [6,15,16,17]counseling and life style modification in the females should be instituted at an early age to reduce the magnitude of the menace of reproductive ill health and infertility.

ACKNOWLEDGEMENT

Authors are thankful to the chairman Sri Aurobindo Medical College & PG Institute for providing facilities for the study and also to the students who participated in the study.

Conflict of Interest: The authors do not have any competing interests.

Source of Funding: The study was not supported financially from any source or agency.

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DOI Number: 10.5958/j.2320-608X.1.2.018

Study of Evoked Potentials in Central Demyelinating Disorders Versus Nondemyelinating Disorders

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ABSTRACT

We studied brainstem auditory, somatosensory and visual evoked potentials in central demyelinating disorders, non demyelinating disorders and control. BAEP studies showed prolonged inter peak latency in demyelinating diseases when compared to non demyelinating diseases. Among those with discernible SSEP waves (N20, P37), no statistically significant differences were seen between the three groups for both latencies as well as amplitudes of waves. The P 100 wave latency in VEP in demyelinating diseases was more prolonged compared to non demyelinating diseases. The findings showed abnormal evoked potentials in both the groups and they help in early and preclinical diagnosis of central nervous system disorders.

Keywords: *Visual Evoked Potential, SSEP, Somatosensory Evoked Potential, BAEP-Brainstem Evoked Potential, IPL, Inter Peak Latency*

INTRODUCTION

Evoked potentials (EPs) are important tools to study nerve signal conduction in central nervous system. They are summated surface electrical potentials generated and recordable on the scalp overlying primary receptive areas of the brain corresponding to visual, auditory and somatosensory systems in the occipital, temporal and parietal cortices[1] The morphology, latency and amplitude of these evoked potentials are fairly characteristic for normal persons and alter in various disease states of the central nervous system.[2]

In central demyelinating disorders there is loss of myelin in the neuron leading to decreased conduction velocity causing increased latency and decreased amplitude in nerve conduction studies . In non-demyelinating disorders, more morphological and amplitude changes are noted .[3]

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Brainstem auditory evoked potentials (BAEP) are recorded from the ear and vertex in response to a brief auditory stimulation. Wave I is generated from the eighth cranial nerve, wave II from the cochlear nucleus, wave III from the superior olivary nucleus, wave IV from the lateral leminiscus and wave V from the inferior colliculus(Fig-1).BAEP is useful in diagnosing cerebellopontine angle tumour, multiple sclerosis, brain stem stroke etc.[4]

The Visual evoked potentials are recorded from scalp in response to visual stimuli. P_{100}, a waveform of VEP is generated in area 19. N_{75} results from foveal stimulation and originates in area 17(Fig-2). N_{145} reflects the activities of area 18.The VEP abnormalities are not specific assist in clinical diagnosis of demyelinating diseases.[5]

Somatosensory evoked potentials (SSEP) are generated by sensory fibers in response to a sensory stimulus applied to them anywhere in their course. In the median nerve SSEP, N_{20} is generated by Ventro-postero lateral nucleus of thalamus and the primary sensory cortex (Fig-3). In SEPs recorded from posterior tibial nerve, the important positive wave form is P_{37}

generated by the primary sensory cortex (Fig-4). SSEPs correlate well with impaired joint position and vibration sensation.[6] In general, the latency abnormalities are common in demyelinating diseases and amplitude abnormalities are common in ischemic lesions. Combination of latency and amplitude abnormalities are seen in compressive lesion.

Some important demyelinating diseases are multiple sclerosis ,post-infectious encephalomyelitis, progressive multifocal leukoencephalopathy, toxic and nutritional disorders.[7] Non-demyelinating disorders include Alzheimer's disease, Parkinson's disease, Spinocerebellar ataxia, Motor neuron disease, cerebrovascular accident, head injury , spinal cord injuries and neuropathies.

MATERIALS AND METHOD

The present study was conducted in the department of Physiology JIPMER after obtaining permission from the ethical committee of the Institute. All evoked potential studies were recorded in electrophysiology laboratory using NIHON KOHDEN-NEUROPACK M. EP/ NCV/ EMG machine. EP tests were performed in 17 demyelinating patient and 10 patients of non demyelinating diseases and 8 controls after obtaining informed consent. The exclusion criteria were severe malnutrition,B_{12} and folate deficiency, thyroid diseases and children less than 12 years. All evoked potentials are recorded in 2 trials for consistency and reproducibility. The techniques were followed as described by U K Misra *et al* (3) and Keith H. Chiappa(1).

Silver chloride disc electrodes were used along with conducting jelly for recordings. BERA active recording electrodes were placed on ipsilateral ear (A_1) and the references were placed on vertex (c_z). The ground electrode is placed on the frontal zero (F_z). The electrode impedance was ensured to be below 5k ohms. The amplifier setting was 20 microvolt's sensitivity; 10 ms sweep speed and the filter settings 30 Hz – 3 kHz. BAEP was produced by a brief click stimulus of 0.1 ms duration square pulse. The clicks are delivered to the ipsilateral ear where as the contralateral ear was masked with white noise of 30db through the head phones. Testing the sensory threshold level and 60-70db higher than sensory threshold level was delivered optimized the click intensity, 2048 averaging were taken for the analysis of waveforms. The latency of wave I-V and inter peak latency I-III, I-V and III-V were measured and analyzed. BAEP amplitude was not recorded, since the equipment used did not have the facility.

For VEP, the recording electrode was placed at Oz as per 10-20 international system of EEG electrode placement. The reference was placed at $F_P Z$. Ground electrode was placed at the vertex at C_Z. Sensitivity was set at 20 microvolt's per division and the sweep speed 200ms with filter setting of 1-3 Hz low cut and 100-300 Hz with high cut. The stimulus was given 1 per second pattern reversal for about 128 averaging. When one eye was stimulated the other eye was kept closed with flap. The check size of 16 is used for stimulation. The N_{75} and P_{100} latencies and amplitudes were measured and analyzed.

The SSEP study was carried out with the patient supine and with proper head support to relax the neck muscles. The impedance was kept below 5kilo ohm. The recording electrode was kept at C_3' for upper SSEP and C_Z for lower SSEP. The reference electrode was placed at F_Z and ground electrode was placed on hand and leg for upper and lower SSEP respectively.50 microvolt sensitivity, 50 ms sweep speed and 20Hz to 3KHz were used for upper SSEP and 50 micro volt sensitivity, sweep speed 20Hz to 3KHz and filter setting were used for lower SSEP.

For upper SSEP recording, the median nerve was stimulated near wrist with square pulse for duration of 100 microseconds, and at a frequency of 5Hz. The strength is decided by the threshold of the patient. 1024 averaging were taken for analysis. N_{20} latency and amplitude was measured and compared .For lower SSEP recording, the tibial nerve was stimulated at ankle with a square pulse of 100 microseconds duration and at a frequency of 5Hz. Like upper SSEP the stimulus intensity was decided by the patient threshold and 1024 averaging was taken for analysis. P_{37} latency and amplitude was measured and analyzed between the groups.

Statistical Analysis

Average value for the BAEP latency and the latencies, amplitudes of VEP, SSEP were expressed as MEAN ± SD. Comparison of data was done by one way analysis of variance (ANOVA) by Tukey method. The probability values of less than 5% were considered to be statistically significant. All calculations were performed using the SPSS version 13.0 for windows.

RESULTS

Table 1: Comparison of Left BAEP latency parameters in controls, demyelination and non-demyelination disorder patients. The data are expressed in MEAN ± SD.

Parameters studied	Controls (n-8)	Demyelination (n-17)	Non-Demyelination (n-10)
1.Wave-I	1.55 ± 0.04	1.51 ± 0.17	1.57 ± 0.11
2. Wave-II	2.61 ± 0.10	2.55 ± 0.15	2.54 ± 0.11
3. Wave-III	3.54 ± 0.08	3.66 ± 0.18	3.61 ± 0.08
4. Wave-IV	4.66 ± 0.14	4.77 ± 0.17	4.79 ± 0.12
5. Wave-V	5.37 ± 0.11	5.54 ± 0.22	5.39 ± 0.17
6. IPL I-III	2.11 ± 0.06	2.12 ± 0.14+* (p value 0.04)	2.00 ± 0.09
7.IPL III-V	1.95 ± 0.10	1.91 ± 0.15	1.77 ± 0.21
8.IPL I-V	4.07 ± 0.10	4.04 ± 0.30	3.79 ± 0.27

*P value less than 0.05 is statistically significant.

+ Comparison between Demyelination and Non-Demyelination groups.

Table 2: Comparison of Right BAEP latency parameters in controls, demyelination and non-demyelination disorder patients. The data are expressed in MEAN ± SD.

Parameters studied	Controls (n-8)	Demyelination (n-17)	Non-Demyelination (n-10)
1.Wave-I	1.59 ± 0.06	1.53 ± 0.19	1.59 ± 0.18
2. Wave-II	2.60 ± 0.09	2.53 ± 0.17	2.59 ± 0.24
3. Wave-III	3.59 ± 0.10	3.69 ± 0.20	3.62 ± 0.16
4. Wave-IV	4.58 ± 0.14	4.74 ± 0.19	4.57 ± 0.28
5. Wave-V	4.92 ± 1.08$* (p = 0.05)	5.48 ± 0.28	5.42 ± 0.18
6. IPL I-III	2.10 ± 0.06	2.17 ± 0.12	2.10 ± 0.15
7.IPL III-V	2.03 ± 0.07	1.83 ± 0.25	1.79 ± 0.16
8.IPL I-V	4.07 ± 0.15	3.97 ± 0.28 +* (p = 0.03)	3.70 ± 0.26

*P value less than 0.05 is statistically significant.

$ Comparison between controls and Demyelination groups.

+ Comparison between Demyelination and Non-Demyelination groups

Table 3: Comparison of SSEP parameters in controls, demyelination and non-demyelination disorder patients. The data are expressed in MEAN ± SD.

Parameters studied		Controls (n-8)	Demyelination	Non-Demyelination
1.	Right N_{20} latency	21.0 ± 0.82	21.2 ± 4.12(n-14)	18.8 ± 1.96(n-5)
2.	Left N_{20} latency	21.2 ± 0.66	20.07 ± 3.51(n-10)	18.7 ± 2.67(n-5)
3.	Right P_{37} latency	37.7 ± 0.30	39.04 ± 3.60(n-10)	37.3 ± 3.5(n-3)
4.	Left P_{37} latency	38.0 ± 0.83	37.9 ± 3.30(n-9)	38.23 ± 3.3(n-3)
5.	Right N_{20} amplitude	1.61 ± 0.60	1.4 ± 1.13(n-14)	1.1 ± 0.64(n-5)
6.	Left N_{20} amplitude	1.88 ± 0.50	2.1 ± 1.7(n-10)	1.22 ± 1.30(n-5)
7.	Right P_{37} amplitude	1.72 ± 0.44	1.58 ± 1.25(n-6)	0.9 ± 0.62(n-3)
8.	Left P_{37} amplitude	1.9 ± 0.43	1.26 ± 1.53(n-5)	1.133 ± 0.923(n-3)

*P value less than 0.05 is statistically significant.

Table 4: Comparison of VEP parameters in controls, demyelination and non-demyelination disorder patients. The data are expressed in MEAN ± SD.

Parameters studied		Controls (n-8)	Demyelination	Non-Demyelination
1.	RightN_{75} latency	76.5 ± 1.34	80.88 ± 18.7(n-12)	79.12 ± 3.86(n-8)
2.	Left N_{75} latency	76.7 ± 1.33	85.1 ± 11.9(n-11)	80.7 ± 5.6(n-10)
3.	Right P_{100} latency	103 ± 1.31	113.03 ± 13.99(n-14)	107.43 ± 7.64(n-8)
4.	Left P_{100} latency	104 ± 0.94	111.73 ± 15.97(n-12)	107.51 ± 6.05(n-10)
5.	Right N_{75} -P_{100} amplitude	4.9 ± 0.25	5.104 ± 2.464(n-13)	3.2 ± 1.62(n-8)
6.	Left N_{75} -P_{100} amplitude	4.96 ± 0.55	4.07 ± 2.17(n-12)	3.13 ± 1.45(n-10)

*P value less than 0.05 is statistically significants

BAEP

In the present study, I-III IPL was significantly higher in demyelination group (2.12 ± 0.14) as compared to non-demyelination group (2.00 ± 0.09) (p=0.04) on the left side.(Table 1). On the rightside I-V IPL was significantly higher in demyelination group (3.97 ± 0.28) as compared to non-demyelination group (3.70 ± 0.26) (p=0.03).(Table 2). Among individual waves only wave V latency was significantly prolonged in demyelination group (5.48 ± 0.08) as compared to control group (4.92 ± 1.08) (p=0.05). Other individual wave latencies and IPL were not statistically significantly different among the three groups. (Tables 1,2)

SSEP

Discernible waveforms for upper SSEP (N_{20}) were obtained only for 14(82%) on right side and 10 (59%) on left side in demyelination group. In lower limb P_{37} was obtained only for 10 (59%) on both sides for the same group. For the non-demyelinating group discernible N_{20} (Upper SSEP) was seen only in 5 (50%) on both sides, whereas P_{37} (lower SSEP) was seen in 3 (30%) on both sides for the same group.(Fig 5). Among those in whom discernible SSEP waves ($N_{20,}$ P_{37}) were obtained, no statistically significant differences were seen between the three groups for both latencies as well as amplitudes of waves.(Table 3).

VEP

In VEP discernible P_{100} waveform was obtained in 13 (69%) in left and 14 (82%) on right side in the demyelinating group. In non-demyelinating group 8 (80%) on right and all cases in left side had discernible P100 waves.(Fig 6). The mean latency for VEP P_{100} on left side was 111.73 ± 15.97 for demyelination group of patients with discernible VEP, where as for the 8 controls mean VEP latency was 104 ± 0.94. Eight of non-demyelination group had mean VEP latency of 107.51 ± 6.05. This trend towards higher latency for demyelination group is along the expected line, though it did not reach the level of significance in this small group of patients. On the right side also mean values were 113.03 ± 13.99, 107.3 ± 7.64, 103 ± 1.31 for the demyelination, non-demyelination and control groups respectively. A statistically significant difference could not be demonstrated here as well. (Table 4)

Since there is little literature on the amplitude of the evoked potentials on BAEP, SSEP and VEP, our study did not focus on this part of evoked potentials. However the amplitude values were all documented, no consistent trends were obtained for amplitudes of evoked potentials between the demyelinating, non-demyelinating and control groups.

DISCUSSION

The BAEP study revealed that abnormal prolongation of inter peak latency and Wave V latency were frequent in demyelinating diseases compared to non- demyelinating brain diseases and normal controls. Chiappa *et al* also reported that most frequent abnormality in demyelination disorder was increase in III- V IPL[8]. Selectively focusing on these parameters may be more effective in terms of time spent on evoked potentials tests for BAEP. In general BAEP abnormalities in classical demyelinating diseases like MS is reported to be about to 20-50%.[9] In a study from SGPGI, U K Misra has reported that usually observed BAEP abnormalities in Multiple sclerosis were amplitude reduction and absence of wave V, prolongation of III- V IPL, prolongation of I- V IPL, reduction of V/I ratio and, absence of wave III.[10]

On SSEP with stimulation from upper limb and lower limbs, we could not find any significant difference between the demyelinating diseases and other two groups. This is most likely because our study confined to cerebral demyelinating cases and no spinal

demyelinating cases such as spinal MS were included as cases. No spinal cord diseases were used in non-demyelination disease group as well. Previous studies have also shown poor yield in cerebral demyelinating diseases SSEP is more likely to be useful in the diagnosis of such diseases like cerebrovascular diseases.[11] In general SSEP abnormalities in classical demyelinating disease like Multiple Sclerosis is reported to be in around 50-70%.[9]

As far as VEP is concerned, in our small group of patients, we clearly observed a trend towards a higher latency for VEPs, though because of small number of cases and controls this trend did not reach levels of significance. Further study with larger number of patients and controls may illustrate this better. Also we had used only one type of stimulus that is pattern shift. Use of more sophisticated methods of stimulation such as colored checks, field stimuli, contrast shift etc. might increase the diagnostic yield. In general VEP abnormalities in classical demyelinating disease like in Multiple Sclerosis is reported to be in around 75-97%.[9]

In our series of non- demyelinating cases there were only 5 cases of Parkinsonism who were under L Dopa therapy and we could not taper these drugs before recording evoked potentials. This could be one reason why we could not observe any significant lowering of amplitude of VEP in these patients. In non-demyelinating diseases, especially VEP abnormalities have been documented in the form of low amplitude, [12] which is thought be due to low dopaminergic activity in Parkinsonism. Some people suggested evoked potentials use, as a preclinical diagnostic test in Parkinsonism. After L Dopa therapy, improvement in amplitude of VEP has been also observed by some workers. It should be helpful in monitoring responses in Parkinsonism.

CONCLUSION

Evoked potentials of the central nervous system such as BAEP, SSEP and VEP are interesting research tools which help in clinical diagnosis of demyelinating diseases such as multiple sclerosis. In demyelinating diseases, latencies are the most useful parameters and abnormalities depend on the site, severity and size of the lesion. In non- demyelinatuing diseases, latency may be less important, where as amplitude may be helpful. More sophisticated forms of stimulation and more sensitive equipments will be helpful in increasing the utility of this tool in neurological investigations.

ACKNOWLEDGEMENT

Authors are thankful to JIPMER institute, all the subjects and all the staffs of the department of Physiology for their contribution and support in the completion of this work.

Conflict of Interest: None

Source of Funding: Institutional

Ethical Clearance: Permission was taken from institutional research and ethical committee.

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DOI Number: 10.5958/j.2320-608X.1.2.019

QTc Interval: Gender Difference and effect of Menstrual Cycle

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ABSTRACT

Context: Women are more predisposed to ventricular arrhythmias than men. The occurrence of Torsades-de-pointes is increased with the degree of QT interval prolongation, and female gender is a known risk factor for its occurrence. Drug induced QT prolongation are greater in women than in men. Sex hormones have potential role on the mechanisms involved in the cardiac repolarization.

Aims: To note gender difference and menstrual cycle effect on cardiac electrophysiology.

Settings and Design: Case-control study

Method and Material: Electrocardiogram (ECG) was recorded in randomly selected healthy 51 men and 51 women; aged between 17-20 yrs. ECG in women was taken during menstrual, proliferative and luteal phases of menstrual cycle. Basal body temperature throughout menstrual cycle was recorded in women to confirm that recordings were done in respective 3 phases of menstrual cycle. RR interval, QT interval and QTc interval were noted from Lead II recording of the subjects.

Statistical analysis used: Student's unpaired T test, Repeated measures ANOVA

Results: Study group was age matched. There was statistically highly significant gender difference during menstrual phase ($p<0.001$) and proliferative phase ($p<0.001$), and significant difference during secretory phase ($p=0.008$). Difference in mean QTc interval in women during different phases of menstrual cycle is statistically not significant ($p=0.08$).

Conclusions: There is gender difference in QTc interval of cardiac repolarization. There is no statistically significant difference in QTc interval in women during different phases of menstrual cycle. This difference is higher during menstrual phase in women.

Keywords: *QTc Interval, Gender Difference, Menstrual Cycle, Cardiac Repolarization, ECG*

INTRODUCTION

"Male and female equality is still far from goal". [1] Many differences are present between males and females in the presentation and clinical course of cardiac arrhythmias. Women are predisposed to ventricular arrhythmias than men. Female gender is a known risk factor for Torsades de pointes, a potentially lethal ventricular arrhythmia. The occurrence of this arrhythmia is increased by various factors such as the degree of QT interval prolongation. Many drugs that prolong the QT interval duration i.e. antiarrhythmics, macrolide antibiotics, quinolone group of antibiotics, antipsychotics are associated with a higher risk of torsades de pointes.[2,3,4,5,6,7] Various studies have shown the incidence of inherited and drug induced QT prolongation are greater in women than in men. [8]

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The predisposition in women is explained by gender differences in baseline cardiac repolarization. The mechanisms responsible are unclear. Bazett was the first to report in 1920 that baseline rate corrected QT interval was 15-20 ms longer in women than in men. [9] Such difference is influenced by age in men and women. [10] Furthermore, QRS amplitude and duration are greater in men, due to greater cardiac mass and thicker left ventricular walls.[11]

Experimental data in animals have explained the potential role of sex hormones on the mechanisms involved in the duration of cardiac repolarization. [12] Difference in QT responses to drug during various phases of menstrual cycle in women has been reported.[13]

This study aimed to note the gender difference and the effect of menstrual cycle on cardiac repolarization by noting the rate corrected QT (QTc) interval in young individuals. The hypothesis tested was "there is gender difference and effect of menstrual cycle on QTc interval".

Aims and Objectives:

1. Recording of ECG in healthy men and healthy women in 3 phases of menstrual cycle, aged between 17-20yr.
2. To note whether there is gender difference in cardiac electrophysiology.
3. To note the effect of menstrual cycle on cardiac electrophysiology.

MATERIALS AND METHOD

Subjects selection

The subjects selected were young healthy men and women aged between 17-20yr. They were randomly selected from the population in Davangere. Following are the inclusion and exclusion criteria.

Inclusion criteria

1. Healthy men and women aged between 17-20yr.
2. Women selected should have regular menstrual cycles ranging 26-34 days.
3. Who have given written consent for the study

Exclusion criteria

1. Family history of congenital cardiac diseases.
2. History of chest pain, breathlessness, fainting or palpitation.
3. Women with irregular menstrual cycles.
4. History of drug intake affecting the menstrual cycle.
5. History of medications like antibiotics, antipsychotics or antiarrhythmics.
6. History of alcohol intake, smoking or tobacco intake.
7. Pregnancy.

The instrument

Standard 12 Lead Computerized ECG machine was used.

Initial Assessment

51 men and 51 women were thus selected based on the above criteria. Their socio-demographic data was collected. They underwent general physical and systemic examination to rule out any disease. Written consent of those subjects were collected. After explaining the purpose and methodology of this study the subjects were made to rest for 10min. Heart rate and BP at rest were noted. ECG of the subjects was recorded in the Dept. of Physiology using standard 12 lead computerized ECG machine in supine position. One recording of ECG was taken in men. Three recordings of ECG were taken in women during various phases of menstrual cycle.

1st recording in menstrual phase (2nd day)

2nd recording in proliferative phase (9 days after 1st sample)

3rd recording in luteal phase (11 days after 2nd sample)

To confirm the recordings to fall in respective various phases of menstrual cycle, women were asked to record their basal body temperature and chart on a sheet as peek will correspond to ovulation. The chart was scrutinized by the observer to confirm the recordings to be in different phases of menstrual cycle.

After recording ECGs and confirming the tracings to be normal, following parameters were considered from Lead II recording by the same observer manually of all the participants of all the 3 phases of menstrual cycle.

i) RR interval

ii) QT interval

iii) Rate corrected QT (QTc) interval, calculated using Bazett's formula.

The data was tabulated and appropriate statistical methods were applied for analysis.

RESULTS

The present study is a case-control study design comparing QTc interval in men and women. In women, QTc interval noted in the three phases of menstrual cycle were also compared. The age group of the subjects selected was 18-22yr. 51 men and 51 women were selected as subjects satisfying all inclusion criteria. ECG of the subjects was recorded and QT interval and RR interval was noted. Using Bazett's formula QTc interval was calculated. This parameter was compared between men and women and also during three phases of menstrual cycle in women.

The data was subject to appropriate statistical treatment.

Study design- Case-control study comparing QTc interval between men and women and also during three phases of menstrual cycle in women.

Table 1: Age distribution of subjects selected for the study

Age (Years)	Women	Men
17	8	9
18	30	28
19	13	10
20	0	4

Table 2: Comparison of mean QTc interval between men and women (during 3 phases of menstrual cycle)

Women	Mean (in sec)	SD	95% C.I	Mean Difference	P* Value, sig
1st recording	0.408	0.038	0.397-0.419	0.024	<0.001 HS
2nd recording	0.402	0.024	0.395-0.408	0.018	<0.001 HS
3rd recording	0.398	0.028	0.390-0.405	0.014	0.008 S
Men	0.384	0.023	0.378-0.391	-	-

* Student's unpaired t test

1st recording - menstrual phase, 2nd recording- proliferative phase, 3rd recording - luteal phase

There is statistically highly significant difference during menstrual phase and proliferative phase, and significant difference during luteal phase.

Table 3: Comparison of mean QTc interval in women during different phases of menstrual cycle

Women	1st recording(in sec)	2nd recording(in sec)	3rd recording(in sec)	P* Value, sig
Mean	0.408	0.402	0.398	0.08 NS
SD	0.038	0.024	0.028	
95% C.I	0.397-0.419	0.395-0.408	0.390-0.405	

* Repeated measures ANOVA

The difference noted is statistically not significant

DISCUSSION

Cardiac repolarization is influenced by various factors like serum electrolyte levels, use of drugs that can potentially prolong QT interval. Along with these physiologically, cardiac repolarization is dependent on age and sex of the individual. Earlier studies have shown that baseline QTc interval is the same for both genders till puberty. After puberty the QTc interval in males is less than the QTc interval in females. The QTc interval in men gradually increases from puberty until age 50 when it is again similar to that of women.

In this study, significant QTc interval difference was noted between men and women, age group being 18-22yr, which is in accordance with earlier studies.[9,10]

Along with the gender difference, effect of menstrual cycle on QTc interval was studied wherein it was noted that there is significant difference in the QTc interval between men and women in all menstrual phases. But there was no statistically significant difference in QTc interval in women during different menstrual phases. This is in accordance with studies done by Rodriguez.et.al and Burke.et.al.[13,14] The mean

QTc interval in women was lesser in the menstrual phase when compared to proliferative phase and luteal phase though the difference was not statistically significant.

Observations of earlier studies such as drug induced QTc interval prolongation and a higher incidence of Torsades de pointes in women and a shorter QTc interval in men after puberty have suggested the influence of sex hormones on cardiac repolarization.

Animal studies have demonstrated the presence of estrogen and androgen receptors in myocardium [15, 16]. These receptors, being functional, can modulate gene expression in the cells.

There are gender related differences in ionic currents as shown in animal studies and gonadal steroids are important determinants of gender differences in repolarization by influencing the ionic currents[17, 18, 19]. Gender related differences in the I Ca, L transmural gradient combined with similar I_{Kr} and I_{KI} densities could result in prolonged repolarization and greater transmural dispersion of repolarization in female compared to male rabbit ventricle.[17, 19]

Studies on rabbits have noted effect of estradiol on ion currents and cardiac repolarization.[19]

Testosterone may exert a protective role, suppressing inward calcium currents and enhancing inward rectifying potassium currents, shortening the action potential duration and diminishing the QT response to potassium channel blockers.[20, 21, 22, 23]

In this study, QTc interval difference though statistically not significant in women during different phases of menstrual cycle, it is more during menstrual phase than during the other two phases. In women, both progesterone levels and progesterone to estradiol ratio are inversely correlated with the drug-induced QT interval prolongation.[12]

Greater emphasis is needed to study such gender difference in ionic currents in humans.

CONCLUSION

There is gender difference in QTc interval of cardiac repolarization. This difference is much higher during menstrual phase in women when compared to differences with proliferative and luteal phases. There is no statistically significant difference in QTc interval in women during different phases of menstrual cycle.

ACKNOWLEDGEMENT

We acknowledge all the staff members of Physiology Dept,SSIMS&RC, for their kind support and valuable guidance. We acknowledge even the participants who volunteered to be part of this study.

Conflict of Interest: No conflict of interest among authors

Source of Support: self funded

Ethical Clearance: institutional ethical clearance taken

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DOI Number: 10.5958/j.2320-608X.1.2.020

Blood Pressure Correlation with Obesity Indices in Young Indian Adults

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ABSTRACT

Background: Prevalence of obesity is reaching epidemic proportion in India and is of concern as it increases risk of coronary heart disease, stroke, diabetes and mortality. This study was done to evaluate the association of BP parameters with obesity indices in young adults.

Materials & Method: The study included 245 subjects in the age group of 18 to 22 yrs. According BMI, subjects were divided into three groups namely Normal Weight(NW), Overweight(OW) and obese. Blood Pressure was measured in sitting posture with a standard mercury sphygmomanometer. Pulse Pressure (PP) and Mean Arterial Pressure (MAP) were calculated. Statistical analysis included descriptive, Pearson's correlation and regression analysis.

Results: Blood pressure was significantly higher in OW and Obese groups. SBP, DBP & MAP were all significantly correlated with obesity indices in both sexes.

Conclusion: Study shows BP Parameters are strongly correlated with obesity indices. Among them BMI is a better predictor of SBP & whereas BMI, WC, HC being equal predictor of DBP & MAP.

Keywords: *Blood Pressure Parameters, Obesity Indices*

INTRODUCTION

The prevalence of obesity, a global public health problem, is reaching epidemic proportions in India and is of great concern because it increases risk of coronary heart disease, stroke, diabetes, certain cancers and mortality[(1)]. The relationship between obesity and hypertension is well established both in adults and children[(2, 3)]. Obese individuals exhibit higher blood pressure levels than non obese individuals even in the normotensive range. Thus the combination of obesity and hypertension increases the risk of cardiovascular diseases [(4)].

A number of obesity indices are used as risk factors or indicators of blood pressure and/or the presence of hypertension. Body Mass Index (BMI) is the most frequently used measure of obesity. Recently, the Body Adiposity Index (BAI), which is based on the measurements of hip circumference and height, has been suggested as a new index of adiposity[(5)].

Previous research has documented that both absolute total body fat and adipose tissue distribution are associated with CVD risk. There are conflicting data as to whether absolute total fat as assessed by BMI and Weight Stature Ratio (WSR) or fat distribution and central adiposity as assessed by Waist circumference (WC), Hip Circumference(HC) & Waist Hip Ratio(WHR) is more closely associated with cardiovascular risk[(6, 7, 8)]. In younger individuals, both BMI and WC are independent and equally important predictors of Systolic Blood Pressure (SBP) and Diastolic Blood Pressure (DBP) in both genders, whereas among older individuals WC is the dominant predictor of blood pressure among men and BMI is the dominant predictor of blood pressure among women. Associations were more evident with respect to SBP than DBP[(7)]. Recently a meta analysis study has shown that WSR is the better indicator of cardio metabolic risk factors in both sexes [(8)].

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In adult Indian population, WC & WHR are thought to be associated with cardiovascular and metabolic risk than BMI [9]. There are not many studies showing the association of different obesity indices like BMI, BAI, WC, WHR and Body Fat Percentage (BFP) to blood pressure in young adults group and gender difference in Indian population. Hence, the purpose of this study was to evaluate the independent association of WC, WHR, WSR, BMI, BAI & BFP with blood pressure in healthy young adults of Indian population and also to know if any gender differences in association.

MATERIALS AND METHOD

All the first year medical students (n = 400) were screened for their age, history of hypertension, cardiac or pulmonary diseases, smoking and consumption of alcohols. Height & Weight were measured. BMI was calculated as weight (kg) / height (mt)^2. Those in the age group of <18 yrs & > 22 yrs (n=4) or with the history of hypertension (n=1), cardiac or pulmonary diseases (n=5) were excluded from the study. Clinical examination was conducted on all subjects to rule out any systemic disorders. Subjects were divided into three groups depending on BMI cut off for Indian population. Subjects with BMI ≥ 25 Kg.m^2 (n = 85) (male = 58 & female = 27) formed obese group and with BMI ≥ 23 to 24.9 Kg.m^2 (n = 75) (male = 39 & female = 36) formed overweight group.

Out of 230 normal weight students (BMI 18.5 to 22.9 Kg.m^2), 85 (Male=50 & Female =35) were selected randomly. Thus the study consisted of three group's namely Normal Weight (NW), Over Weight (OW) and obese. This sample size was estimated to be enough to detect a clinically relevant difference of 10% in the parameters under study at 5% level of significance with 80% power. The study was approved by the Ethical committee of the institution. Subjects were informed about the purpose of the study, the study protocol and the informed consent was obtained.

WC & HC were measured. WHR & WSR were calculated. BAI was calculated using the equation suggested by Bergman and colleagues, BAI = (HC in cm / height in mt X root of height in mt) - 18 [5]. Body fat Percentage (BF %) was calculated using equation to predict percentage body fat from BMI[10]. BF% = 63.7 - 864 x (1/BMI) – 12.1 x Sex + 0.12 x Age + 129 x Asian x (1/ BMI) – 0.091 x Asian x Age – 0.030 x African American x Age, Where, Sex = 1 for male and 0 for female; Asian = 1 and 0 for other races; African American = 1 and 0 for other race; Age in yrs; BMI in Kg.m^2.

Study was carried out in the human experiment laboratory of the Department. Subjects were briefed again about the experiment protocol and were allowed to relax for 10 minutes. Blood Pressure was measured in sitting posture with a standard mercury sphygmomanometer. Pulse Pressure (PP) and Mean Arterial Pressure (MAP) were calculated.

Descriptive statistics with mean and Standard Deviation (SD) were calculated. Inferential statistical analysis (Pearson's correlation, regression analysis, t-test and analysis of variance (ANOVA)) were performed using the SPSS version 19.

RESULTS

The study included 245 subjects in the age group of 18 to 22 yrs. The physical characteristics of the three study groups, both in males and females are shown in table 1. There was no significant difference in the mean ± SD of age and height between the three groups. WC in obese males and females was 94.27 ± 9.04 and 87.04±7.17 respectively, these values were more than the cut off points for Indian population (cut off points for male: >90cms and females: >80cms).

Table 1: Mean and Standard Deviation of Physical Characteristics of study subjects.

Parameters	NW		OW		Obese		p VALUE
	MEAN	SD	MEAN	SD	MEAN	SD	
Age Weight Height BMI	18.55	0.88	18.32	0.98	18.42	0.88	0.269
WC HC WHR WSR BFP	*#57.99	8.13	#66.92	8.49	79.84	11.27	7.71E-36
	1.68	0.10	1.67	0.10	1.69	0.08	0.277
	*#20.67	1.38	#24.04	0.59	28.64	2.85	3.08E-75
	*#74.77	6.85	#83.36	7.83	91.38	11.03	2.62E-26
	*#92.26	4.70	#100.12	5.44	105.79	10.44	3.06E-25
	*#0.81	0.06	#0.83	0.07	0.86	0.06	1.06E-06
	*#0.44	0.04	#0.50	0.04	0.54	0.06	3.71E-30
	*#20.12	5.65	#27.38	5.97	30.08	6.18	6.37E-23
BAI	*#24.40	3.84	#28.72	4.00	30.73	4.21	2.30E-20

* Significantly different from overweight group.

\# Significantly different from obese group.

Table 2 shows the Systolic Blood Pressure (SBP) and Diastolic Blood Pressure (DBP) between the three groups in both sexes. Blood pressure values were within normotensive range in all three groups. SBP and DBP were significantly higher in obese group and OW group when compared to NW group in both the sexes. SBP was significantly higher in males than in females in all three groups. Statistically significant differences in mean DBP between two sexes were found in OW and obese groups. There was significant increase in mean MAP in OW and obese groups compared to NW group. Males had higher PP and MAP in all three groups. Increase in MAP in males was significant in all groups whereas increase in PP was significant only in OW group. The Pearson's correlation coefficients between BP parameters and the obesity indices are presented in Table 3. SBP, DBP and MAP were all significantly correlated to BMI, WC, HC, WSR & BF% in both sexes. In males the SBP & MAP also showed significant correlation with WHR & BAI and DBP also showed significant correlation with BAI. SBP was more strongly correlated with obesity indices in males than DBP where as correlation between DBP and obesity indices were stronger in females. On multiple regression analysis it was found that, the predictive value of obesity indices taken together was 28.70% for SBP, 25.31% for DBP and 35.38% for MAP.

Table 2: Mean and Standard Deviation of Blood pressure parameters of study subjects

Parameters		NW		OW		Obese		p VALUE
		MEAN	SD	MEAN	SD	MEAN	SD	
SBP	BOTH	*#109.20	9.74	#112.40	9.75	121.41	10.45	1.02E-13
	MALE	*#111.96	7.91	#116.15	8.72	123.21	10.33	1.07E-08
	FEMALE	*#105.14	10.38	#108.33	9.25	117.56	9.82	1.25E-05
DBP	BOTH	*#69.93	5.92	#72.56	7.24	77.98	6.30	9.76E-14
	MALE	#72.16	4.91	#73.54	6.75	78.59	6.37	2.41E-07
	FEMALE	*#68.63	4.99	#71.50	7.68	76.67	6.05	1.90E-05
PP	BOTH	#38.45	8.63	#39.84	10.95	43.44	9.28	0.011
	MALE	*#39.80	7.98	42.62	12.45	44.62	9.45	0.043
	FEMALE	#36.51	8.25	#36.83	8.22	40.89	8.53	0.086
MAP	BOTH	*#83.52	6.20	#85.84	6.32	92.45	6.61	1.62E-18
	MALE	*#85.43	4.78	#87.74	4.62	93.46	6.54	9.18E-12
	FEMALE	*#80.80	6.12	#83.78	7.27	90.30	6.36	1.03E-06

* Significantly different from overweight group.

\# Significantly different from obese group.

Table 3: Pearson's correlation coefficient between Obesity indices and Blood pressure

		BMI	WC	HC	WHR	WSR	BF%	BAI
SBP	BOTH	0.471*	0.459*	0.412*	0.293*	0.376*	0.039	0.121
	MALE	0.499*	0.434*	0.419*	0.255*	0.417*	0.541*	0.298*
	FEMALE	0.460*	0.353*	0.405*	0.124	0.343*	0.418*	0.231
DBP	BOTH	0.450*	0.454*	0.447*	0.245*	0.366*	0.113	0.153
	MALE	0.392*	0.366*	0.374*	0.197	0.339*	0.411*	0.320*
	FEMALE	0.482*	0.449*	0.417*	0.240	0.372*	0.458*	0.170
PP	BOTH	0.222	0.205	0.155	0.162	0.172	-0.035	0.031
	MALE	0.298*	0.241	0.218	0.155	0.241	0.333*	0.094
	FEMALE	0.198	0.087	0.180	-0.036	0.137	0.165	0.158
MAP	BOTH	0.528*	0.524*	0.496*	0.306*	0.426*	0.092	0.159
	MALE	0.506*	0.456*	0.453*	0.257*	0.431*	0.540*	0.375*
	FEMALE	0.522*	0.450*	0.455*	0.209	0.398*	0.487*	0.219

* p value < 0.001 Statistically significant

DISCUSSION

Obese subjects display higher BP levels than non-obese individuals even in the normotensive range [4]. In our study, there was a statistically significant increase in SBP in over weight and obese groups when compared to normal weight group with a mean increase of SBP by 3.2 mm Hg in over weight and 12.21 mm Hg in obese groups. Similarly, there was a statistically significant increase in DBP in study groups when compared to normal weight with a mean increase of DBP by 2.63 mm Hg in overweight and 8.05 mm Hg in obese groups. Mean increase in PP & MAP were 1.39mm Hg, 2.32 mm Hg in overweight and 4.99 mm Hg, 8.93 mmHg in obese groups respectively. The complex mechanisms of obesity-related hypertension are unclear. Obese subjects have increased sympathetic nerve activity, increased insulin levels and increased activity of the renin–angiotensin-aldosterone system which can contribute to higher BP [11, 12]. Obesity also produces an increment in total blood volume and cardiac output that is caused in part by the increased metabolic demand induced by excess body weight [13].

Upper-body fat distribution and increased visceral fat mass have been found to be better predictors of hypertension and cardiovascular morbidity than overall fat mass. Thus it has been suggested that WC, WHR and WSR are better measures of obesity than BMI in predicting cardiovascular risk factors [14,15]. The present study shows a positive correlation between SBP, DBP & MAP and all obesity indices in both sexes. Association of BMI with SBP, DBP & MAP was more than the other obesity indices in both sexes. In males association of BMI with SBP was more when compared to females whereas in females association of BMI with DBP & MAP was higher when compared to males. On simple linear regression analysis for SBP, DBP & MAP which were significantly correlated with obesity indices, BMI explained 22.18%, 20.22% and 27.55% of variation in SBP, DBP and MAP respectively whereas WC explained 21%, 20.80% and 27.14% of variation in SBP, DBP and MAP respectively. HC explained 17%, 20% and 27% of variation in SBP, DBP and MAP respectively. On multiple regression analysis describing the effect of explanatory variables acting on SBP showed R^2 improving to 0.3045 (30.45%), on DBP R^2 improved to 0.2714 (27.14%) and on MAP R^2 improved to 0.3696 (36.96%). Thus BMI was the major predictor for the variation in SBP whereas BMI, WC and HC were the major equally significant predictors for the variation in DBP and MAP of both sexes. In several previous studies, compared with BMI, WC had a stronger association with SBP and DBP in both men and women [16]. Thus our results differ from the others which could be due to the age group included in the study.

Recently, the Body Adiposity Index (BAI), which is based on the measurements of hip circumference and height, has been suggested as a new index of adiposity [5]. The present study is the first on Indian population to show a significant correlation (r = 0.687) between BAI & BF% calculated by using the formula. This correlation was higher than between BMI & BF% (r = 0.561) when both sexes were taken together. The study also shows a smaller positive correlation between BAI & BP parameters in both sexes together, but showed a higher significant correlation in men. So even though BAI is well correlated with BF% than BMI, it is not a good predictor for cardiovascular risk factors.

CONCLUSION

The present study shows significant higher Blood pressures in overweight and obese young adults in normotensive ranges. Study also shows a strong correlation between obesity indices and BP parameters in young adults, BMI being a better predictor of SBP. Whereas BMI, WC, HC were equal predictors of DBP & MAP. So in young adults, all obesity indices have to be considered for early evaluation of cardiovascular risk factors.

Acknowledgement: Nil

Source of Funding: Nil

Conflict of Interest: Nil

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DOI Number: 10.5958/j.2320-608X.1.2.021

Variations in the Pulmonary Function Tests Interpreted through Spirometry in Cotton Mattress Workers and their Correlation with the Occupation - A Study

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ABSTRACT

Objective: The following are the main objectives of the present study:-1.To evaluate the health hazards of the cotton mattress workers after prolonged exposure to cotton dust.2.To assess the spirometric profile in these cotton mattress workers. 3.To examine the relationship of the degree of impairment of long functions with duration of exposure.

Materials and Method: A total number of study groups of 30 male cotton mattress workers working for more than 5 years from the material for the present study. In addition, a control group of 15 male cases were also taken for evaluation. A detailed history and clinical examination was done, other coexisting lung diseases like Diabetes mellitus, Hypertension and smokers were excluded. Spirometric (pulmonary function test) evaluation was done with the aid of Medispiror spirometer. Results were analyzed.

Results: 100% of the study group is symptomatic in the order of cough, sneezing, chest tightness and shortness of breath. There is significant decrease in Forced vital capacity - FVC ($P<0.00086$), forced expiratory volume in 1st second- FEV1 ($P<0.001787$), forced expiratory flow - FEF25-75% ($P=0.119072$).But there is no significant change in FEV1% in cotton mattress workers and others maintaining equal ratio. The results were also analyzed statistically.

Conclusion: All the subjects with more than 5 years exposure are symptomatic with cough and sneezing as predominant symptoms. FVC, FEV1 decrement and its negative correlation with duration and exposure is statistically significant. The changes are observed in FEF25-75%, PEF parameters. Cotton mattress workers occupation has a definite bearing in the severity of restrictive ventilatory defect which is statistically significant.

Keywords: *Spirometry, Cotton Mattress Workers, FVC, FEV1*

INTRODUCTION

Inhalation of foreign material at the work place can cause a number of pulmonary syndromes in the lung, next to skin, and is the second most common organ affected by the occupation-related toxic reactions. Lung parenchyma and airways as well as pleura can be affected by inhalation of toxic materials. A very curious occupational chronic respiratory disease due to the inhalation of dust have been observed in the textile workers of Lancashire for the past 200 years[1].In Europe and in United States, the disease was known as " Byssinosis" (derived from Greek word meaning linen or fine flax) which is popularly known as "The Monday Morning Fever". Byssinosis is a disease of the lungs brought on by breathing in cotton dust or dusts from other vegetable fibers such as flax, hemp, or sisal while at work.[2]The morbid conditions may range from chronic respiratory diseases due to cotton dust inhalation to anemia because of nutritional deficiency[3]. Occupational airway diseases can manifest as chronic bronchitis without airway hyperactivity (industrial

bronchitis) or asthma with hyperactive airways (occupational asthma).Cotton dust is the most common substance causing industrial bronchitis. Without reporting any well documented cases of occupational asthma, cotton mattress workers are more prone to chronic bronchitis and occupational asthma.

The present study is to evaluate the pulmonary function tests profile of cotton mattress workers.

MATERIALS AND METHOD

30 male cotton mattress workers were enrolled in the present study to evaluate spirometric profile. The study group was selected from the cotton spinning mill nearer to the Visakhapatnam city. Another 15 male subjects were selected as the control group for the present study. The selection criteria were based on the fact that the cotton mattress workers should be working for more than 5 years in the spinning mill. Those workers who had any coexisting lung disease or diabetes mellitus or hypertension or any coexisting cardiovascular disease were excluded from the study. Smokers were also not included in the present analysis. After taking detailed history and thorough clinical examination, the spirometric analysis was done using 'Medispiror', an electronic spirometer taken from the department of Physiology.

METHOD OF SPIROMETRY

The patient should be instructed not to take inhaled bronchodilators or any other medication within 6 hours before testing. The patient is asked to take a deep breath as much as he can to fill the lungs completely. Now he is asked to hold the mouth-piece of the spirometer in his mouth and he is instructed to blow out all the air rapidly, forcibly and completely as possible. The airflow is converted into electrical signals and these are integrated to give the volume and flow at a particular time. Data is obtained from the forced expiratory maneuver which is connected to the computer from which both the volume-time and flow-volume types of curves can be generated. A diurnal rhythm is recognized so that the test should be repeated at the same time of the day.

OBSERVATIONS AND RESULTS

Table 1: Age distribution of study and control population

Age group	Study group		Control group	
	Number	%	Number	%
15-20	1	3.33	0	0
21-25	2	6.66	1	6.66
26-30	4	13.33	1	6.66
31-35	9	30.00	5	33.3
36-40	8	26.6	5	33.3
41-45	4	13.33	1	6.66
46-50	1	3.33	1	6.66
51-55	1	3.33	1	6.66
Total	30	100.00	15	100.00

Table 2: Duration of exposure in years

Duration in years	Study group	
	Number	%
5	2	6.66
6-10	19	63.33
11-15	7	23.30
16-20	0	0.00
21-25	2	6.66
Total	30	100.00

Table 3: Duration of exposure in hours

Exposure hours	Number	%
0-5,000	2	6.66
6,000-10,000	10	33.3
11,000-15,000	4	13.33
16,000-20,000	2	6.66
21,000-25,000	2	6.66
26,000-30,000	1	3.33
31,000-35,000	4	13.33
36,000-40,000	2	6.66
41,000-45,000	2	6.66
46,000-50,000	1	3.33
Total	30	100.00

Exposure hours calculated by a formula

No. of working hours/days x No. of working days/ wk x 52 x Total no. of years exposure.

53.29 of study population are in the range of 6,000 to 20,000 exposure hours.

Table 4: symptoms

Symptom wise	No. of cases
Cough	30
Sneezing	24
Chest tightness	21
Shortness of breath	21
Wheeze	8

Table 5: FVC, FEV1, FEV1%, $FEF25_{-75\%}$, PEFR values

	STUDY GROUP				CONTROL GROUP				t-value	p-value
	Mean		S.D		Mean		S.D			
	Actual value	Decrement value	Actual value	Decrement value	Actual value	Decrement value	Actual value	Decrement value		
FVC	2.5703	1.0726	0.7517	0.78	3.3513	0.1466	0.7980	0.534	-3.71327	0.00086623 (significant)
FEV_1	2.3153	0.7413	0.6855	0.653	2.9373	0.0526	0.6564	4.707	-3.4394	0.001787 (significant)
FEV_1%	89.173	9.7933	10.079	10.164	90.193	7.24	10.426	10.75	-3.37492	<0.710447 not significant)
$FEF_{25-75\%}$	3.069	1.207	1.3553	1.258	3.6706	0.7526	1.3707	1.224	-1.60617	0.119072 (not significant)
PEFR	6.6953	1.9626	2.2349	2.1798	6.6693	1.80	2.2654	1.777	0.04547	0.964038 (not significant)

Table 6: Correlation with hours

	FVC	FEV_1	FEV_1%	$FEF_{25-75\%}$	PEFR
Actual	-0.64	-0.68	-0.61	-0.47	-0.39
Decrease	-0.527	-0.592	-0.10	-0.399	-0.342

Table 7: study group master chart

S.No	Name	Age	Work	Work	Cough tightness	Chest	Wheelze	Sneezing	SOB	FVC	FEV_1	FEV %	$FEV_{25-75\%}$	PEF
			Duration	Duration										
			Years	Hours										
1	N.VeeraBabu	39	9	5,616	+	-	-	-	-	3.61	3.02	80.2	4.22	8.6
2	Md Rahiu	48	5	4,680	+	-	-	+	-	3.46	2.83	78.6	3.86	8.28
3	Surya rao	35	10	9,360	+	-	-	+	+	3.6	3.05	80.9	4.36	8.65
4	Nayeem	28	6	4,680	+	-	-	+	-	3.61	3.11	82.2	4.6	8.77
5	Adi narayana	26	7	8,736	+	+	-	-	+	3.75	3.26	82.5	4.72	8.98
6	Narasimhulu	45	7	7,246	+	+	-	-	-	3.37	2.63	75.5	3.24	7.92
7	Reddy	36	7	6,552	+	-	-	+	+	2.93	2.54	80.7	4.06	7.8
8	Eswara rao	36	8	9,984	+	-	+	+	+	3.68	3.1	80.7	4.35	8.73
9	Appala raju	35	10	6,240	+	-	-	+	-	3.18	2.63	78.8	3.78	7.95
10	Sama reddy	35	10	9,360	+	+	-	+	+	3.6	3.05	80.9	4.36	8.65
11	Prakasha rao	32	7	13,104	+	+	-	+	+	3.32	2.86	81.4	4.35	8.35
12	N.Ramu	33	10	12,480	+	+	-	+	+	2.99	2.61	81.3	4.19	7.94
13	G.Hussain	39	8	12,480	+	+	-	+	-	4.61	3.77	80.2	4.61	9.83
14	Kailasa rao	43	10	18,720	+	+	-	+	+	4.17	3.41	79.5	4.3	9.23
15	Amen	19	7	21,840	+	+	-	+	-	4.31	3.71	83.8	5.18	9.77
16	Achi babu	25	10	31,200	+	-	+	+	+	4.53	3.82	82.7	5.06	9.94
17	Chandradu	25	7	26,208	+	+	+	+	+	4.43	3.75	82.7	5.02	9.82
18	Ratnam	31	13	32,448	+	+	-	+	+	3.04	2.66	81.6	4.28	8.03
19	Venkat rao	42	12	33,696	+	+	-	+	+	3.44	2.87	79.6	4.06	8.35
20	Valli	42	12	33,696	+	+	+	+	-	3.44	2.87	79.6	4.06	8.25
21	Subba rao	38	8	19,698	+	+	-	+	+	4.23	3.5	80.4	4.5	9.38
22	Saidulu	36	15	37,440	+	+	+	-	+	4.23	3.51	80.7	4.57	9.41
23	Ramulu	35	22	41,184	+	+	+	+	+	3.51	2.86	78.2	3.81	8.32
24	Raju	55	25	39,000	+	+	+	-	+	3.1	2.51	77.3	3.48	7.73
25	Venkatesh	38	13	48,674	+	+	+	-	+	3.88	3.23	80.4	4.36	8.95
26	Basha	39	8	6,240	+	+	-	-	+	2.83	2.19	74.8	2.9	70.2
27	Ramesh	28	5	7,800	+	-	-	+	-	4.01	3.41	82.2	4.76	9.26
28	Jukka rao	29	8	14,976	+	+	-	+	-	8.34	3.27	82	4.65	9.03
29	Aslam	33	4	43,680	+	+	-	-	+	3.6	3.06	81.3	4.42	8.68
30	Appa rao	33	12	22,464	+	+	-	+	+	2.99	2.61	81.3	4.19	7.94

Table 8: Control group

S. No	Name	Age	FEV	FEV_1	FEV%	$FEF_{25-75\%}$	PEFR
1	Bhaskara rao	25	3.88	3.34	82.7	4.81	9.14
2	Narayana rao	36	2.91	2.59	82.2	4.33	7.91
3	Ramana murthy	38	3.53	3.06	82.3	4.6	8.67
4	Venkateswarlu	55	2.83	2.28	76.8	3.27	7.36
5	Ramesh	34	3.42	2.92	81.1	4.32	8.45
6	Sankara rao	38	3.48	3.03	82.3	4.58	8.63
7	Babu rao	32	3.68	3.12	81.4	4.49	8.78
8	Srinivas	36	3.34	3.27	82	4.65	9.03
9	P.Raju	33	2.65	2.26	88.1	3.97	5.95
10	Kailash	33	3.6	3.06	81.3	4.42	8.68
11	Murthy	35	4.00	3.35	80.9	4.56	9.14
12	Sampath	32	3.71	3.19	82.2	4.64	8.89
13	Jagadish	42	3.47	2.97	81.4	4.41	8.54
14	Rambabu	27	4.13	3.51	82.3	4.84	9.43
15	Ravi kumar	49	3.34	2.9	82	4.46	8.42

DISCUSSION

Both study and control population included in the study were above 15 years of age group only for the reason of better comprehension and understanding of the performance of spirometry and to get reliable results in the study.

The study and control population are age matched to a great extent (56.6%) 30-40 years age group is predominant in both groups. In the study group, 63.27% of them had exposure duration in the range of 5-20 years and 23.3% in 10-15 years. All put together 86.57% of the study population has the exposure duration of more than 5 years (remaining exposure for exactly 5 years) which is sufficient to exert pathophysiological effects in this profession. Since the working hours and days vary among the workers, a more concrete estimation of exposure is worked out in the form of exposure hours. 53.29% of the study population fall in the range of 6,000-20,000 working hours.100% of the subjects (both study and control) are symptomatic; with cough and sneezing as predominant symptoms.

In case of FVC, the difference between the predicted and actual values of the study group is more statistically significant (t- value=5.0493; $p<0.05$) and FEV_1 described a statistically significant decrement change in the study group (t-4.707).

FEV_1% value which is a ratio-percentage has not changed in the study as well as control groups, implying a restrictive defect in the study population and normal unchanged ratio in control population. PEFR and $FEF_{25-75\%}$ values in the study group didn't change much when compared to predictive value indicating that obstructive airway disease is less likely in the study population. There is a negative correlation between exposure duration and the change in FVC i.e., with increasing duration of exposure the FVC values fell down.

Though symptoms are present in all subjects of the study group with varying periods of exposure to cotton dust, the ventilatory defect is mostly seen in the study group with a minimum duration of 6-10 years of exposure. In the present study, in terms of exposure hours, the restrictive defect is mostly seen with 10,000-35,000 hours, where a maximum no. of workmen (13 subjects) fell in this category.

ACKNOWLEDGEMENTS

I thank all the cotton mattress workers who extended their co-operation in performing various parameters of the study. I also extend my gratitude to the Professor and HOD of the department of Physiology for lending the spirometer.

Conflict of Interest

The respiratory system of the human beings has a natural design to carry out several functions like gas exchange, defense mechanism, maintenance of pH etc. Being in direct contact with atmosphere, it also has a disadvantage of acquiring air borne infections and diseases caused by dust. Since cotton mattress work is a common profession everywhere, these professionals are at the risk of prolonged exposure to cotton fibers. This forms the conflict of interest for the present study to look for the pathophysiological profile and lung functions in these workers.

Source of Funding

The instrument required for the present study is the spirometer. It was obtained from the department of Physiology with due permission from the Professor and HOD.

Ethical Clearance

Consent from all the cotton mattress workers was taken prior to performing various parameters of the lung function tests. The control group was also selected after their consent for the study.

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DOI Number: 10.5958/j.2320-608X.1.2.022

Effect of Yoga Regimen on Premenstrual Body Weight and Reaction Time in Young Healthy Females

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ABSTRACT

The present study aims to evaluate the effectiveness of yoga practice, if any, on reducing premenstrual body weight and improving reaction time or motor performance in normal healthy females. Fifty young women between age group 17-21 years volunteered for the study. The following baseline parameters were recorded in postmenstrual and premenstrual phase of a menstrual cycle (Initial menstrual cycle) at the start of yoga practice- Body weight, Auditory Reaction Time (ART) and Visual Reaction Time (VRT).

Following the baseline recording, subjects were randomly divided into two groups each having 25 subjects. Group I practiced yogic exercises for a duration of 35 minutes; 5 days a week for a period of three menstrual cycles and group II served as control (non yoga group). No recording was taken in the first menstrual cycle of yoga practice. Follow up recordings were taken in postmenstrual and premenstrual phases of second and third menstrual cycle in both the groups. Yoga group depicted a significant decrease in premenstrual body weight and also Auditory and Visual Reaction Times. The study also demonstrated over all beneficial effect of yoga during post menstrual phase also as depicted by reduction in reaction time leading to improvement in performance.

Keywords: *Yoga practice, Auditory Reaction Time (ART), Visual Reaction Time (VRT) Premenstrual phase, Postmenstrual Phase Body weight*

INTRODUCTION

The literature is replete with reports that women frequently gain weight sometimes upto 10 lbs in the premenstrual phase and loose corresponding amount following the menses. The degree of premenstrual weight gain is reported to correlate with degree of various premenstrual neurological symptomatology viz. Headache, malaise, nervous irritability, emotional instability and in many case leading to poor attention and performance.[1,2,3,4] Various studies have reported deterioration in reaction time during premenstrual phase.[5] Reaction time measurement is an indirect index of processing capability of central nervous system and simple means of determining sensory motor association and performance of an individual.[6,7] 'Yoga' is a way of life which gives the practitioner a healthy body, sound mind and is known to alleviate stress and produce relaxation.[8] Previous studies on yoga have shown that regular practice of yoga can significantly decrease VRT and ART.[9,10] There is paucity of data on the effect of yoga practice on premenstrual weight gain and reaction time, hence the aim of the present study is to investigate the effectiveness of yoga practice, if any, in reducing premenstrual weight gain and improving reaction time of performance in normal healthy females.

MATERIALS AND METHOD

The present study was carried out in fifty normal healthy female volunteers without any chronic illness,

or menstrual abnormalities and without any hearing or visual disorder in the age group 17-21 years.

Their detailed menstrual history was noted and the postmenstrual and premenstrual phases were calculated as follows[5]:

Postmenstrual Phase: 5th to 10th day of the menstrual cycle.

Premenstrual Phase: 1st to 7th days prior to onset of next menstruation.

STUDY DESIGN

After taking their initial baseline recordings during both postmenstrual and premenstrual phases of a menstrual cycle (initial menstrual cycle), they were randomly divided in following two groups:

Group I: Consisted of twenty five subjects (n=25) who practiced Yoga.

Group II: Also consisted of twenty five subjects (n=25), but they did not practice Yoga and acted as control group.

To ensure regularity and uniformity in Yoga practice, the training was given in the Department of Physiology, Lady Hardinge Medical College, New Delhi under the supervision of a trained yoga teacher. The subjects were taught yogic techniques for 35 minutes in the morning on empty stomach six days a week for a total period of three menstrual cycles. Since according to yogic texts, yoga asanas are prohibited during the days of menstruation, hence the students were instructed only to do yogic prayer, sukshma Vyayam (minor exercises) and meditation during these days.

Yoga practice was started just after cessation of menstruation in the next cycle (of initial recording) and is denoted as first menstrual cycle of yoga practice and the practice was continued in the second and third menstrual cycles. All the parameters were re-evaluated during postmenstrual and premenstrual phases of second and third menstrual cycles and not in the first menstrual cycle of yoga practice.

The following yogic techniques were practiced by subjects of yoga group

I. YOGIC PRAYER

II. SUKSHMA VYAYAM (Minor-exercises)

1. Greeva Sakti Vikasaka
   (strengthening the neck)
2. Vaksa-sthala Sakti Vikasaka
   (strengthening the chest)
3. Udar Sakti Vikasaka
   (strengthening the abdominal muscles)
4. Kati Sakti Vikasaka
   (strengthening the muscles of back)
5. Skandha tatha Bahu Mool Sakti Vikasaka
   (strengthening the muscle of shoulder blades and shoulder joints)
6. Jangha Sakti Vikasaka
   (strengthening the thigh muscles)
7. Gulpha-pada-prstha-pada-tala Sakti Vikasaka
   (developing the strength of ankle and feet)

III. Sthula Vyayama (Macro exercises)

1. Urdhav Gati
2. Surya Namaskar

IV. Asana (Postures)

1. Shavasan
2. Supta Pavan Muktasan
3. Uttanpadasan
4. Bhujangasan
5. Ushtrasan
6. Gomukhasan
7. Ardh-Matsyendrasan
8. Tadasan
9. Shavasan

V. Pranayam

Nadi Shodhan Pranayam

VI. Dhyan (Meditation)

Their body weight was recorded by Detecto Medico Brooklyn weight scale in pounds and then it was converted into kilograms (weight was taken immediately after emptying of the bladder).[5]

Auditory reaction time (ART) and Visual reaction time (VRT) were measured by reaction time instrument supplied by Medicaid System, Chandigarh (Fig.13). This instrument is equipped with very sensitive quartz clock which can measure upto $1/10^{th}$ of a msec. Accuracy of this instrument is ± one digit. For ART the stimulus used was a continuous beep of 1 KHz on speaker. For VRT a red light incorporated on the instrument was given. Before measuring ART and VRT every subject was made familiar with the apparatus. All the subjects were asked to keep the index finger of the dominant hand over the switch in ready to press position[5]. They pressed the switch immediately after receiving auditory and visual stimulus respectively. Three readings of each stimulus were noted by auto display after giving three practical trials and the lowest was taken as the reaction time. All the data was statistically analyzed using the paired't' test.

OBSERVATION AND RESULT

Table 1 depicts that there is no statistical difference between age, height, duration of menstrual cycle and duration of menstruation in both yoga and control group. There is also no statistical difference between body weights during postmenstrual phase of initial cycle in the two groups before starting yoga practice. Hence, the two groups are comparable.

Table 2 shows body weight, auditory reaction time and visual reaction time during postmenstrual and premenstrual phases in the groups practicing yoga and the control group during initial, second and third cycle.

When compared to premenstrual phase of initial cycle, there was significant decrease in VRT during postmenstrual phase too in the third cycle of yoga practice. Initial cycle in both the groups depicted significant increase in body weight during the premenstrual phase when compared to their postmenstrual phase.

With the yoga practice there was a reduction in premenstrual body weight during second and third cycle when compared to their initial cycle and this reduction in premenstrual body weight became significant in the third cycle. No such changes were observed in control group.

Auditory reaction time (ART) has also shown an increased value during premenstrual phase of initial cycle in both the groups when compared to their postmenstrual phase.

With yoga practice there was a significant decrease in Auditory Reaction Time during premenstrual phase in second ($P<.05$) and third cycle ($P<.001$) when compared to the premenstrual phase of initial cycle. There was also significant decrease postmenstrual ART in second and third cycle when compared to initial postmenstrual phase. No such changes were observed in control group.

Both yoga and control group showed significant increase in Visual Reaction Time in the Initial cycle during the premenstrual phase.

Yoga practice significantly decreases VRT during premenstrual phase of second and third cycle compared to premenstrual phase of initial cycle. There was significant decrease in VRT during postmenstrual phase in the third cycle of yoga practice itself. Control group did not demonstrate similar changes.

Table 1. Distribution of Age, Height, Weight and Duration of menstrual cycle and duration of menstruation in both the groups (Mean ± SD).

PARAMETERS	YOGA GROUP (I)(n = 25)	CONTROL GROUP (II)(n = 25)	p value
Age (years)	18.6 ± 1.080	18.08 ± 0.759	NS
Height (cm)	154.19 ± 6.79	154.92 ± 5.90	NS
Weight (kgs) during postmenstrual phase of initial cycle.	51.44 ± 10.24	49.6 ± 8.150	NS
Duration of menstrual cycle (days)	28.6 ± 1.40	29.34 ± 1.45	NS
Duration of Menstruation (days)	4.42 ± 1.06	4.46 ± 0.720	NS

- NS: Not significant

Table 2. Body weight, Auditory Reaction Time (ART) and Visual Reaction Time (VRT) during postmenstrual and premenstrual phases in two groups (mean±SD)

Variables	Phases for Menstrual cycle	Yoga Group (n = 25)			Control Group (n = 25)		
		Initial cycle	Second cycle	Third cycle	Initial cycle	Second cycle	Third cycle
Body Weight (kg)	Postmenstrual	51.44 ±10.24	51.94± 9.50	50.72± 8.93	49.60± 8.15	50.58** ± 7.93	49.16±6.85
	Premenstrual	52.28±10.37	52.00± 9.92	51.32*± 9.51	50.60± 8.66	50.94± 8.14	50.44±7.98
	Postmenstrual Vs. Premenstrual	P<0.01	NS	NS	P<0.001	P<0.05	P<0.01
ART (msec)	Postmenstrual	171.24± 27.61	156.92*± 17.25	133.60***± 17.07	158.72± 22.79	163.16± 29.67	184.88***± 21.36
	Premenstrual	186.16± 19.15	170.60* ± 26.62	166.12***± 15.94	181.28± 20.98	186.64± 38.92	202.72*± 37.99
	Postmenstrual vs. Premenstrual	NS	P < 0.01	P < 0.001	P<0.001	P < 0.01	P < 0.01
VRT (msec)	Postmenstrual	177.80± 21.81	171.80± 22.13	141.76***± 22.23	158.92± 24.14	178.48*± 37.73	185.20***± 26.83
	Premenstrual	197.40± 17.60	176.24**± 25.78	167.32***± 17.59	188.56± 34.41	195.84± 31.90	203.44± 45.50
	Postmenstrual Vs. Premenstrual	P<0.001	NS	P < 0.001	P<0.001	P < 0.01	P < 0.05

NS: Not significant

P < 0.05, p < 0.01, P < 0.001: Significant (Postmenstrual Vs. Premenstrual)

* < .05, ** < .01, *** P < .001: Significant (Second & Third cycle vs Initial cycle)

DISCUSSION

The present study demonstrated significant increase in gain in body weight during premenstrual phase when compared to post menstrual phase of initial cycle in both yoga and control group before the beginning of the study.

Our reports of premenstrual weight gain are in consistence with other scientific reports of gain in body weight during premenstrual phase.[11, 12, 13, 14]

With yoga practice, decrease in body weight was observed from initial to second and third cycle in premenstrual phase i.e. 52.28±10.37 to 52.00±9.92 and 51.32±9.51 respectively. This decrease was statistically significant in third cycle (p<.05). No such trends were observed in control group.

Thorn et al[11] have demonstrated that premenstrual weight gain in normal women and those exhibiting premenstrual edema can be accounted for by sodium retention. Perrine and Piliego[15] have reported the cause of water and sodium retention due to increase level of aldosterone during luteal phase of the cycle, where as Frank[12] proposed its mechanism to be due to excessive levels of female sex hormone in the blood. However, Israel[16] asserted that the retention of sodium and water is due to deficient progesterone production with unopposed estrogenic effect in cases of premenstrual syndrome.

With yoga practice, the present study depicted decrease in body weight in yoga group during the premenstrual phase from initial to second and third menstrual cycle, and the decrease was significant in the third cycle (p<0.05). The decrease could be attributed to decrease in salt and water retention due to yoga practice, because in control group no such trend in weight changes were observed.

Similarly, ART and VRT also depicted an increase in these values during the premenstrual phase of initial cycle in both the groups. Backstrom and Carstensen[17] observed significantly higher levels of estrogen in plasma on day five to two before the onset of menstruation in the women having premenstrual tension. The progesterone levels were low. The estrogen/ progesterone ratio was significantly higher on day six to three before menstruation in the symptomatic patients as compared to the control group. There was gain in the weight in the women during last days of menstrual cycle.

With yoga practice, the yoga group demonstrated a significant decrease in both ART and VRT during the premenstrual phase of second and third cycle as compared to premenstrual phase of initial cycle.

Reaction time measurement is an indirect index of processing capability of central nervous system and simple means of determining sensory motor association and performance of a individual.[6, 7] Our finding of a decrease in reaction time indicates an improved sensorimotor performance and could be due to an enhanced processing ability of the central nervous system.

Probably yoga practices modulate cerebro cortico-limbic-hypothalamus system of the brain[18] and provide beneficial effect due to release of optimum levels of Follicular stimulating hormone (FSH) and luteinizing hormone (LH) from anterior pituitary which may be maintaining the estrogen/ progesterone ratio, so as to reduce the retention of salt and water during premenstrual phase.

Shaw and Kolb[19] and Orme Johnson et al[20] also found faster reaction time after a period of Transcendental Mediation (TM) technique whereas it remained static or increased after mere relaxation. They concluded that increased alertness developed through Meditation resulted in improvement of reaction time.

Similar observations of decrease in reaction time were made by Malathi and Parulkar[10] and Madan Mohan et al[9] in subjects practicing other yogic techniques. Udupa and Singh[21] reported that yoga practice results in a decrease in mental fatigability and an increase in performance quotient. Madan Mohan et al[9] proposed that the effect of yoga training of Central Nervous mechanism could be due to (1) greater arousal and faster rate of information processing and (2) improved concentration power and ability to ignore and or inhibit extraneous stimuli.

Study of Das et al [5] on 105 healthy females between the age group 17-20 years, which demonstrated a significant increase in body weight, auditory reaction time and visual reaction time during premenstrual phase when compared to postmenstrual phase.

Present study demonstrated efficacy in not only reduction in premenstrual body weight, ART, VRT with yoga practice but also reduction in these values during postmenstrual phase of yoga practice. The present study demonstrated effectiveness of yoga not only in reducing premenstrual weight gain and improving reaction time or performance in normal healthy females but also improvement/ reduction in these values during postmenstrual phase of yoga practice.

The study clearly depicts that yoga practices can also be taken into consideration in treating women suffering from premenstrual stress syndrome.

ACKNOWLEDGEMENT

Authors are thankful to Mr. Ashok Tiwari, Yoga Instructor, for yoga pre-training also we are extremely thankful to our student volunteers of first year MBBS for their help in the study.

Conflict of Interest: Nil

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DOI Number: 10.5958/j.2320-608X.1.2.023

Acute effect of Unilateral and Bilateral Nostril Breathing on Sympathovagal Balance in Yoga Practitioners and Healthy Male Volunteers

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ABSTRACT

Objective: To study the effect of deep breathing and single nostril breathing on the heart rate, blood pressure and frequency domain parameters of heart rate variability in yoga practitioners (pranayama) and healthy male volunteers.

Background: Heart rate variability (HRV) is used as an index of cardiac autonomic function. HRV is influenced even by one single deep breath. Ancient Sanskrit literature describes that autonomic balance is maintained by rhythmic alterations of airflow through the 2 nostrils. Studies have shown that sympathetic activity increases after breathing through right nostril and parasympathetic activity increases after breathing through left nostril breathing.

Method: Study was conducted in Autonomic lab, Department of Physiology, JIPMER, Puducherry, India. Healthy volunteers in the age group of 18-20 were included in group 1and the volunteers practicing yoga for 2 months were included in group 2. Subjects were asked to perform the following procedure: breathing at comfortable rate with both nostril, left nostril and right nostril, deep breathing with both nostrils, left nostril and right nostril at the rate of 6 breaths per min. All the procedure was done in supine position and 5 min ECG was recorded immediately after each procedure with the breathing at a comfortable rate involuntarily with both nostrils and HRV was analyzed.

Result: Deep breathing in all the 3 methods increases HRV both in control and yoga group. Deep breathing through both the nostrils increased parasympathetic activity (HRV) in both the groups. Left nostril breathing increased parasympathetic activity and decreased sympathetic activity and the right nostril breathing increased sympathetic activity and decreased parasympathetic activity in both the groups. The finding was observed in both the groups but it was more pronounced in yoga group.

Conclusion: Regular practice of yoga (pranayama) enhances the lateralizing effect of autonomic function.

Keywords: *Yoga, HRV, Unilateral Nostril Breathing, Sympathovagal Balance*

INTRODUCTION

The balance between sympathetic and parasympathetic limbs of autonomic nervous system is essential for maintaining the milieu interior. The physiological state of the body determines the dominance of either of the limbs over the other. Heart rate variability (HRV) is used as an index of cardiac autonomic function [1]. HRV is influenced by various factors, the most important being respiration. Studies have been done to demonstrate the influence of respiration at various rates and depths on HRV [2,3]. Even one single deep breath can modulate HRV [4]. Ancient Sanskrit literature describes the continuous shifting of

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autonomic balance between two body halves as represented by rhythmic alterations of airflow through the two nostrils [5]. Recently, it has been suggested that there might be nostril laterality affecting the autonomous nervous system differentially [2]. Studies have shown that sympathetic activity increases immediately after normal as well as forced/deep breathing through right nostril [5,6]. However, there is paucity of literature on the acute effect of unilateral nostril breathing on sympathovagalbalance. Therefore we planned to study the effect of normal and deep breathing through both, right and left nostril on short term HRV in normal human healthy volunteers and in subjects who have been practicing yoga (Pranayama) for 2 months.

MATERIALS AND METHOD

The tests were performed at Autonomic Lab, Department of Physiology, JIPMER, India. Study was approved by JIPMER scientific advisory committee and JIPMER Ethics committee for Human studies. Written informed consent was obtained from all the participants.

Subjects: Subjects were healthy male volunteers in the age group of 18-20.

Group 1: Healthy male volunteers (n=18)

Group 2: Healthy male volunteers practicing yoga for 2 months (n=16). Yoga practice included, Chandra nadi pranayama (left), Surya nadi pranayama (right), Nadishuddhipranayama (both) each for 6 cycles, 3 repetitions with 1 minute interval for 5 days a week for 2 months.

Protocol: Subjects were instructed, not to consume coffee, tea or any other stimulant or engage in any strenuous physical activity for at least 4 hours before reporting to the laboratory. After familiarizing them with the laboratory environment and after 10-15 minutes rest, Lead II ECG and respiration were recorded using Biopac MP 100 system and 3.7.3 Acqknowledge software for five minutes. The recordings were taken immediately after each maneuver with the subjects lying supine comfortably on the couch

Breathing at comfortable rate through

- Both nostrils
- Right nostril while left nostril was closed by cotton plug
- Left nostril while right nostril was closed by cotton plug

Deep breathing at the rate of 6 breaths per min through

- Both nostrils
- Right nostril while left nostril was closed by cotton plug
- Left nostril while right nostril was closed by cotton plug

After recording ECG for 5 minutes, heart rate (HR) and blood pressure (BP) were measured with a non-invasive automated blood pressure monitor (Press-mate BP8800, Colin Corporation, Japan). Rest was given for five minutes after each recording. ECG was acquired at a rate of 500 samples per second. ECG was analyzed using HRV software (version 1.1., Biomedical signal analysis group, University of Kuopio, Finland) by fast Fourier Transformation (7). Frequency spectral components classified based on the range of area under the power spectrum as low frequency power (LF) betweem 0.025 to 0.15 Hz represents contribution from parasympathetic and sympathetic systems, high frequency power (HF) between 0.16 to 0.4 Hz represents contribution from parasympathetic system alone to cardiovascular system and the ratio of LF/ HF represents a measure of the balance of parasympathetic and sympathetic system influenced primarily by parasympathetic nervous system. The normalized units were calculated as LFnu=LF x 100/ (LF+HF) and HFnu= HF x 100/ (LF+HF).

Statistical analysis

The parameters were compared using repeated measures ANOVA (post hoc) for intra group comparisons and unpaired t test (parametric) and Mann- Whitney test (non-parametric)for inter group comparisons. $P < 0.05$ was taken as statistically significant.

Results&Discussion

Deep breathing through both nostril reduced/ improved the HR and BP in both yoga and control group. The fall/improvement was more pronounced in yoga group represented in Table 2. Reduction/ improvement in HR may reflect reduction in sympathetic activity or increase in parasympathetic activity. But the reduction in BP should be primarily due to decrease in sympathetic activity as

Table 1: Comparison between bilateral nostril, left nostril and right nostril breathing during normal and deep breathing maneuvers in control (C) n=18 and yoga (Y) n=16 group

Parameters		Normal Breathing Through			Deep Breathing Through		
		Both nostril	Left nostril	Right nostril	Both nostril	Left nostril	Right nostril
HR (beats/min)	C	82.0±11	81.5±13.3	82.5±11.9	81±8.8	83.3±7.3	84.5±7.3
	Y	78.7±8.0	75.3±8.7	82.5±8.9	75.8±8.4	70.2±9$^{\$}$	81.0±8.5
SBP (mmHg)	C	113.6±11.6	113.0±12.9	114.0±9.7	112.4±12.1	111.0±5.7	114.1±12.1
	Y	106.2±6.0$^{\$\$}$	100.8±5.7$^{\$\$\$}$	108.0±9.4$^{\$}$	103±4.5	95.7±11.6$^{\$}$	106.2±5.0
DBP (mmHg)	C	72.8±9.6	72.1±11.5	73.0±11.0	71.6±8.5	70.1±8.2	72.6±8.0
	Y	65.6±3.8	63.8±3.3	67.0±3.4	64.5±5.2	61.3±6.6	67.0±7.5
LF	C	202.0±188	198.0±132.0	210.0±156.0	214.0±114	203.8±111.3	220.0±192.0
	Y	277.3±124.4	255.8±106.5	297.3±104	316.5±145.8	258.7±132.8	386.6±132.7$^{\$}$
HF	C	141.0±151.0	151.0±125.0	128.0±116.0	219.5±178.5	239.0±169.2	191.0±127.0
	Y	236.0±124	266.0±126.0	198.0±146.0	457.0±190.0	529.0±254.0$^{\$\$\$}$	351.0±178.0$^{\bullet\bullet}$
LFnu	C	58.89±12.0	56.73±11.8	62.13±12.4	49.37±13.9	46.03±13.3	53.53±14.8
	Y	54.02±14.6	49.02±15	60.02±12.8	40.92±8.0	32.84±9.0	52.41±9.1$^{\bullet\bullet\bullet}$
HFnu	C	41.11±11.8	43.27±11.9	37.87±12.5	50.63±14.0	53.97±13.3	46.47±14.7
	Y	45.98±14.6	50.98±14.8	39.98±12.8	59.08±8.0	67.16±9.1	47.59±9.1$^{\bullet\bullet\bullet}$
LF/HF	C	1.43±0.8	1.31±1.2	1.64±1.4	0.97±0.5	0.85±0.4	1.15±0.8
	Y	1.18±0.6	0.96±0.9	1.50±1.2	0.69±0.6	0.49±0.8$^{\$\$}$	1.10±1$^{\bullet\bullet}$
Total Power	C	393.0±201.0	394.0±154.0	394.0±160.1	508.5±186.5	522.8±182.2	485.0±190.2
	Y	613.3±146.0	634.8±150.2	607.3±141.3	899.5±206.1	912.7±220.3	867.6±208.0

*Comparison between both nostril and left nostril , £ Comparison between both nostril and right nostril, • Comparison between left nostril and right nostril , # Comparison between normal breathing and deep breathing, $ Comparison between yoga and control group, *,•,$,#,£ : p<0.05 **,$$,£ £ ,##,••: p<0.01 ***,$$$,###, •••,£ £ £ : p<0.001

Table 2: percentage increase or decrease in cardiovascular parameters and HRV parameters in unilateral breathing as compared to bilateral nostril in each group

Parameters		Normal Breathing Through			Deep Breathing Through		
		Both nostril (exact values)	Left nostril	Right nostril	Both nostril*	Left nostril	Right nostril
HR (beats/min)	C	82.0±11	-0.61	0.61	-1.22	2.84	4.32
	Y	78.7±8.0	-4.32	4.83	-3.68	-7.39	6.86
SBP (mmHg)	C	113.6±11.6	-0.53	0.35	-1.06	-1.25	1.51
	Y	106.2±6.0$^{\$\$}$	-5.08	1.69	-3.01	-7.09	3.11
DBP (mmHg)	C	72.8±9.6	-0.96	0.27	-1.65	-2.09	1.40
	Y	65.6±3.8	-2.74	2.13	-1.68	-4.96	3.88
LF	C	202.0±188	-1.98	3.96	5.94	-4.77	2.80
	Y	277.3±124.4	-7.75	7.21	14.14	-18.26	22.15
HF	C	141.0±151.0	7.09	-9.22	55.67	8.88	-12.98
	Y	236.0±124	12.71	-16.10	93.64	15.75	-23.19
LFnu	C	58.89±12.0	-3.67	5.50	-16.18	-6.77	8.43
	Y	54.02±14.6	-9.26	11.11	-24.26	-19.74	28.09
HFnu	C	41.11±11.8	5.25	-7.88	23.17	6.60	-8.22
	Y	45.98±14.6	10.88	-13.05	28.50	13.67	-19.46
LF/HF	C	1.43±0.8	-8.47	14.52	-31.95	-12.54	18.14
	Y	1.18±0.6	-18.16	27.79	-41.06	-29.39	59.04
Total Power	C	393.0±201.0	0.25	0.25	29.39	2.81	-4.62
	Y	613.3±146.0	3.51	-0.98	46.67	1.47	-3.55

*As compared to normal bilateral nostril breathing

parasympathetic discharge has no direct effect on blood vessels. So it can be clearly stated that deep breathing through both the nostril reduces sympathetic activity but its effects on parasympathetic activity has to be confirmed with HRV findings. Discorillet al., has reported that metronome breathing at the rate of 12 breaths/ minute does not produce any significant change in radial artery BP [3]. Author also commented that the depth of breathing was more but the rate was similar to the subject's normal respiratory rate (RR) [3]. In our study the deep breathing was done at the rate of 6 breaths/ minute. So reduction observed in HR and BP in our study may be mainly due to the change in the RR rather than the change in depth of breathing.

While breathing at a comfortable rate through both nostril i.e., at rest, HR and BP were less in yoga group as compared to control group. Further it is interesting to note that their resting HR and BP were similar or even lesser as compared to values of control group doing deep breathing with both nostrils. The respiratory rate (RR) of the yoga practitioners at rest was less as compared to control group. Decreased resting RR may be a possible cause of decrease in resting HR and BP in yoga group but the RR was still above 6 breaths/ minute in all the yoga practitioners. So we can argue that eventhough the RR plays an important role in reducing HR and BP, regular practice of yoga can alter the basic tone of the discharge of autonomic nervous system irrespective of RR.

It has been reported that deep breathing through right and or left unilateral nostril in male subjects increases systolic blood pressure (SBP) and HR but not diastolic blood pressure (DBP) [2]. In our study we observed a decrease in HR, DBP and SBP after left nostril breathing in both deep and comfortable breathing in both groups. The fall was more after deep breathing (Table 2). So deep breathing increases the lateralization effect of unilateral breathing. Further the fall was more in yoga group as compared to control group. So it can also be concluded that the yoga training accentuates the lateralizing effect of unilateral nostril breathing on autonomic nervous function. Opposite to this, we were able to observe an increase in HR and BP after right nostril breathing. It has been reported that deep breathing is beneficial in heart failure patients where it increases baroreflex sensitivity and causes a significant decrease in DBP [8]. With our results we can suggest that the deep breathing with left nostril can give a better result to reduce the BP and to get the best, yoga (breathing practices) to be practiced.

Total power (TP) in frequency domain analysis indicates the overall HRV. Increase in TP decreases the risk for future cardiovascular diseases [9]. TP was increased after deep breathing through both nostrils in both the groups. TP was increased in yoga group as compared to control group both after comfortable breathing and deep breathing. HF represents parasympathetic activity while the LF represents predominantly sympathetic activity with small contribution from parasympathetic activity. Eventhough LF which denotes sympathetic activity was observed to rise after deep breathing, it should be noted that the corresponding increase in HF was more, ultimately resulting in decreased LFnu. Hence the basal tone of both sympathetic and parasympathetic are increased which ultimately increases the TP but the parasympathetic activity has a dominant hand over sympathetic activity which gets reflected in LFnu and the same was reflected in decreased HR as stated earlier. LFnu was lesser and HFnu was higher during deep breathing with both nostrils and left nostril as compared to comfortable breathing in both the groups. Further LFnu was found to be increased and HFnu was decreased during right nostril breathing. As we probed deeper into the percentage increase in the HFnu and decrease in LFnu, we were able to note that the there was a trend: Increase/decrease in HRV parameters in yoga group after normal comfortable breathing was more than that observed after deep breathing in control group and the increase/decrease in HRV parameters in yoga group deep breathing was more than that observed after normal breathing in the same group. LF/HF ratio was reduced after deep breathing(both nostrils) in both the groups and it was decreased in yoga group as compared to control group.

By considering both the cardiovascular parameters and the HRV parameters it can be deduced that yoga training can reduce sympathetic discharge and increase parasympathetic discharge even at rest and the deep breathing can bring those effects immediately. One of the limitation of this study is that we have not measured the duration for which the effects of deep breathing or unilateral nostril breathing lasts which would give the logical extension to the present study.

Our findings are consistent with the long held view that Chandra nadi pranayama (left nostril breathing) reduce sympathetic activity and Surya nadi pranayama (right nostril breathing) increase sympathetic activity. There are studies supporting that right nostril breathing have sympathetic stimulating effect [5,6] but there are very few reports regarding left nostril breathing.

There is growing evidence that cerebral laterality controls the autonomic function [10]. Right hemispheric inactivation is known to produce a significant decrease in BP and an increase of HF whereas left hemisphere inactivation produces increase HR, BP and LF [1]. Unilateral forced nostril breathing is known to differentially activate the two hemispheres and bring about improvement in specific cognitive tasks [11]. Forced nostril breathing in through one nostril produces a relative increase in EEG amplitude in the ipsilateral hemisphere and lateralized increase in release of catecholamine [11]. Thus, the decrease in DBP during left nostril deep breathing among yoga group can be attributed to activation of left hemisphere and inactivation of right hemisphere that predominantly influences sympathetic activity. During left nostril breathing HF was high in subjects and this indicates a predominant vagal modulation of cardiac activity. These interesting findings need confirmation using a larger sample size. The fact that modification of breathing alters HR, DBP and SBP of our yoga group more than the control group suggests that yoga practice has a specific effect on central autonomic modulation.

Earlier studies have shown that the yoga practitioner have lower resting HR and BP due to vagal predominance [12,13]. Our findings also are suggestive of sympathetic dominance during rest, among yoga group.

CONCLUSION

Deep breathing increases the TP in HRV.

Lateralization is more pronounced with yoga practice.

ACKNOWLEDGEMENTS

We would like to thank the participants in this study for their cooperation.

Conflict of Interest: Nil

Source of Funding: Nil

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DOI Number: 10.5958/j.2320-608X.1.2.024

Assessment of Central Processing Ability after Attending Theory Classes with Various Teaching Aids

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ABSTRACT

Context: In undergraduate medical education, one hour theory classes are integral part of teaching activity. Previously it was carried out by using black boards but now various teaching aids are available.

Aim: Study was planned to know the status of central processing ability after attending classes having various teaching aids.

Material and Method: Twenty (20), 2nd MBBS students were included in the study. Central processing ability was evaluated using Arithmetic Ability Test (AA). Subjective performance was assessed using Visual Analogue Scale (VAS) before and after theory classes with teaching aids.

Statistical Analysis: Paired't' test was used for analysis of the data.

Results: Statistically significant impairment in the performance was observed after attending the Over Head Projector (OHP) p= 0.0019, Power Point (PPT) p= 0.0023 and Black Board (BB) p= 0.0016 classes. Alteration in the performance was not significant after attending the classes with OHP along with BB and PPT along with BB. Significant differences were observed in all the three VAS after attending PPT and OHP along with BB classes and after PPT along with BB class in the VAS-2.

Conclusions: It can be concluded that mixing of OHP or PPT along with BB during the lecture is better method and central processing ability is best after attending such classes. Mixing of OHP or PPT along with BB during the lecture is better method of undergraduate teaching.

Keywords: *Central Processing, Over Head Projector, Power Point, Visual Analogue Scale*

INTRODUCTION

In undergraduate medical education, one hour theory (lecture) classes are integral part of teaching activity. Histories of lectures are available since the time of Greeks of the fifth century BC, and from the medieval times, as the most common form of teaching method [1]. Moreover, limited number of faculties and resources in medical colleges are also responsible for more theory classes. It indicates that lectures are important tool of teaching methodologies; otherwise it might be replaced with other tools.

The main purpose of this method is to deliver the information. In this method the lecturer speaks for a specified period of time and the students listen and record [2]. In the process of learning the student perceives, processes, stores and recalls what they are attempting to learn [3]. Participation by the students is generally minimal in the method. But the advantage is that this mode of teaching can be used in any size and often large classes [2].

Previously theory classes were arranged by using chalk and black board (BB) method. In recent years, undergraduate medical education has been changed with adoption of new methods of teaching including use of audiovisual aids during lectures [4]. Lectures are delivered with the help of Overhead Projector (OHP) and Power Point (PPT). The models of learning focus on different aspects of the learner like cognitive personality style or information processing style [2].

Various studies have been conducted for comparison between effectiveness of lectures using PPT, OHP and black board. But there are mixtures of

views regarding the superiority of one method over the other and not clear whether the use of a particular lecture delivery method is superior to others [5]. Therefore, we planned this study to evaluate the effectiveness of lecture delivery method by assessing the status of central processing ability after attending the lectures having various teaching aids.

MATERIALS AND METHOD

Rajiv Gandhi Institute of Medical Sciences (RIMS) Adilabad is a medical college located in north tribal region of Andhra Pradesh, India with intake capacity of 100 students each year. This work is based on data taken from the academic year 2010-2011. A total of 20 (n=20) volunteers from second MBBS students of RIMS Adilabad were included in the study after taking informed consent and permission from the institutional authorities. Subjects receiving drugs like sedatives, antianxiety or antihistamines were excluded from the study [6]. None of the subjects was dependent on alcohol, tobacco or other drugs. The volunteers were asked to refrain from smoking, drinking alcohol or taking any medication one day prior to the study [7, 8, 9,10]. Each volunteer acted as his own control.

Central processing ability was evaluated using Arithmetic Ability Test (AA) in which the volunteers were asked to solve simple mathematical problems i.e. addition, subtraction, multiplication and division (five of each) within two minutes time. The score was given depending upon the number of correct problems solved [8, 11].

Visual Analogue Scales (VASs) were used for assessment of subjective performance since by these scales subjects can express their mood, feeling and current state of awareness. The subjects were asked to indicate the state of their current feeling by marking on a 100 mm horizontal line [12]. The midpoint of each scale was taken as normal state. The semantic opposites for VAS-1 were; alert———dull, for VAS-2; ability to concentrate————inability to concentrate and for VAS-3; active———tired. 100 marks were considered at the positive feeling side of the scale; towards left side (alert, ability to concentrate and active), 0 marks was allotted towards negative side of the scale; towards right side (dull, inability to concentrate and tired) while midpoint was considered as 50 marks.

Performance studies were carried out before and after exposing the volunteers to lectures with different visual aids like BB, OHP, PPT and OHP along with BB and PPT along with BB. Paired't' test was applied using Prism software, version 5.03 (Trial) for the analysis of data. Power of the study was 80%.

RESULTS

Statistically significant impairment in the performance on the AA score was observed after attending the lectures in which OHP (p= 0.0019), PPT (p= 0.0023) and chalk with BB (0.0016) was used (Table 1 & 2). Alteration in the performance was not significant statistically after attending the class in which OHP and BB both were used and in the class in which chalk and BB was used along with PPT (Table-3).

Table 1: AA and VASs performance

Test	OHP			PPT		
	Mean (SD)			Mean (SD)		
	Pre Class	Post Class	p value	Pre Class	Post Class	p value
AA	11.35(2.2)	8.85(2.5)	0.0019*	11.05(3.4)	8.25(2.3)	0.0023*
VAS- 1	62.25(35.3)	64.25(29.9)	0.8002	80.25(22.6)	56.25(29.4)	0.014*
VAS- 2	59.00(36.5)	61.25(30.8)	0.7934	79.5(18.6)	47.5(31.5)	<0.001*
VAS- 3	58.75(35.4)	60.75(34.4)	0.8213	81.00(23.7)	49.75(31.0)	0.0012*

SD= Standard Deviation, *= significant p value

Table- 2: AA and VASs performance in BB classes

Test	BB		
	Mean (SD)		
	Pre Class	Post Class	p value
AA	12.6(2.1)	10.85(2.4)	0.0016*
VAS- 1	60.0(34.0)	55.75(33.7)	0.3464
VAS- 2	59.5(33.3)	55.00(31.4)	0.4312
VAS- 3	59(35.6)	51.5(31.5)	0.051

SD= Standard Deviation, *= significant p value

Table 3: AA and VASs performance

Test	OHP + BB			PPT + BB		
	Mean (SD)			Mean (SD)		
	Pre Class	Post Class	p value	Pre Class	Post Class	p value
VAS- 1	81.25 (20.6)	67 (25.8)	0.0271*	83.25 (16.6)	81 (12.2)	0.4895
VAS- 2	76.5 (23.7)	64 (23.9)	0.0358*	83.75 (15.8)	75.75 (14.8)	0.0186*
VAS- 3	82.75 (15.0)	67 (23.6)	0.014*	79 (17.2)	74 (18.5)	0.3431

SD= Standard Deviation, *= significant p value

Statistically significant differences were observed in all the three VAS after attending classes in which PPT and OHP along with BB were used (Table 1 & 3) as the state of feeling was indicated more towards dull, inability to concentrate and tired side (Shifting of VASs toward right side). In the class where PPT and BB both were used significant difference was observed on the VAS-2 as the performance was more towards inability to concentrate side (Table-3).

DISCUSSION

Present study was planned with the intention to know which of the lecture delivery methods are superior, PPT, OHP, BB, PPT and BB or OHP and BB by evaluating central processing ability which is a measure of cognitive (psychomotor) performance. As far as superiority is concerned we found that those lectures which are taken with help of PPT along with BB and OHP along with BB are better than other methods.

There are mixed literature regarding the superiority of an individual method. In the study of Novelli and Fernandes, student preferred BB method in comparison to OHP and PPT methods [13]. Chaudhary R et al also found that students favored BB teaching instead of teaching with OHP. [2] Lowry observed marked improvement in examination results when use of OHP was replaced with PPT [14]. But Bartsch and Cobern found that performance of student was less when they were taught using PPT in comparison to other groups [15]. Vikas Seth et al concluded that students preferred PPT over OHP subjectively and on the objective tests their performance was also far better after attending the classes with PPT and BB than after classes with OHP [5]. In the study of Szabo and Hastings, they have not observed any difference in the performance of students who were taught by different methods [16].

In the study, central processing ability was not impaired after attending the classes in which PPT or OHP was combined with BB. Probably it may be due to even individuals with strong learning style preferences, likes variety of teaching approach to avoid boredom [17]. PPT encourages active learning environment [18], enhances memory retention and analytical skills [19]. Integration of text and images makes it as more interesting and engaging method which improves educative value [20]. While BB classes are more students centric because of natural pauses and breaks which occur during writing on the BB, it allows students to take down the notes leading to their increased concentration towards the topic. In the classes with OHP, it is easier to take notes if handwriting is good; lecturer faces the audience leading to alertness. That's why combination of PPT or OHP with BB minimizes the disadvantages of each teaching method leading to better performance on the central processing ability parameter of cognitive component.

In the classes in which only PPT or OHP or BB was used significant impairment was observed in the central processing ability. It may be because; PPT reduces teacher/ student interaction [21]. Student becomes a passive observer with very little active participant [22]. Some ill prepared lectures contain too much material which is delivered very fast and thus creates boredom.

Faculties use BB for very short duration and rarely write on it or if write then only few key words. Turning towards BB side is responsible for loss of teacher's eye contact with students. Illegible hand writing coupled with continuous speech creates monotonous atmosphere leading to loss of interest and impairment in performance.

In OHP class, if quality and hand writing is not good it leads to poor visibility and if much material

is kept in single transparency which is delivered too quickly, it sometimes serves as a distraction [23]. All these factors are responsible for loss of concentration in the class.

Our subjective findings are not correlated with objective results except in PPT alone class in which student indicated dullness, inability to concentrate and tiredness significantly and in PPT with BB class where they felt no significant change in their state of feelings in VAS-1 and VAS- 3. Although objectively their performance was not impaired after OHP with BB class but subjectively they don't prefer that method. PPT alone method was also disliked by the students. While they preferred BB alone and OHP alone class more readily. Maxwell studied the sensitivity and accuracy of VAS by a psycho-physical classroom experiment and indicated adequate sensitivity of VAS but also stated that exactly statistically significant wrong results can also occur [24].

CONCLUSION

We conclude that use of only single lecture delivery method create monotonous atmosphere for the learners which impairs their central processing ability during that period. It decreases their ability to understand the topic. Mixing of OHP or PPT along with traditional method of chalk and BB during the lecture is useful to maintain interest and attention. Thus it will be helpful for students to learn the topic.

Conflicting Interest: Nil

Source(s) of Support: Nil

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DOI Number: 10.5958/j.2320-608X.1.2.025

Effects of Right Lateral Position of Body on Cardiovascular Parameters

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ABSTRACT

Aim of this study was to assess the effects of right lateral position of body on cardiovascular parameters. Systolic blood pressure, diastolic blood pressure and heart rate are the main cardiovascular parameters. A total of 100 healthy male subjects were chosen for the study. Systolic blood pressure, diastolic blood pressure and heart rate were recorded after 10 minutes of rest in supine position and right lateral position. Systolic blood pressure, diastolic blood pressure and heart rate were significantly lower in right lateral position than supine state. The results suggest higher vagal activity and lower sympathetic activity in right lateral position of the body.

Keywords: *Right Lateral Position, Systolic Blood Pressure, Diastolic Blood Pressure, Heart Rate*

INTRODUCTION

Blood pressure and heart rate are important cardiovascular parameters. Measurement of systolic blood pressure, diastolic blood pressure and heart rate is very easy, rapid and non invasive diagnostic tool for assessment of health status of cardiovascular system. Like other various visceral activities of body, blood pressure and heart rate are controlled by autonomic nervous system. Both of its divisions-sympathetic and parasympathetic, act independently but synergistically and often in opposite directions. Baroreceptors play important role in regulation of blood pressure and heart rate[1].

The sympathetic nerves that constrict arterioles and veins and increase heart rate and stroke volume discharge in a tonic fashion, and blood pressure is adjusted by variations in the rate of this tonic discharge. Impulses reaching the medulla also affect the heart rate via vagal discharge to the heart. The neurons from which the vagal fibers arise are in the dorsal motor nucleus of the vagus and the nucleus ambiguous. When vasoconstrictor discharge increases, arteriolar constriction also increases and blood pressure rises. Venoconstriction and a decrease in the stores of blood in the venous reservoirs usually accompany these changes, although changes in the capacitance vessels do not always parallel changes in the resistance vessels. Heart rate and stroke volume are increased because of activity in the sympathetic nerves to the heart, and cardiac output is increased.[2].

Autonomic nervous system is influenced by many factors like orthostatic stress, cold shower, body posture etc [3]. Postural stress in the form of head –up tilt produces sustained increase in heart rate and rate pressure product, so tilting can be used for assessing the integrity of autonomic cardiovascular regulatory mechanisms in physiological as well as clinical situations [4, 5]. Studies have shown a decreased vagal activity in various physiological and pathological conditions such as congestive heart failure and coronary artery disease [6, 7]. Also, the pharmacological measures have been tried to increase the vagal activity in patients of cardiac diseases [8, 9]. Therefore any physiological means that can increase the vagal activity may be helpful in maintaining general well being and delay the disease process. The autonomic nervous system is amenable to cortical influences.

Though change in posture influences autonomic activity, but not much work has been done in this regard. The primary aim of this study therefore, was to find out the body posture which may enhance vagal tone or reduce sympathetic tone in healthy adult males.

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MATERIAL AND METHOD

One hundred asymptomatic healthy male subjects, aged 20-30 years, participated voluntarily in the present study, undertaken, to assess the effects of right lateral position of body on cardiovascular parameters -systolic blood pressure, diastolic blood pressure and heart rate during rest

Experiment procedures were in accordance with the ethical committee on human experimentation and were carried out at ambient temperature with minimal external or internal sound disturbances in the room. Subjects reported to laboratory 2 hours after light lunch. They were explained in detail about the experimental procedure. Informed consent was taken from all subjects. Systolic blood pressure (SBP), diastolic blood pressure (DBP) and heart rate (HR) were recorded by using automatic sphygmomanometer (National). The accuracy of the apparatus was compared and checked from time to time with mercury sphygmomanometer. Study was done in 2 steps. Each subject lied in supine (step-1) posture for 10 minutes. SBP, DBP and HR were recorded from left arm. The above tests were repeated with subjects in right lateral position (step-2). Statistical analysis was done by paired t- test using the window SPSS Statistics 17.0 version.

FINDINGS

Table 1: Comparison of Cardiovascular Parameters in Supine and Right Lateral Positions of Body

S. N.		Supine	Right lateral	p-value
1	SBP	118.54±7.39 *	115.42±8.29 **	<0.001
2	DBP	74.10±8.20*	72.44±7.29*	<0.01
3	HR	75.14±7.82 *	70.14±6.53 **	<0.001

Data presented are mean ± SD. Analysis of data was done by paired t- test.

Table 1 shows that basal systolic blood pressure, diastolic blood pressure and heart rate were significantly lower in right lateral position as compared to supine state. Decrease in systolic blood pressure and heart rate were more significant ($p < 0.001$) in comparison to decrease in diastolic blood pressure ($p<0.01$) in right lateral position.

CONCLUSION

Change in heart rate or stroke volume produces variations in cardiac output. Heart rate is controlled by the cardiac innervations, sympathetic stimulation increasing the rate and parasympathetic stimulation decreasing it. The stroke volume is also determined in neural input as well as on preload and after load on cardiac muscle. Preload is increased with increase in venous return to heart while after load is increased with increase in peripheral resistance in arterial tree and vice versa. In resting state, venous return to heart is affected by gravity. The peripheral resistance in the body in man is primarily controlled by the arterioles which are richly supplied with sympathetic fibers, but sparse parasympathetic innervations but acetylcholine stimulates synthesis of nitric oxide which produces vasodilatation.

An increase in intra pericardial pressure limits the extent to which the ventricle can fill. So does a decrease in ventricular compliance, i.e., an increase in ventricular stiffness produced by myocardial infarction, infiltrative disease, and other abnormalities. Contractions of atria aid ventricular filling. The other factors affect the amount of blood returning to the heart and hence the degree of cardiac filling during diastole. An increase in total blood volume increases venous return. Constriction of the veins reduces the size of the venous reservoirs, decreasing venous pooling and thus increasing venous return. An increase in the normal negative intra thoracic pressure increases the pressure gradient along which blood flows to the heart, whereas a decrease impedes venous return. Standing decreases venous return, and muscular activity increases it as a result of the pumping action of skeletal muscle [2].

Table 1 shows that basal systolic blood pressure, diastolic blood pressure and heart rate were significantly lower in right lateral position as compared to supine state. Decrease in systolic blood pressure and heart rate were more significant ($p < 0.001$) in comparison to decrease in diastolic blood pressure ($p<0.01$).

Human S-A node receives its vagal innervations mainly from right vagus nerve. The right vagus nerve in the neck might be stimulated by periodic massage from the pulsation of the carotid artery in the right lateral decubitus position leading to higher parasympathetic activity. The position of the heart is lower in the left lateral decubitus than in the right lateral decubitus position. Gravity might exert an increased workload on cardiac function when the left lateral decubitus is assumed. A larger workload required in left lateral decubitus, as compared with the right lateral decubitus position, will produce more sympathetic and less vagal activity. Reduction in this

workload in right lateral decubitus position will lead to an enhancement of vagal activity. Because of right sided anatomical position of right atrium, the venous return from the venous system via inferior and superior vena cava to the right atrium is more favorable when assuming the right lateral decubitus position, which may increase vagal activity. While in left lateral position, venous return is less in comparison to supine and right lateral decubitus. To compensate for decrease in venous return and cardiac output, sympathetic tone is enhanced and vagal tone is suppressed in left lateral position [11]. Therefore there is possibility of, higher vagal activity and lower sympathetic activity in right lateral position with reversal of autonomic activity in left lateral position.

Acknowledgements: Nil

Conflict of Interest: Nil

Source of Funding: Nil

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DOI Number: 10.5958/j.2320-608X.1.2.026

Relationship between Self-concept and Academic Achievement in 17-19 Years Old Students

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ABSTRACT

Introduction: Over the past decades, self-concept has been extensively studied in relation to academic achievement. However, there is little agreement about the causal ordering of these constructs. This paper seeks to address the issue of causal relations between self-concept and academic achievement in young Indian students.

Material and Method: Participants were 17-19 yrs old students of both sexes preparing for All India Pre Medical Test (AIPMT) and enrolled with reputed coaching classes in Delhi. Self-concept was measured twice over a period of one year using Self Description Questionnaire III (SDQ III). Qualifying AIPMT 2012 was taken as a measure of academic achievement.

Findings: The authors found no statistically significant differences in the self-concept scores of students, before and after qualifying AIPMT. Similarly there were no significant differences in the before and after self-concept scores of students who could not qualify AIPMT and pursued alternative courses. However, before appearing for AIPMT, those who eventually qualified had statistically significant higher scores on most scales of SDQ III.

Conclusion: Prior self-concept strongly influences subsequent academic achievement. However, neither academic achievement improves prior self-concept nor failure deteriorates prior self-concept.

Keywords: *Self-Concept, Academic Achievement*

INTRODUCTION

The study of self-concept has awakened growing interest in psychological research of recent years. Self-concept has been linked to various education outcomes such as academic effort, coursework selection, educational aspirations and academic achievement[1].

There are several definitions of self-concept but the most unanimously accepted is the one given by Shavelson et al. They have defined self-concept as the perception that one has about oneself, formed from experiences and relationships with the environment, where significant people play an important role[2]. It is multi-dimensional and hierarchically organised. Self-esteem or general self-concept is positioned at the apex and is divided into academic (English and Maths) and non-academic (physical, social and emotional) components.

Based upon Shavelson's model of self-concept, Marsh et al. developed the Self Description Questionnaire (SDQ). The SDQ III is one of a series of three instruments designed to measure self-concepts for preadolescents (SDQ I), young adolescents (SDQ II) and late adolescents and young adults (SDQ III)[3]. It is a comprehensive, valid, stable and consistent instrument containing 136 items and measuring 13 areas of self-concept.

An abundance of research has examined the relation between self-concept and academic achievement. However there are no conclusive studies that clearly identify the direction of the link which joins these two variables. The present study differs from earlier studies in that it focuses on the direction of causality. The authors have approached this research keeping three objectives in mind.

1. To determine whether prior self-concept affects subsequent academic achievement.
2. To determine whether academic achievement affects subsequent self-concept.
3. To determine whether self-concept and academic achievement are mutually reinforcing.

METHODOLOGY

Participants: The study sample consisted of 50 students of both sexes, in the age group of 17-19 yrs and enrolled with reputed coaching classes in Delhi for the preparation of All India Pre Medical Test (AIPMT). The students were either in class XII in the academic session 2011-2012 or taking a gap year for the preparation of AIPMT.

Research Instrument: The research used SDQ III which is a self explanatory questionnaire, intended for use by late adolescents and young adults in the age range of 16-25 yrs. No special training is needed to administer the SDQ III. The 136-item SDQ III assesses 4 areas of academic self concept, 8 areas of non-academic self- concept and a single general esteem. On the SDQ III, each item is a simple declarative statement with 8 possible responses, varying from definitely false scoring 1 to definitely true scoring 8. Each of the 13 SDQ III scales is inferred on the basis of responses to 10 or 12 items, half of which are negatively worded. The scoring for the negatively worded items is reversed. For each scale the lowest possible score is 10 or 12 and highest possible score is 80 or 96.

Procedure: The study involved two waves of data collection spanning over a period of 1 yr. Informed consent was obtained from 86 students and SDQ III was then administered to them for the first time in April 2012 (phase I) in groups of 15-20 students, during class time, over a period of 2 days. No discussion was allowed through the test. The SDQ III was administered for the second time in April 2013 (phase II), almost 8-9 months after the declaration of AIPMT result. However, only 50 students could be traced in phase II and data was obtained from 30 students who qualified the AIPMT and were studying in first year M.B.B.S. (group I) and 20 students who could not qualify the AIPMT and were pursuing alternative courses like BSc(H), BSc(nursing), BPhty (group II).

The measure used to assess academic achievement was qualifying the AIPMT 2012, conducted by Central Board of Secondary Education. The entrance exam consisted of a preliminary and final exam and tested the knowledge of students in Physics, Chemistry and Biology through objective type questions.

Data Analysis: Descriptive statistics were used to calculate the means and standard deviations of the 13 scales of SDQ III. A two tailed t-test was employed to examine the differences in the self-concept-

- In phase I between group I and group II
- Between phase I and phase II of group I students.
- Between phase I and phase II of group II students. p value <0.05 was considered significant.

FINDINGS

The characteristics of study groups are summarized in Table 1. The comparison of SDQ III scores in phase I between group I and group II are presented in Table 2. Group II had statistically significant lower scores in phase I on all scales except for Physical ability, same sex and opposite sex peer relations. Table 3 presents the phase I and phase II SDQ III scores of group I students. No statistically significant differences were found in the scores on all scales. However, the total SDQ III scores in phase II were significantly higher. Table 4 presents the phase I and phase II scores of group II students. No statistically significant differences were found on any of the scales.

Table 1: Characteristics of study sample

	Group I	Group II
No. of subjects	30	20
Age in yrs.	17.6±0.67	17.5±0.83
Male : Female ratio	14:16	12:8

Table 2: Comparison of SDQ III scores in phase I between group I and group II

Scale	Group I	Group II	p value
Maths	54.40±14.08	46.35±12.81	0.04*
Verbal	57.37±10.34	49.10±9.23	0.0*
Academic	59.67±9.66	47.40±10.71	0.0*
Problem solving	57.93±9.06	45.55±11.94	0.0*
Physical ability	55.87±12.49	49.75±13.74	0.11
Physical appearance	56.27±8.63	46.95±10.32	0.0*

Table 2: Comparison of SDQ III scores in phase I between group I and group II (Contd.)

Scale	Group I	Group II	p value
Same sex peer relations	60.33±11.27	54.45±11.61	0.08
Opposite sex peer relations	51.30±11.07	47.35±10.58	0.21
Parent relations	67.60±7.65	49.85±12.91	0.0*
Spiritual values/religion	60.87±13.0	47.95±13.74	0.0*
Honesty/ trustworthiness	67.60±9.94	51.65±12.49	0.0*
Emotional stability	53.93±6.71	46.70±14.62	0.02*
General esteem	80.07±10.38	63.75±14.64	0.0*
Total score	783.20±63.18	649.90±61.06	0.0*

*P<0.05

Table 3: Comparison of SDQ III scores between phase I and phase II of group I

Scale	Group I	Group II	p value
Maths	54.40±14.08	57.57±13.38	0.37
Verbal	58.17±9.95	61.30±7.53	0.17
Academic	59.67±9.66	59.67±9.69	1
Problem solving	57.93±9.06	58.33±8.60	0.86
Physical ability	55.87±12.49	58.67±11.07	0.36
Physical appearance	56.27±8.63	59.17±9.73	0.22
Same sex peer relations	60.33±11.27	59.80±8.43	0.83
Opposite sex peer relations	53.77±10.04	57.37±9.07	0.15
Parent relations	67.60±7.65	68.33±10.49	0.75
Spiritual values/religion	60.87±13	67.60±13.23	0.05
Honesty/ trustworthiness	67.60±9.94	67.30±12.71	0.91
Emotional stability	53.93±6.71	57.30±11.25	0.16
General esteem	80.07±10.38	84.50±7.08	0.05
Total score	783.20±63.18	817.80±45.70	0.01*

*P<0.05

Table 4: Comparison of SDQ III scores between phase I and phase II of group II

Scale	Group I	Group II	p value
Maths	49.45±12.98	46.3±13.36	0.45
Verbal	49.1±9.23	48.7±10.76	0.90
Academic	47.4±10.71	48.55±8.59	0.71
Problem solving	45.55±11.94	49.05±8.88	0.29
Physical ability	49.75±13.74	46.7±16.39	0.52
Physical appearance	46.95±10.31	46.4±10.23	0.86
Same sex peer relations	54.45±11.61	52.75±9.38	0.61
Opposite sex peer relations	47.35±10.58	42.15±11.63	0.14
Parent relations	49.85±12.90	52.75±12.87	0.48
Spiritual values/religion	47.95±13.73	56.85±17.25	0.07
Honesty/ trustworthiness	51.65±12.48	56.65±12.57	0.21
Emotional stability	46.7±14.61	47.0±12.90	0.94
General esteem	63.75±14.63	63.4±11.75	0.93
Total score	649±61.06	658.1±73.56	0.26

DISCUSSION

Prior knowledge from many educational researches clearly point out that self-concept is an important factor that affects student's academic achievement[4] .The present study was designed to examine the causal relationship between self-concept and academic achievement and whether the two variables are mutually reinforcing or not.

Looking at the results as obtained through three approaches it was found that in phase I, group I students had significantly higher SDQ III scores on all scales of academic self-concept, all scales of non-academic self-concept except physical ability, same sex peer relations and opposite sex peer relations. Total SDQ III scores were also significantly higher for group I. However, self-concept is more adequately captured in terms of multidimensional profile of self-concept scores rather than a single total score[5]. The phase I and phase II scores of the two groups were not significantly different. This suggests that prior self-concept strongly influences subsequent academic achievement, or in simple words, how people value themselves positively influences their academic achievement. However, neither does success in a competitive exam improve prior self-concept nor does failure deteriorate prior self-concept.

The results are partly consistent with the results of a landmark study by Marsh[6]. In this study, he tested the causal ordering of academic self-concept and academic achievement with four waves of data (last three years of high school and 1 year after high school graduation). He found support for reciprocal effects in which the largest paths were from prior academic self-concept to subsequent school grades. A later study by Marsh and Yeung and a review of reciprocal effects model by Marsh and Craven also demonstrate that academic self-concept and academic achievement are both a cause and an effect of each other [7,8]. In contrast studies by Chapman and Turner, Bachman and O'Malley have shown no significant causal influence self-concept and academic achievement[9,10].

Our data does not support two of our three assumptions i.e. academic achievement affects subsequent self-concept and that self-concept and academic achievement are mutually reinforcing. Similar results have been reported by Byrne, who found no cross-lagged effects and by Shavelson and Bolus who reported causal predominance of self-concept over academic achievement [4,11]. The present study has few limitations. There are several student characteristics such as conscientious effort, intrinsic motivation, persistence in the face of difficulties, academic choice and coursework selection which might positively influence prior self-concept and hence subsequent academic achievement. Parents' educational background and socioeconomic status might also have a role to play. However, in the present study we did not take these factors into consideration because all the students were enrolled with reputed coaching classes which are not affordable by everybody. There was not much difference in their family backgrounds.

In conclusion, results of previous studies in different age groups show no consistent pattern and our results also do not allow any firm conclusion to be drawn about the causal ordering of self-concept and academic achievement. But our results support the idea that total self-concept has a stronger influence on subsequent academic achievement. Further research is needed in multi-wave, multi variable fashion to explore the psychological processes that mediate the effects of prior self-concept on subsequent academic achievement. Parents and teachers should be offered methodological guidance so that they can put more effort into enhancing student's self-concept rather than fostering achievement.

Conflict of Interest: None

Source of Funding: Self funded

Ethical Clearance: Permission was taken from institutional research committee

Acknowledgement: Authors are thankful to the subjects for their support in the completion of this work.

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DOI Number: 10.5958/j.2320-608X.1.2.027

Prevalance of Diabetes, Hypertension, Renal Dysfunction and Hyperlipidemia among Doctors of a Medical College in Odisha

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ABSTRACT

There is increasing evidence that a doctor with a healthy lifestyle tends to have a positive influence on their patients' health behaviours. They are at higher risk for diabetes, hypertension, renal dysfunction and hyperlipidemia. The present study focuses on finding prevalence of the above mentioned conditions and thus generating awareness among present doctors and future generation young doctors regarding their health status. 169 doctors of Kalinga Institute of Medical Sciences, Bhubaneswar, Odisha consented for the present study. Age, sex, height, weight, body mass index, blood pressure, fasting blood sugar, lipid profile (triglycerides, cholesterol, HDL, LDL, VLDL), serum creatinine, urine albumin, food and other habits were documented for each subject. Comparison was done between 121 males and 48 females of different age groups for hypertension, diabetes, hypercholesterolemia, hypertriglyceridemia, albuminuria and renal dysfunction. Nearly 60% of doctors in the study were found to be hypertensives, 26% had hypercholesterolemia, 27% had hypertriglyceridemia, 7% had albuminuria and 67% had high levels of HDL. It was observed that older age group doctors were hypertensives while middle aged doctors had diabetes while younger doctors had higher lipid profiles. As seen from studies in Southern and Nothern India, our study also shows similar trend of higher prevalence of modifiable risk factors for non-communicable diseases in Eastern India. This calls for interventional studies to curb the rapid progression of morbidity and mortality among doctors.

Keywords: *Diabetes, Hypertension, Renal Dysfunction, Hyperlipidemia, Hypercholesterolemia, Hypertriglyceridemia, Albuminuria, Doctors, Odisha*

INTRODUCTION

Increasing incidence of lifestyle disorders such as diabetes and hypertension are being reported among doctors in recent years. Doctors presumably lead a stressful life with little time to relax physically and mentally. Many of them adopt a "club life culture, with lack of physical exercise falling prey to lifestyle disorders. It is evident that a doctor with a healthy lifestyle tends to have a positive influence on their patients' health behaviour[1]. The paradox of the situation is such that the doctors advising their patients to undergo exercise, dietary restrictions, regular medical checkups, avoidance of alcohol, smoking and tobacco abuse, themselves can be questionable on each of these parameters. Lack of time, sedentary lifestyle, higher socio-economic status and challenge of balancing personal and professional lives are few to list the many factors which could explain the lack of adequate health care of doctors [2]. Altruistic attitude might be the cause of putting their professional lives to the forefront, giving less importance to personal health and specific time for self-relaxation.

Although many studies have emerged from developed rich countries, scanty data exist from

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developing countries like India and particularly from Eastern India where malnutrition is common and diet is different. This has motivated to conduct the study on all doctors working in a medical college hospital of Odisha.

Diabetes, dyslipidaemia, hypertension and metabolic syndrome are the bench-mark of future clustering of morbidities and mortalities. Renal dysfunction and hypercholesterolemia are recognised as public health problem since they are associated with poor cardiovascular outcome as well as progression to end stage renal disease both being conditions that require high health care expenditures.

MATERIALS AND METHOD

A cross-sectional study was undertaken at Kalinga Institute of Medical Sciences, Bhubaneswar, Odisha from September 2011 till May 2012, after obtaining approval of the Institutional Ethics Committee and consent of the subjects. 169 doctors (121 males and 48 females), aged between 24 to 70 years (mean age of 41.72 ± 14.56 years) volunteered to participate in the study. Simple questionnaires pertaining to vegetarian or non-vegetarian diet, smoking and alcohol habits, exercise, prior medical history with drug intake, and any relevant family history of cardiovascular disease, diabetes mellitus or chronic kidney disease were answered by the doctors. Thereafter, they were subjected to physical examination of height, weight and blood pressure. Height was recorded using a standard height measuring rod calibrated in inches and converted into meter. Weight was measured using a standard physicians weighing machine and body mass index (BMI) was computed using the formula: BMI = Weight (in kg) / [Height (in m)]^2.

The subjects were grouped according to their BMI as underweight (BMI<18.5kg/m^2), Normal BMI (BMI 18.5- 24.9 kg/m^2), Overweight (BMI 25-29.9 kg/m^2) and Obese (BMI >30kg/m^2).

Right arm blood pressure was measured by mercury sphygmomanometer in sitting position after 15 minutes of complete physical and mental relaxation. Three readings were recorded by palpatory and auscultatory methods by trained observers and the average of higher two readings was considered for this study. A systolic blood pressure (SBP) reading between 120 – 140 mm of Hg was considered as pre-hypertensive levels and above 140mm of Hg as hypertension. Similarly, diastolic blood pressure (DBP) above 80mm of Hg was considered as pre-hypertensive and above 90mm Hg as hypertension, according to the Joint National Committee –VII criteria.

Fasting Blood sugar (FBS) estimation, Triglycerides (TG), Cholesterol (Chol), high density lipoproteins (HDL), low density lipoproteins (LDL), very low density lipoproteins (VLDL), serum creatinine (S.Cr) and urine albumin (U. Alb) were estimated by standardized procedures followed in the Central Laboratory of the institute. Plasma glucose was estimated by glucose – oxidase peroxidase method and lipids by standard enzymatic method using Hitachi 902 Auto-analyser. Reagents of Roche diagnostics (Germany) were used. Albuminuria was conducted from a fresh morning urine sample by Albistix method and was graded as nil, trace, one+ and above.

Diagnosis of diabetes was made if the fasting plasma glucose was > 126mg/dl. Hypercholesterolemia was defined as total cholesterol ≥ 200mg/dl and/or LDL cholesterol ≥ 100mg/dl. Hypertriglyceridemia was defined as triglycerides ≥ 150mg/dl. Low HDL cholesterol levels less than 40 mg/dl in men and less than 46mg/dl in women were considered as normal. Serum creatinine values between 0.7-1.2mg/dl were considered under normal range. Presence of significant amount of albumin in urine and abnormal range of serum creatinine were considered as indicators of renal dysfunction.

The data collected was analyzed using SPSS version 16 software. For all statistical purposes, two tailed p-value of <0.05 was considered as statistically significant.

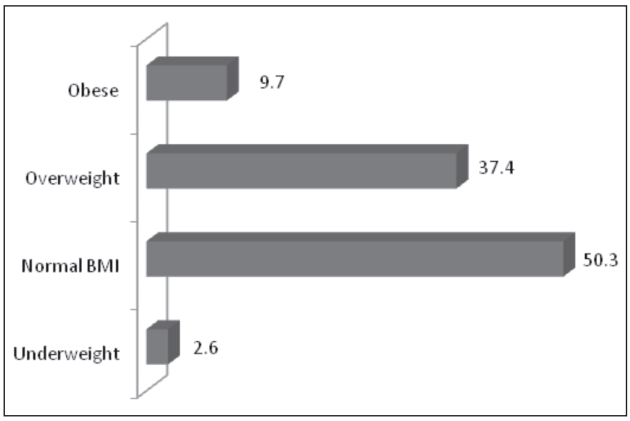
RESULTS

The mean ± SD values of the different parameters of males and females are shown in Table-1. The percentage of distribution of subjects according to BMI categories are depicted in Graph -1. More number of females were obese as compared to males ($p<0.001$) while a statistically significant number of males were overweight. Most of the subjects had SBP in pre-hypertensive levels and DBP in hypertensive levels; nearly 50% of females were normotensives while over 60% males had SBP and DBP of pre-hypertensive levels. It can be concluded that diastolic hypertension was more prevalent than systolic hypertension. 101 subjects (82 males and 19 females) were detected as hypertensives, of which 55 subjects were pre-hypertensives, 36 had Stage I hypertension and 10 subjects had Stage II Hypertension (according to JNC7 criteria).

Table 1. Mean values of all parameters as compared to males and females

	MALES		FEMALES	
	Mean ±SD	**t-value**	**Mean**	**t-value**
Age (in years)	43.32±15.480	30.400**	37.79±11.198	23.381**
Height (in m)	1.69±0.082	213.721**	1.56±0.087	122.218**
Weight (in kg)	70.88±10.074	74.799**	61.07±9.737	43.456**
BMI (in kg/m^2)	25.02±3.318	78.596**	25.08±4.993	34.441**
SBP(mm Hg)	128.07±12.916	103.999**	118.44±15.123	52.539**
DBP(mm Hg)	84.00±8.018	109.873**	77.21±9.369	57.092**
FBS (mg/dl)	98.30±28.533	35.804**	90.09±28.301	21.354**
S.Cr (mg/dl)	1.028±0.185	58.153**	0.98±0.152	42.915**
Chol (mg/dl)	179.12±42.067	44.250**	182.40±32.830	5.465**
TG (mg/dl)	147.63±74.215	20.577**	131.07±43.48	19.994**
HDL (mg/dl)	43.78±8.419	54.292**	47.11±9.982	31.659**
LDL (mg/dl)	104.26±36.321	29.692**	109.33±36.75	19.956**
VLDL (mg/dl)	30.36±13.476	23.302**	26.26±8.784	19.829**

** p-value <0.0001 = Highly statistically significant



Graph 1. Percentage distribution of subjects according to BMI categories.

Out of 8.4% of total subjects,9.2%males and 6.2% females were detected to have diabetes as determined from fasting blood sugar levels >120mg/dl. 89% of total subjects had serum creatinine within normal range of 0.7-1.2mg/dl. 25.7% of total subjects (24.4%males and 29.2% females) were detected to have hypercholesterolemia while hypertriglyceridemia was seen in 26.9% subjects (29.4% males and 20.8% females). 50% of both males and females had LDL levels ≥ 100mg/dl. 47.9% of females had HDL levels >46mg/dl while 66.9% of males had HDL levels >40mg/dl. 2.5% of total males and 4.2% of total females had significant levels of albumin in their urine.

On grouping the subjects into different age groups of 24-30years, 31-40 years, 41-50years, 51-60years, 61-70 years and comparing the different parameters of screening, it was observed that hypertension was more marked in elderly doctors of 61-70yrs age-group while diabetes was more prevalent in doctors of 41-50yrs and serum creatinine values were significantly higher in 61-70yrs age-group as evident from Table-2. However, lipid profile depicted somewhat different trends, as seen from Table-3, with highest values in 24-30yrs followed by 51-60yrs age group of doctors while in 61-70yrs age group, the lipid profile mean values were significantly lower as compared to the other age categories.

Table 2 Mean blood pressure, blood glucose and serum creatinine levels in different age group categories

Age groups	No of subjects	SBP	DBP	FBS	S. Cr
24-30	47	120	80	86	0.9
31-40	56	123	82	96	1.01
41-50	15	116	79	100	1.053
51-60	17	126	80	96	1.023
61-70	34	137	85	84	1.148

Table 3. Mean Lipid profile values in different age group doctors

Age groups	Chol	TG	HDL	LDL	VLDL
24-30	194	151	44	114	30
31-40	175	147	46	97	31
41-50	183	125	45	102	26
51-60	189	149	46	115	29
61-70	160	123	43	103	25

DISCUSSION

Doctors are equally prone to all the expected illness as the general population such as cardiovascular diseases, respiratory disorders, musculoskeletal disorders, cancer and psychiatric illness [3-5]. Although awareness of lifestyle diseases is high among doctors, the study showed that Indian physicians had risk factors for cardiovascular diseases, diabetes and renal dysfunction. Although males were significantly at higher risk as compared to female doctors in this study, the older doctors were more affected by hypertension and diabetes and renal dysfunction. Younger generation doctors had higher levels of serum cholesterol, triglycerides, LDL and VLDL with lower HDL levels. This might be used as an indicator that the younger doctors lack regular medical check-up which might have lead to uncontrolled levels of hyperlipidemia. With 37.4% of total subjects overweight and 9.7% as obese, it can be inferred that doctors needed more time for physical fitness and the need for regular BMI assessment requires still more motivation among doctors. Most of the doctors had a mixed diet while just 11% of the doctors adhered to a vegetarian diet and very few underwent regular physical exercise regimens.

High prevalence of obesity, diabetes, hypertension and dyslipidaemia had been reported in another study of a smaller group of physicians in northern India [6]. Another study on a group of doctors from southern and northern parts of the country showed significantly higher prevalence of metabolic syndrome, diabetes, hypertension, obesity, dyslipidaemia, smoking and alcohol consumption as compared to age-matched general population [7]. Male preponderance of diabetes, hypertension and hyperlipidemia among doctors was also reported in previous studies [6-8]. Studies conducted in developed countries also show that doctors generally have a trend of neglecting own health [3, 9, 10]. The present study, undertaken in developing country, India also shows similar characteristics, supported by the observation of high blood glucose and blood pressure values even among the known diabetic and hypertensive doctors. However, studies in United States of America points that physicians maintained very good health habits compared to general population [11] and it lead to effective stimulation of the patients to follow suit after being explained self-practised habits by these physicians [12,13].

Primary prevention should be initiated at a young age to ensure life-long maintenance of healthy living among the medical professionals. Many documented studies bring forth the sad plight of young doctors neglecting their health[14-16]. This calls for immediate intervention in doctors, giving priority to younger doctors, to become aware of their health status and be motivated for routine investigations assigning time for their health and well-being. They can put forth positive examples to their patients for better health care practices leaving a greater impact on present burden of morbidity due to lifestyle associated diseases.

Conflicts of Interest: None declared.

Source of Funding: KIIT University

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DOI Number: 10.5958/j.2320-608X.1.2.028

A Comparative Study of Cardiovascular Autonomic Function Tests in 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. Rhythmic breathing controls the mind, lungs and heart which are located in the thoracic cage and are under the control of autonomic nervous system. The aim of this study was to evaluate the cardiovascular autonomic function tests among yoga practitioners.

Method: 75 healthy volunteers (aged 18-31 years)were divided in to three groups; the first two yoga groups (each group ,n=25) 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=25). 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 evident 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]

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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 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 75 healthy students and volunteers aged between 18-31 years of either sex (M 45: F30) from Santhiram Medical College, Nandyal , other academic colleges and yoga centres. Subjects were divided into 3 groups: the yoga group 1 (n=25) who had less than 2 years of yoga practicing and the yoga group 2 (n=25) who had more than 2 years of yoga practicing and 3rd group was healthy control group (n= 25) . 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 Santhiram Medical College and Hospital , Nandyal 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 $p < 0.05$.

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 ($p<0.05$).

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	P>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

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.

ACKNOWLEDGEMENTS

We sincerely thank all the subjects who participated in the study.

Conflict of Interest: We declare that there is no conflict of interest

Source of Funding: None

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DOI Number: 10.5958/j.2320-608X.1.2.029

Cognitive Speed, Attention & Working Memory in Female BPO Employees Exposed to Regular Shifts

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ABSTRACT

Background: Information Technology industry is the most rapidly expanding sector in India in the last two decades. BPO sector is a major part of IT industry with around 4.5 million employees of which 35 % are women. These women employees are subjected to high work stress, odd working hours and frequent shift changes apart from environmental & domestic stressors leading to increased physical and mental health problems.

Aim: to study the cognitive functions - mental speed, attention & working memory in female BPO employees exposed to regular shifts.

Method: 50 female BPO employees exposed to regular shifts were assessed for speed and attention functions. They were compared with 50 female non BPO employees not working in shifts.

Results: BPO employees performed poorly compared to their controls in tests for mental speed. No changes were seen between groups in test for attention & working memory.

Conclusion: cognitive functions are partly impaired in female BPO employees exposed to regular shift changes.

Keywords: *BPO, Mental Speed, Attention, Shift work*

INTRODUCTION

India is the front runner in cyber world with Information Technology-Information Technology enabled service (IT-ITES) industries coming up with increasing pace even in tier 2 cities. Recent NASSCOM survey has found that around 5 million employees are working in BPO and related sectors and 35 % of them are women. Any average BPO employee puts in 11-12 hours of work per day and at times it reaches 14 hours in case of companies that encourage overtime. BPO sector demands odd working hours, long travel time, insufficient breaks and frequent shift changes leading to high levels of stress among its employees. This is compounded by the fact that most of the women need to put extra hours of work at home apart from their regular work at office which makes them more vulnerable to stress and related disorders.

In people whose circadian rhythms have been disrupted e.g night shift workers, cognitive efficiency is found to be reduced[1]. A variety of adverse biological, psychological and social effects of shift work on the workers have been reported by many studies. Effects on a wide set of health and well being components have been observed, including sleep, eating, behavior, neuropsychic and cardiovascular functions, menstrual cycle, work accidents, absenteeism and many others[2]. Long working hours, sleep deprivation, irregular dietary habits, etc which are common to these industries may have a negative effect on cognitive performance in individuals[3].

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IT professionals face continuous stress due to job deadlines which are compounded by environmental and domestic stressors. During stressful situations, concentration, awareness on posture, dexterity during work and many neuro-physiological changes occur in the body leading to drop in work performance. Adverse effects on learning and memory, following intense stress have repeatedly been found.

India is a forerunner in the IT world and therefore there is an urgent need to understand the dynamics of computer sector related health problems to prevent it from assuming epidemic proportions. Literature available on this problem is in the west with very few studies done in an Indian setup and almost no studies done in female population.

Our previous study done on male BPO employees showed a significant decrease in majority of the cognitive functions tested[4]. The present study is therefore aimed at evaluating the cognitive functions of female BPO employees, the influence of shift work on speed performance.

METHOD

The present study was conducted on female employees of various BPOs of Bangalore city. The study was approved by institutional ethical committee. Informed written consent was obtained from every subject after explaining the study protocol. Subjects in the age group of 25- 35 yrs who were on compulsory rotating night shifts were selected for the study. BPO employees who had a minimum work experience of six months in the field and working on computers for at least five hours per day or 25 hours per week were considered for the study. Subjects with good physical and mental health were chosen after obtaining a detailed history and doing relevant clinical examination. Individuals with history of pre existing conditions like diabetes, hypertension and sleep disorders, those who were on medication for any illness and smokers were excluded from the study.

Fifty female BPO employees selected from various BPOs across Bangalore formed the study group. They were compared with fifty age matched individuals working in non BPO sectors and did not have any night shifts who formed the controls. Mean age of study subjects was 27.82 ± 2.36 years and that of controls was 28.58 ± 2.42 years. All the subjects were assessed for cognitive functions at the end of their work.

The cognitive function tests were during a single session in a quiet room. The tests were administered according to the instructions provided in the NIMHANS Neuropsychology battery[5].

The tests administered were as follows:

Domain	Function	Test
Speed	Mental speed	Digit Symbol Substitution Test
Attention	Sustained attention & working memory	Digit Vigilance Test Digit Symbol Substitution Test

The Digit Symbol Substitution Test[6] is a test of visuomotor coordination, motor persistence, sustained attention and response speed. Rapid information processing is required in order to substitute the symbols accurately and quickly. The test consists of a sheet in which numbers 1-9 are randomly arranged in four rows of 25 squares each. The subject substitutes each number with a symbol using a number-symbol key given on top of the page. The first ten squares are for practice. The time taken to complete the test forms the score.

Vigilance Test

The Digit Vigilance Test[7] consists of numbers 1 to 9 randomly ordered and placed in rows on a page. There are 30 digits per row and 50 rows on the sheet. The digits are closely packed on the sheet. The same level of mental effort or attention deployment is required over a period of time. The subject has to focus on the target digits 6 and 9 amongst other distracter digits and has to cancel the digits as fast as possible without missing the targets or cancelling wrong numbers.. Inability to sustain and focus attention levels leads to both increased time to complete the test as well as errors. The time taken to complete the test forms the score.

Statistical Analysis

The data was analyzed using t-test and Mann-Whitney test. The difference was considered statistically significant whenever P d" 0.05. SPSS V.13.0 was used for analysis of data.

RESULTS

Our results show a significant difference between female BPO employees and controls in tests of mental speed. BPO employees performed poorly compared to their controls in digit symbol substitution test. However no statistically significant difference was observed in digit vigilance test, a test for attention & working memory(Table 1).

Table 1. Cognitive functions in Female BPO employees and controls

Test	BPO employees	Controls	MeanDifference	t	P Value
Digit symbol substitution test	172.34 ± 29.21	149.98 ± 28.42	-22.360	-3.879	< 0.001
Digit vigilance test	402.40 ± 73.54	398.42 ± 61.72	-3.980	-0.293	0.770

Data presented are mean ± SD.

DISCUSSION

Female BPO employees performed poorly when compared to their controls in Digit symbol substitution test which tests for visuomotor coordination, motor persistence, sustained attention and response speed, BPO employees took a longer time to complete the task. Our findings are consistent with previous studies which have shown decrease in cognitive efficiency associated with shift work[1,8]. Sleep deprivation in night shift workers is known to affect memory and performance speed[9,10]. Increased stress also has adverse effects on learning and memory[11,12]. BPO employees are exposed to highly stressful working environment & frequent changes in shift. This dual effect may be responsible for decreased cognitive functions seen in BPO employees.

Sustained attention scores are similar in BPO and control groups. Our results are similar to studies which have found no difference in attention and working memory between sleep deprived and non sleep deprived subjects[13,14,15]. However few studies have shown a decrease in attention and working memory due to sleep deprivation[16]. The speed/accuracy phenomenon is moderately affected by gender, age, and individual differences in response style, which could be a reason for inconsistencies in the sleep deprivation results. It is also suggested that speed processes are rapidly affected by shift work while verbal memory processes would be impaired after several years of exposure[1].

In conclusion, BPO employees recorded lower scores in tests of speed but not in sustained attention. This decreased performance is possibly due to the nature of their work involving long working hours, frequent shift changes, pressure to meet deadlines and monotonous nature of work. Also Cognition is negatively affected by sleep deprivation, excessive stress and fatigue. Together, these factors would have contributed to a decrease in cognitive performance among the BPO employees.

ACKNOWLEDGEMENTS

The Authors sincerely acknowledge the support of Mr Tejaswi for providing help in statistical analysis.

Conflicts of Interest: Nil

Source of Funding: Self funded

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DOI Number: 10.5958/j.2320-608X.1.2.030

Influence of Body Mass Index on Pulmonary Functions

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ABSTRACT

Obesity is a major health hazard in developed and developing countries. It is proved to be a co-morbid condition in various metabolic and cardiovascular disorders. Obesity offers mechanical obstruction to different movements of the body including that of the respiratory system. Hence, it is reasonable to hypothesize that obesity could adversely affect the lung functions. This study was undertaken to establish role of obesity in influencing the pulmonary functions.

Pulmonary functions FVC, FEV1 and PEF were evaluated in 20 obese (BMI of 33.04 ± 2.42) and 20 normal (BMI of 22.39 ± 1.65) male subjects in the age group of 40 to 60 years by using computerized spirometer in sitting position. Three recordings of pulmonary functions was done after giving sufficient trials to familiarize with the instrument. Best of the three readings were computed.

The percentage of predicted value of FVC, FEV1 and PEF in normal subjects were 94.82 ± 13.07, 96.62 ± 15.19, 91.49 ± 23.21 and the corresponding values for obese subjects were 84.45 ± 15.75, 89.35 ± 16.48, 81.14 ± 20.54. There was a moderate decline in FVC, FEV1 and PEF in obese subjects when compared to the normal individuals.

It can be concluded that obesity adversely affects the pulmonary functions by posing mechanical restriction to respiratory movements. Decline in pulmonary functions suggest a predominant restrictive and mild obstructive effect.

Keywords: *Pulmonary Function, Obesity, Restrictive Air Way Disease*

INTRODUCTION

Obesity is an emerging global public health problem due to altered food habits, sedentary life style and lack of regular exercise[1]. Obesity is a medical condition of excessive accumulation of fat on the human body. It causes an increase in body mass, measured by using Body mass index (BMI) [2]. It is a major co-morbid condition for metabolic and cardiopulmonary diseases. Breathlessness during exercise, without any respiratory pathology is a major problem in obese individuals. It has a direct effect on the well being of the respiratory system. It increases mechanical work for breathing and stiffens the respiratory system[3]. Obese subjects consume more oxygen and release more carbon dioxide[4]. There is an established relationship between obesity and the causation of metabolic and cardiovascular diseases. However, there is no demonstrable alteration in the anatomical structures of respiratory system[5]. The subjects with excessive body weight have reduced aerobic capacity and exercise tolerance. This can be attributed to increased thickness of the thoracic wall, abdominal mass and decreased compliance[6]. Increased accumulation of fat leads to decrease in the skeletal muscle mass and hence the strength of the respiratory muscles. Obesity can adversely affect functions of diaphragm, thoracic and abdominal muscles. Further, it can impair the gas transport system and respiratory functions[7]. Mechanical effects of obesity may contribute to airway dysfunction, substantially increasing morbidity and mortality. Earlier studies

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have reported conflicting results in pulmonary function in obese subjects [10,11,12]. In the present study, efforts are made to assess pulmonary functions in obese subjects and compare it with non-obese South Indian subjects.

METHOD

The study was carried out in M.S.Ramaiah teaching hospital. Twenty males in the age group of 40 to 60 yrs with a Body mass index of ≥30kg/m^2 were recruited as subjects. Twenty age and anthropometrically matched males attending the OPD for master health check up, satisfying the inclusion and exclusion criteria were recruited as controls. Ethical clearance was obtained from the institutional ethical review board. The subjects participated in this study by giving written informed consent. Subjects with coronary artery disease, respiratory diseases, skeletal abnormalities and smokers were excluded from the study.

The medical and dietary history, use of drugs, personal habits of the participating subjects was recorded by using a standardized questionnaire. Later, they were subjected to general physical examination. BMI, waist circumference and the blood pressure was measured. Height was measured in meters using a stadiometer and weight was measured in kilograms using sensitive balance. BMI was calculated by using the formula weight in Kg / (Height in meter)^2. Waist circumference was measured at a level midway between the lowest rib and the iliac crest, and the hip circumference at the level of the greater trochanter and Waist hip ratio (WHR) was calculated. Blood pressure was recorded in supine position using mercury sphygmomanometer and readings were expressed as mmHg.

Spirometry was performed under standard conditions of body temperature and ambient pressure in sitting position in the chest medicine PFT laboratory. Tests were carried out between 9-30am and 12-30 pm in order to avoid circadian influences. The subjects were instructed to rest for 15 minutes prior to the test. The area in which the tests were carried out was quiet; temperature and humidity were maintained at constant levels. After instruction and practice attempts, final measurements were done by using a spirometer (Model RESMED'S Spirobank G, MIR SRL, ROMA, ITALY.) with nose closed using a nose clip. Each subject performed 3 trials (with at least two reproducible and acceptable maneuvers) of forced vital capacity (FVC), forced expiratory volume in one second (FEV_1), FEV_1% and peak expiratory flow rate (PEF) maneuvers according to the American Thoracic Society recommendations[8]. The values were considered reproducible when the difference between two highest recorded values was not more than 5% [9]. The best value of FVC, FEV_1, FEV_1% and PEF were considered for evaluation and comparison.

STATISTICAL METHOD

The actual and the predicted values of pulmonary function & the percentage of the predicted value were expressed as Mean ± SD. The percentage change of the predicted values in normal & obese subjects were compared by Independent t-test. P value less than 0.05 was considered significant.

RESULTS

Age, blood pressure & the anthropometric parameters are shown in Table 1. There was a significant difference in BMI, hip & waist circumference, waist hip ratio. The difference in age, systolic & diastolic BP was not significant between the groups.

Table 1. Comparison of anthropometric data between controls & obese subjects

Study characteristics	Controls	Obese subjects
Age in years	47.20±6.70	49.50±7.35
BMI (kg/m^2)	22.36±1.54	33.19±2.59*
Waist (cm)	81.85±3.49	115.20±5.28*
HIP (cm)	92.12±3.91	112.95±467*
W/H ratio	0.88±0.01	1.02±0.03*
SBP (mmHg)	123.90±9.14	127.85±9.28
DBP (mmHg)	78.90±6.66	82.60±4.01

* $P < 0.05$

Pulmonary functions like FVC, FEV_1, FEV_1% & PEF are indicated in Table 2. The predicated value for the same age group, anthropometric measurements and ethnicity were obtained. The two values were used to get percentage of predicted value. The differences in percentage of predicated values were used for comparison. There was a significant reduction in FVC, FEV_1 & PEF in obese subjects when compared to their normal counter parts.

Table 2. Comparison of pulmonary functions between controls & obese subjects.

		Controls	Obese subjects
FVC (in litres)	Observed	3.15±0.62	3.01±.0.79
	Predicted	3.32±0.61	3.61±0.59
	Percentage change	94.82±13.07	84.45±15.75*
FEV_1 (in litres)	Observed	2.62±0.51	2.63±0.69
	Predicted	2.74±0.50	2.95±0.48
	Percentage change	95.62±15.19	89.35±16.48*
FEV_1%	Observed	83.31±6.11	86.03±4.95
	Predicted	81.99±1.81	81.22±1.32
	Percentage change	101.48±7.36	101.47±20.50
PEF (litres/sec)	Observed	7.28±1.88	6.74±2.06
	Predicted	7.76±0.99	8.21±0.97
	Percentage change	91.49±23.21	81.14±20.54*

* $P < 0.05$

DISCUSSION

In the present study, lung functions like FVC, FEV_1 and PEF were estimated in normal & obese subjects in comparable age groups. There was a significant reduction in FVC, FEV_1 and PEF in obese subjects when compared to normal individuals. Wannamethee et al., have not reported any difference in the pulmonary functions between obese and non-obese subjects[10]. Our findings are in line with those of Chinn et al., who observed an association between increase in fat mass and reduction in FEV_1 and FVC [11].

Lazaras et al., showed a decrease in lung function with increasing fat mass and central body fat distribution. Similar findings were observed in middle aged men, but not in those older than 60 years[12]. Our finding of a significant inverse relationship between adiposity indices; BMI, WHR and lung functions like FVC, FEV_1 & PEF supports the previous reports. The altered lung function is suggestive of an obstructive and restrictive type of airway dysfunction.

The lung volume and airway caliber were reduced in subjects with increasing BMI in linear fashion compared with subjects in the normal weight range. In addition subjects in the underweight category ($<18.5 kg/m^2$) also had reduced airway caliber compared with normal weight subjects[13]. Higher BMI is inversely related to lung functions. Different mechanisms have been proposed by earlier studies to support these observations. Mechanical obstruction impedes the descent of diaphragm in subjects with abdominal obesity. It is associated with reduced compliance of chest wall, work of breathing and elastic recoil of lungs.

The relation between height and pulmonary function was studied previously, height is one of the variables used in estimating lung functions and therefore age related changes in height may significantly affect pulmonary function[14].

Pelosi P, Croci M et al., showed that reduced compliance of the total respiratory system in obese subjects was almost entirely related to reduced chest wall compliance[15]. The reduction in pulmonary function is due to deposition of fat in abdominal cavity and thoracic cage. This may diminish rib cage movement and thoracic compliance, both of which lead to restrictive respiratory movement. Other mechanism suggested that abdominal fat deposition leads to a redistribution of blood to the thoracic compartment that reduces vital capacity [16].

Airway resistance depends on the elastic recoil of the lung. This tends to increase the airway caliber at high lung volumes and to reduce it at low lung volumes. In addition, closure of small peripheral airways may participate in the increase of resistance to flow of air.

Decreased lung elasticity is the main factor causing the age related reduction in airway caliber and it is therefore, possible that the present findings in this age group may not be present in older populations.

The observed reduction in FVC, FEV_1 & PEF suggests a restrictive and an obstructive lung function. Restrictive lung function can be attributed to mechanical obstruction, reduced compliance of the chest wall due to enhanced adiposity. The obstructive lung function is due to reduced elasticity of the lung and closure of the smaller airways.

ACKNOWLEDGEMENT

Authors are thankful to the institution, M.S. Ramaiah Medical College, all the subjects, Dr. Mohan Rao.K.N, Prof & Head, Chest Medicine, M.S. Ramaiah Medical College and Dr. Gayathri.L for their contribution and support in the completion of this work

Conflict of Interest: None

Source of Funding: Personal funds.

Ethical Clearance: Permission was taken from institutional research and ethical committee

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DOI Number: 10.5958/j.2320-608X.1.2.031

To Study Seasonal Variation in Autonomic Parameters in Adult Males

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ABSTRACT

The present study was conducted to assess the seasonal changes in autonomic parameters. The study was conducted in 55 healthy male medical students of first professional M.B.B.S. and employees of 18 to 50 years age group at G.S.V.M. Medical College, Kanpur. The change in mean weight, mean height, body mass index(BMI), and Waist to Hip ratio of the subjects were found stastistically insignificant($p>0.05$). Waist circumference in Dec-Jan was 81.3±7.9 cm and in May-June was 80.6±8.0 cm. This decrease in waist circumference was significant ($p<0.05$). Autonomic parameters like difference of SBP (in standing test), 30:15 R-R Ratio (ratio of longest R-R interval around 30th beat and smallest R-R interval around 15th beat) (in Lying to standing test), E:I Ratio (in Deep breathing test), Valsalva Ratio, difference of DBP (in Hand grip test), and difference of SBP & difference of DBP (in Cold pressor test) were found insignificant ($p>0.05$).

Thus, it is concluded that in healthy men autonomic parameters do not vary with season whereas waist circumference vary with season, with higher level in the winter (Dec-Jan) and lower in summer (May-Jun).

Keywords: *Autonomic Parameters, Waist Circumference*

INTRODUCTION

The autonomic nervous system co-ordinates involuntary control of the viscera and other tissues throughout the body, with the exception of skeletal muscles. This branch of the control nervous system, organized into parasympathetic and sympathetic division, integrates efferent and afferent fibres that regulate the activities of the majority of organs, glands, and smooth musculature found in the body. The pre-synaptic cell bodies of these neurons comprising both categories originate in the gray matter of the spinal column, but are classified by fundamental difference. Anatomically, the origins of the sympathetic (Thoraco-lumbar) division of the central nervous system lie between the first section (L2 or L3). In contrast, the existing fibres of the parasympathetic division (Cranio-sacral) originate from both the medulla oblongata and the sacral portion of spinal cord (S2 or S4). In the sympathetic division, Nor-epinephrine is the principal postsynaptic neurotransmitter, where as acetylcholine is the chief transmitter found throughout the parasympathetic division. The primary physiological response induced by each respective neurotransmitter is also a useful way to categories the divisions of the autonomic nervous system. Such classifications are important considerations when investigating the autonomic nervous system regulation and function of the heart[1].

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MATERIAL AND METHOD

The present study was conducted in 55 healthy male medical students of first professional M.B.B.S. and employees of 18 to 50 years age group at G.S.V.M. Medical College, Kanpur. Subjects with a history of physical exercise, addiction, drug history, personal or

family history of Diabetes, Hypertension and heart diseases, and history of any chronic disease were excluded from the study. Autonomic questionairres were done and autonomic function tests were performed.

Anthropometric measurements: Height, weight, body mass index, and waist hip ratio.

Autonomic parameters

For autonomic function test, three channel physiograph machine, sphygmomanometer, hand-grip dynamometer and ice-cold water were used. All the readings were recorded by a single observer; so that interpersonal differences were eliminated. An average of 3 readings was taken for each subject for all the autonomic function test as well as blood pressure recordings.

Autonomic functions were measured with a standard battery of tests, according to methodology reported in literature [2].

(A) For assessing parasympathetic activity

Standing test: Each subject was asked to lie supine on the couch and relax for 15 min. ECG leads and the BP cuff were applied. Base-line BP was recorded. ECG lead II was recorded. Then the subject was asked to stand without support, and remain motionless for 3 min, recording the ECG continuously. BP was recorded at the end of 30 sec., 1, 2, 2:30 and 5 minutes after standing. Then fall in SBP was calculated.

Lying to Standing test (30:15 RR ratio): Each subject was asked to lie supine on the couch and relax for 15 min. ECG leads and the BP cuff were applied. Base-line BP was recorded. ECG lead II was recorded. Then the subject was asked to stand without support, and remain motionless for 3 min, recording the ECG continuously. BP was recorded at the end of 30 sec., 1, 2, 2:30 and 5 minutes after standing. We marked the point of standing on ECG paper. HR was calculated from R-R interval at 15^{th} beat and at 30^{th} beat after standing. 30:15 ratio = longest R–R interval at beat 30^{th} / shortest R-R interval at 15^{th} beat was calculated. Ratio more than 1.04 considered normal and less than 1.00 considered autonomic insufficiency.

Valsalva ratio: Subject was seated on a couch and was explained the procedures. ECG lead II and BP cuff was connected and the nostrils were closed with a nose-clip. The cuff from another BP apparatus was disconnected and subject was asked to take a deep breath, blow into the manometer and maintain the pressure at 40 mm Hg for 15 seconds. ECG lead II was recorded for 15 seconds during straining, and for 45 seconds after the release of strain. Valsalva ratio = longest R-R interval after the strain / shortest R-R during the strain. A ratio more than 1.45 is considered normal, 1.20-1.45 is considered border-line and less than 1.20 is considered autonomic disturbance.

Deep breathing test: subject was asked to sit on the couch and relax. ECG lead II was connected and stethograph was tied at the chest, and then the subject was asked to breathe deeply and slowly at a rate of 6 breaths per minute, with 5 seconds for inspiration, and 5 second for expiration. ECG was recorded before and during breathing. The maximum and minimum HR with each respiratory cycle was determined. E:I ratio = mean of max. R-R intervals during expiration/ mean of mini. R-R intervals during inspiration. Decrease in HR more than 15 beats/ min. is normal, decrease in HR less than 10 beats/ min. is vagal insufficiency.

(B) For assessing sympathetic activity

Hand grip test: BP cuff on the non-exercising arm was applied. Base-line BP & HR was recorded. The subject was asked to hold hand-grip dynamometer in the dominant hand and take a full grip on it. Subject was asked to exert max. tension and it was noted. It was repeated 3 times at intervals of 2 min. highest reading was taken as max. isometric tension (T max.). Then the subject was asked to maintain a tension of 30% of T max. for 4 min. During this procedure BP and HR at the end of 1, 2, 4, 6 min. were recorded. DBP was noted at the point just before the release of hand grip. Increase in DBP between 11-15 mmHg is considered border-line, more than 15 mm Hg is normal, and less than 10 mmHg is sympathetic insufficiency.

Cold pressor test: subject was seated on couch. Base line BP was recorded. Subject was asked to immerse one hand in ice-cold water at 10 degree Celsius for 1 min. The BP from the other arm, just at the time of hands taken out, at 1:30 min., and 4 min were recorded. The maximum increase in SBP and DBP was noted and was compared with the pretest readings.

Statistical Analysis

For each parameter, the mean and standard deviation were calculated in the months of Dec-Jan

and May-June according to accepted methods. The mean difference of each parameter in both season were tested for significance by applying paired Students't'-test. All statistical tests were done by SPSS version 16.

Conflict of Interest: Nil

Source of Funding: Self Financed

OBSERVATIONS AND RESULTS

The present study was conducted on 55 healthy male medical students of first professional M.B.B.S. and employees of 18 to 50 years age with an average of 22.56±2.42 years in the Department of Physiology, G.S.V.M. Medical College, Kanpur. Autonomic function tests were done in the months of December, 2011-January, 2012 and May–June, 2012. The average environmental temperatures were 12°C in Dec-Jan (winter) and 40°C in May-June (summer).

Autonomic function tests

Various autonomic function tests performed were Standing test, lying to Standing test (30:15 R-R Ratio), deep breathing test (DBT), Valsalva Ratio, Hand grip test (HGT) and Cold pressor test. The results of all the autonomic parameters are depicted in table 1.

Table 1. Seasonal variation in Autonomic parameters

Sl. No.	Parameters		Dec-Jan Tests (n=55) Mean±SD**	May-Jun Tests n=55) (Mean±SD	P value
1.	Standing Test	Δ SBP	4.75±4.21	8.62±5.78	>0.05(NS*)
2.	L/S Ratio	30:15 R-R Ratio	1.14±0.13	1.10±0.13	>0.05(NS)
3.	DBT	E: I Ratio	1.36±0.19	1.34±0.17	>0.05(NS)
4.	Valsalva Ratio		7.72±33.28	1.73±0.55	>0.05(NS)
5.	HGT(in mmHg)	Δ DBP	35.20±17.67	39.73±16.77	>0.05(NS)
6.	CPT(in mmHg)	Δ SBP	15.45±15.40	15.22±12.55	>0.05(NS)
		Δ DBP	13.35±12.57	9.75±8.95	>0.05(NS)

Figure 1. Seasonal variation in Autonomic parameters

In standing test, the fall in SBP (baseline SBP – minimum SBP during standing) in Dec-Jan was 4.75±4.21 mmHg (Mean ± SD) and in May-June was 8.62±5.78 mmHg (Mean ± SD). This increase in fall in systolic blood pressure(SBP) was statistically not significant (p>0.05) (table 1).

In Deep breathing test, E: I Ratio (ratio of mean of maximum R-R interval during expiration and mean of minimum R-R interval during inspiration) in Dec-Jan was 1.36±0.19 (Mean ± SD) and in May-June was 1.34±0.17 (Mean ± SD). This decrease in E: I ratio was statistically not significant (p>0.05) (table 1).

Valsalva ratio (ratio of longest R-R interval after the strain and shortest R-R interval during the strain) in Dec-Jan was 7.72±33.28 (Mean ± SD) and May-June was 1.73±0.55 (Mean ± SD). This decrease in valsalva ratio was statistically not significant (p>0.05) (table 1).

In Hand grip test, difference of DBP (highest DBP during test - baseline DBP) in Dec-Jan was 35.20±17.67 mmHg (Mean ± SD) and in May-June was 39.73±16.77 mmHg (Mean ± SD). This increase in difference of diastolic blood pressure(DBP) was statistically not significant (p>0.05) (table 1 figure 1).

In **Cold pressor test**, difference of SBP (highest SBP during test - baseline SBP) and difference of DBP (highest DBP during test - baseline DBP) in Dec-Jan were 15.45±15.40 mmHg (Mean ± SD) and 13.35±12.57 mmHg (Mean ± SD) and in May-June were 15.22±12.55 mmHg (Mean ± SD and 9.75±8.95 mmHg (Mean ± SD) respectively. This decrease in both difference of SBP and difference of DBP were statistically not significant (p>0.05)(table 1).

Figure 2. Seasonal variation in Anthropometric parameters

Anthropometric measurements

Table 2: Seasonal variation in Anthropometric parameters

Sl. No.	Parameters	Dec-Jan Tests (n=55) Mean±SD	May-Jun Tests (n=55) Mean±SD	P value
1.	Height (in mt)	1.69±0.06	1.69±0.06	>0.05(NS*)
2.	Weight (in kg)	62.37±8.91	62.59±8.75	>0.05(NS)
3.	BMI (in kg/m²)	21.78±2.76	21.86±2.69	>0.05(NS)
4.	WC (in cm)	81.3±7.9	80.6±8.0	>0.05(NS)
5.	WHR	0.89±0.05	0.88±0.05	>0.05(NS)

*Not significnt

Waist circumference (WC) in Dec-Jan was 81.3±7.9 cm (Mean ± SD) and in May-June was 80.6±8.0 cm (Mean ± SD). This decrease in waist circumference was statistically significant ($p<0.05$) (table-2 & figure-2).

Other anthropometric parameters like weight, body mass index(BMI), waist hip ratio(WHR) were found insignificant ($p>0.05$) (table-2).

DISCUSSION

The present study was conducted on 55 healthy male first professional M.B.B.S. students and employees of 18 to 50 years age group. The aim of our study was to see seasonal variation in autonomic parameters. Kanpur (India) is located at 26.4670° North and 80.3500° East. Kanpur features an atypical version of a humid subtropical climate that resembles the climate of Delhi to some degree. Unlike many other cities with a humid subtropical climate, Kanpur features long and very hot summers, mild and relatively short winters, dust storms and a monsoon season. Kanpur lies in northern plains of India, which witness extremes of temperature. It can drop to a minimum of 0.0°C in the winters while it goes up to 48°C in summers. Kanpur experiences severe fog in December and January.

Autonomic Parameters

Seasonal variation in autonomic parameters was not significant ($p>0.05$). our finding was supported by Hata et al [3], reported that normal subjects display no seasonal difference in blood pressure, but their levels of urinary sodium and norepinephrine are significantly higher in winter than in summer, whereas patients with essential hypertension show higher values for all three parameters in winter. This rise may be related to increased sympathetic nervous activity and an increased load of sodium presented to the kidney for excretion. Radke KJ et al [4] reported that systolic and diastolic BP remained relatively constant across seasons. Cardiac output and stroke volume significantly decreased 10 and 15%, respectively, from summer to winter, whereas heart rate and systemic vascular resistance significantly increased 5 and 11%, respectively. Plasma aldosterone (PA) significantly increased 59% from summer to winter, whereas plasma norepinephrine (PNE), plasma epinephrine, and plasma renin activity (PRA) increased 19, 2, and 17%, respectively (pNS for each). Across the four seasons, mean arterial pressure significantly correlated with PRA and PA, whereas systemic vascular resistance significantly correlated with PNE and PRA. There are dramatic counter-regulatory hemodynamic and hormonal adaptations to maintain a relatively constant BP. Norepinephrine, PRA, and aldosterone have a function in mediating the changes in hemodynamic.

In contrast, Kristal-Boneh E et al [5] monitored ambulatory systolic blood pressure (SBP) and diastolic blood pressure (DBP) once in summer and once in winter in 101 healthy normotensive subjects aged 28-63 years, engaged in similar physical work, from two plants with and three without air conditioning. The mean SBP and DBP during work were significantly higher in winter than in summer. The seasonal change in SBP and DBP showed an independent association with the presence or absence of air conditioning of the industrial plants. Gideon Charach et al [6] also found that both systolic and diastolic mean blood pressures were higher during winter compared to summer based on a prospective 5-year study of 182 elderly Israeli patients with essential hypertension. Makinen TM et al [7] observed that cold habituation lowers sympathetic activation and causes a shift toward increased parasympathetic activity. Prasad GV et al [8], Law BM [9]

also reported that both systolic (SBP) and diastolic blood pressure (DBP) were greatest during the winter across the whole distribution of blood pressure.

In our study, Waist circumference of subjects was significantly lower in May-June (summer) in comparison to Dec-Jan (winter). Similar findings were noted by Visscher TLS and Seidell JC [10], reported that levels of BMI and Waist Circumference were lower in summer than in winter seasons. This decrease in Waist Circumference could be due to greater physical activity, smaller meal size and lesser rate of food intake in summer than in winter seasons. Uitenbroek DG [11] reported that people are generally more active in summer than in winter seasons.

Thus, it is concluded that in healthy men the seasonal change in waist circumference could be due to change in physical activity and food intake behaviours. Autonomic parameters do not vary with season. It could be due to counter-regulatory hemodynamics and hormonal adaptations.

ACKNOWLEDGEMENT

We want to thank our colleagues, juniors and students who have contributed in this work.

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DOI Number: 10.5958/j.2320-608X.1.2.032

Correlations of Diaphragm Thickness and Body Surface Area on Pulmonary Functions in Healthy Adults

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ABSTRACT

Objective: The present study was undertaken to determine the correlation of diaphragm thickness and body surface area with pulmonary functions in healthy adults.

Background: The various lung functions in humans are due the coordinated contraction and relaxation of different respiratory muscles. Pulmonary functions and strength of the respiratory muscles can get affected by the thickness of the diaphragm and body surface area (BSA). However, not many studies have been undertaken in healthy adult population.

Method: Thirty nine healthy adult male students volunteered for the study. Diaphragm thickness, pulmonary function test & respiratory muscle strength was determined by non-invasive methods. Diaphragm thickness was measured by thoracic ultra-sonogram, pulmonary functions were measured by computerized spirometer. Respiratory muscle strength was estimated as Maximum mouth inspiratory pressure (MMIP) and Maximum mouth expiratory pressure (MMEP) by a calibrated pressure transducer attached to a student Physiograph. Correlation coefficient were obtained between pulmonary function parameters [tidal volume (VT), inspiratory reserve volume(IRV), expiratory reserve volume (ERV), vital capacity (VC), forced vital capacity (FVC), timed vital capacity (FEV_1), FEV_1 / FVC%, peak expiratory flow rate (PEFR), Maximum mouth inspiratory pressure (MMIP) and Maximum mouth expiratory pressure (MMEP)] and diaphragm thickness & BSA.

Result: MMIP showed significant correlation with diaphragm thickness, ($r = 0.3401$, $P<0.05$). Body surface area showed significant positive correlations with MMEP, IRV, VC, FVC, MVV, FEV_1.

Conclusion: This study proves that greater the diaphragm muscle thickness and higher the body surface area, better is the lung function.

Keywords: *Diaphragm Thickness, Body Surface Area, MMIP, MMEP, Pulmonary Function Test*

INTRODUCTION

The pulmonary functions in humans are due to the coordinated contraction and relaxation of different respiratory muscles. However, any given respiratory muscle does not contribute to all the respiratory functions to the same extent. They may contribute more to some respiratory functions and less or least to other functions. In case of inspiration, the major inspiratory muscles are diaphragm and the internal intercostals muscles. But, quite inspiration is predominantly a function of diaphragm accounting for around 75% [1]. The contribution of diaphragm during respiratory efforts like, maximal inspiration or vital capacity is not conclusively known. Specifically, studies have reported that lung functions and strength of the respiratory muscles are affected by the thickness of the diaphragm.[2] The respiratory muscle strength can be measured as the Maximum mouth inspiratory pressure (MMIP) and Maximum mouth expiratory pressure (MMEP). [3] Body surface area has also been proposed to affect the pulmonary functions, from a

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study done in pediatric population.[4] Hence, the present study was undertaken to determine the diaphragm thickness and body surface area in healthy adults and correlate it with the lung functions and respiratory muscle strength (MMIP & MMEP).

MATERIALS AND METHOD

The approval of Institute research and ethical committee was obtained. The study was conducted in 39 healthy adult males. The subjects who took part in the present study were the volunteers from Pondicherry University. They were explained about the study and the procedure. Informed written consent was obtained from them.

The volunteers were recruited after the fulfillment of the inclusion and exclusion criteria.

Inclusion Criteria: young healthy adult males in the age group of 21 -25 years.

Exclusion Criteria: smoking, alcohol, respiratory diseases, diabetes mellitus, hypertension. Subject undergoing any form of training like yoga or physical training.

Anthropometric assessment was done. The body weight was measured using the weighing balance with minimal comfortable clothing, corrected to the nearest 0.1 kg. Height was measured using a wall mounted stadiometer, corrected to the nearest 0.1 cm. Body surface area (BSA) was calculated using Du Bois formula, given as $BSA = 0.007184 \times W^{0.425} \times H^{0.725}$.

The pulmonary functions, namely, tidal volume (VT) inspiratory reserve volume (IRV), expiratory reserve volume (ERV), vital capacity(VC), Forced vital capacity (FVC), Forced expiratory volume in the 1st minute (FEV_1), FEV_1 / FVC%, Peak expiratory flow rate (PEFR), maximal voluntary ventilation (MVV) were measured using computerized spirometer (Spirolab II, Japan). Maximum mouth inspiratory pressure (MMIP) and Maximum mouth expiratory pressure (MMEP) were measured using a calibrated pressure transducer attached to a student Physiograph, (Bio-Devices, India) based on the method of Black LF and Hyatt RE 1969 [5,6]. For MMIP measurement, the subject in the standing posture after a maximal expiration was asked to put his maximum effort to inspire from a closed volume containing the pressure transducer. For MMEP measurement, the subject in the standing posture after a maximal inspiration was asked to put his maximum effort to expire into the closed volume containing the pressure transducer. Measurement of the maximal inspiratory mouth pressure is a simple, reproducible, and non-invasive method frequently used for estimation of the inspiratory muscle strength. The diaphragm thickness was determined by ultrasonography in right and left side thorax [7] and the average thickness is calculated.

Statistical analysis: Data for VT, IRV, ERV, VC, FVC, FEV1, FEV1 / FVC%, PEFR, MMEP, MMIP, average diaphragm thickness, BSA was expressed as mean ± SD. Correlation was done by Karl Pearson's correlation analysis between the average thickness of diaphragm and pulmonary function parameters. Correlation analysis was also done between the body surface area of the subjects and pulmonary function parameters..

RESULTS

The average diaphragm thickness of the subjects was 3.9 ± 0.5 mm. The average BSA of the subjects was 1.7 ± 0.15 sq. m. (Table 1). The mean ± SD values of MMIP, MMEP, IRV, ERV, VC, FEV1, FVC, FEV1/ FVC, PEFR and MVV are given in table 1. Diaphragm thickness showed a significant positive correlation with MMIP. Body surface area showed significant positive correlations with MMEP, IRV, VC, FVC, MVV, FEV1 and negative correlation FEV1/FVC.

Table 1. Correlation of respiratory parameters with diaphragm thickness and body surface area. (n=39)

	Average diaphragm thickness (mm) (mmHg)	MMIP (mmHg)	MMEP (mmHg)	IRV (L)	ERV (L)	VC (L)	FVC (L)	MVV (L)	FEV1 (L)	FEV1(L) FVC (%)	PEFR (L/min)	BSA(m^2)
Mean ± SD	3.9 ± 0.5	75.29 ± 15.84	79.57 ± 22.73	1.6 ± 0.51	1.4 ± 0.44	3.86 ± 0.63	3.9 ± 0.48	127 ± 15.23	3.38±0.41	88.05±5.83	528±81.4	1.7±0.15
r value with diaphragm thickness		0.340*	0.211	0.030	-0.051	0.318	0.105	0.010	-0.014	-0.221	0.245	0.231
r value with BSA		0.232	0.328*	0.627***	0.230	0.557***	0.663***	0.470**	0.474**	-0. 381*	0.153	

The values are expressed in mean ± SD. Pearson correlation is used for analysis. * p<0.05, **p<0.01, ***p<0.001. MMIP-Maximum mouth inspiratory pressure, MMEP-Maximum mouth expiratory pressure, IRV-Inspiratory reserve volume, ERV- Expiratory reserve volume, VC- Vital capacity, FVC-Forced vital capacity, MVV-Maximum voluntary ventilation, FEV1-Forced expiratory volume in the 1st minute, PEFR-Peak expiratory flow rate (PEFR), BSA- Body surface area.

DISCUSSION

It was observed that among the various parameters studied, diaphragm thickness showed a significant positive correlation with MMIP. This suggests that diaphragmatic thickness contributes to the inspiratory muscle strength consistent with the previous studies [8,9,10,] Diaphragm is known to contribute to the maximum to quite inspiration. This positive correlation suggests that even during maximal inspiratory efforts, contribution of diaphragm would be the greatest. This is further supported by the fact that respiratory muscle training improves ventilatory functions.[11, 12]

Also, it's known that pulmonary functions are positively affected by the height and built of the individual.[4] In our study, we have studied the effect of body surface area, which takes into account both height and weight of the subjects, on pulmonary functions. Body surface area showed significant positive correlations with MMEP, IRV, VC, FVC, MVV, FEV1. These positive correlations suggest that pulmonary functions are dependent on the physique of the individual. With increase in BSA, there will be an increment in the respiratory functions. The negative correlation with FEV1/ FVC could be merely observational, which could not be explained.

CONCLUSION

From our study, we conclude that increase in diaphragmatic thickness and BSA leads to improved ventilator functions. Therefore this study provides an insight that physical training may improve respiratory muscle strength and performance in healthy adults.

ACKNOWLEDGEMENT

The authors are thankful to the participants and the technical staff who helped in completing the study.

Conflict of Interest: The authors declare that there is no conflict of interest.

Source of Funding: Self funded.

Ethical Clearance: Obtained from the Institute Ethics committee.

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DOI Number: 10.5958/j.2320-608X.1.2.033

Effect of Artesunate on Electrocardiographic QT Interval in Patients with Plasmodium Falciparum Malaria

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ABSTRACT

Background: Several anti-malarial drugs are associated with adverse cardiovascular effects. There are a few reports available on the potential cardiac effects (QTc interval) of artesunate, which includes an increased risk of potentially ventricular arrhythmia. This study aimed to evaluate the electrocardiographic (ECG) Changes (QTc interval) in malaria patients treated with artesunate.

Method: Total 32 (16 male & 16 female) patients with severe Falciparum malaria enrolled in medical ward, CIMS hospital Bilaspur (C.G) were selected. Electrocardiogram was recorded, and QTc interval was calculated before and after administration of three doses of artesunate given by intravenous injection in all patients who were positive for Falciparum malaria.

Results: The mean QTc interval was not affected by intravenous artesunate (2.4 mg/kg) given at different time intervals($p>0.05$). There was no significant effect observed on the JTc or PR interval, QRS width, blood pressure and heart rate. Intravenous artesunate does not have significant other cardiovascular effects in patients with severe Falciparum malaria.

Conclusion: Intravenous artesunate does not have significant cardiovascular effects in patients with falciparum malaria.

Keywords: *QT Interval, Plasmodium Falciparum, Artesunate*

INTRODUCTION

Artemisinin-based therapy are currently recommended worldwide as the first-line treatment for severe patients with Falciparum malaria recommended by the World Health Organization [1](WHO). Intravenous artesunate is the recommended first choice for the treatment of severe Falciparum malaria in areas of low to moderate malaria transmission, as it has been shown to be superior to quinine in that setup [2,3]. Other antimalarial drugs, notably quinidine and halofantrine produce clinically significant delays in ventricular repolarization, resulting in a prolongation of the electrocardiographic QT interval on the electrocardiogram (ECG)[4]. Heterogeneous prolongation of ventricular repolarization predisposes to potentially lethal polymorphic malignant ventricular tachyarrhythmias (torsades de pointes). The antimalarial halofantrine causes marked QT prolongation and sudden death. After its registration by several regulatory authorities, it has focused attention on the potential cardiotoxicity of the antimalarial drugs.The artemisinins are remarkably well tolerated. High intramuscular doses of the oil-based artemether are associated with significant QT prolongation. The electrocardiographic effects of the artemisinin derivatives in humans is limited. In clinical studies reporting modest QT interval prolongation with the artemisinins, the contributions of drug and disease cannot be disentangled, because recovery from malaria itself is associated with significant lengthening of the QT interval [5-9]. Previous studies do not suggest a significant

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cardiovascular effect. Therefore, this study was conducted to evaluate the effects of intravenous artesunate at different time intervals on the electrocardiographic intervals in patients with severe malaria.

MATERIALS AND METHOD

This study was conducted between June 2009 -Jan 2010 in the Department of Medicine at CIMS Medical College Hospital, a large 550- bed teaching hospital in Bilaspur (C.G). We have been taken permission from ethical committee Bilaspur before doing study. Malaria transmission is seasonal and high prevalence zone specially Plasmodium Falciparum malaria. patients who had been admitted in the hospital with the complaints of fever, headache, altered sensorium, vomiting with a slide test –confirmed the diagnosis of malaria according to modified WHO criteria [10].Criteria on admission for severe malaria included one or more of the following: cerebral malaria (Glasgow Coma Scale [GCS] < 11), severe anemia (hematocrit < 20% with parasite count > 100,000/ìL), jaundice (bilirubin > 1.5 mg/dL with parasite count > 100,000/ìL), renal failure (serum creatinine > 1.4 mg/ dL), hypoglycemia (blood glucose < 40 mg/dL), shock (systolic blood pressure < 80 mm of Hg with cool extremities).

Exclusion Criteria

Pregnant or breast-feeding women and any patient who had received any cardioactive drugs within 1 week before the start of artesunate and having cardiovascular disease were excluded from the study. Patients with abnormal ECG before starting artesunate are also excluded.

STUDY DESIGN

On admission, a full history and examination were carried out. Blood samples were obtained for hemoglobin, hematocrit, parasitemia, platelet count, white cell count, glucose levels, and biochemical tests. Patients were followed up a minimum of twice daily until discharge, including a neurologic examination where clinically indicated. Antimalarial drug artesunate (2.4 mg/kg body weight on admission, followed by 2.4 mg/kg at 12 and 24 hours was given and ECG taken before starting the first dose of artesunate and after each doses. Serial 12 lead electrocardiograms were performed (electrocardiograph model Schiller AT - 1 with a paper speed of 25 mm/s and sensitivity of 10 mm/Mv). Time points for recording ECGs were before artesunate administration and after first hour, second dose (12 hour), last dose (24 hours) of administration. At each time blood pressure, heart rate, were measured. The QTc interval was calculated using the mean QT interval, as measured manually over 10 complexes, corrected for heart rate using Bazett's [11].The JTc interval was calculated as QTc (Bazett's correction) minus QRS duration. The primary outcome measure of the study was a change in QTc interval before and after artesunate. Secondary outcome measures were other significant changes in the ECG including JTc interval and arrhythmias, change in heart rate, and change in systolic blood pressure.

Statistical Analysis

Two-sided 95% confidence intervals (CIs) were calculated for mean QTc intervals and changes in QTc. Means were compared using a paired t test. We calculated that a minimum of five patients were needed to show an increase in mean QTc of 25% from baseline, with significance level (a) of 0.05 and a power (1-b) of 0.90.

RESULTS

32 patients (16 males and 16 females) were enrolled, of whom ECGs were recorded first, second and after last dose of artesunate. The median number of doses of artesunate received intravenously was three. Baseline characteristics and clinical outcome are summarized in Table 1 and Figure 1.

Table 1. Particulars of Patients with Falciparum malaria

Variable		Mean ± SD
Age, mean years		37.5(17.9- 50.34)
Number of Male/ Female		16/16
Blood pressure	Systolic (mmHg)	110(97.4- 129)
	Diastolic (mmHg)	60(54-68)
Heart rate, mean beats/min		102(96-118)
Haemoglobin, mean g/dL		7.78 +3.26
Total WBC count ,mean cells/mm		8966.25+717.34
Serum creatinine level, geometric mean mg/dL		1.38+0.117
Serum urea level, geometric mean mg/dL		54.25+10.3
Serum sodium level,mean mmol/L		134.5+7.616
Serum potassium level,mean mmol/L		3.9+0.801
Serum glucose, geometric mean mg/dL		122.94+7.165

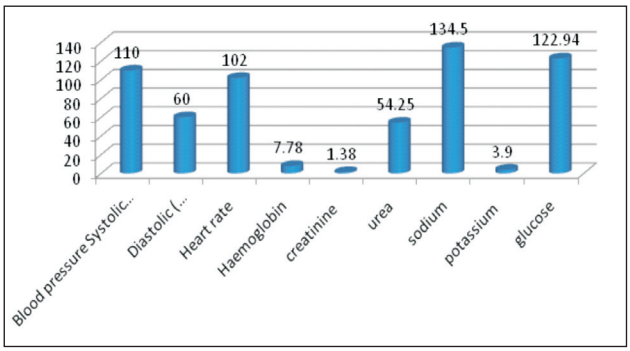

Fig. 1 Baseline charactertics of Patients with Falciform malaria

Table 2. Mean (95% CI) QTc (Bazett) and change from baseline after artesunate administration.

Time post dose(hrs)	QTc (ms)	Change QTc from base line
0 hours (Baseline)	422(406-452)	0NA
1 hour	423 (408–441)	1
12 hours	426(408-488)	4
24 hours	432(414-474)	10

Five patients (14.28%) were already in hemodynamic shock on admission, but only 3 patient required vasopressor drugs. Other complications during admission included acute renal failure (9/32), and aspiration pneumonia (5/32). Ten patients received a blood transfusion, and 7 patients were treated for suspected concomitant septicemia.

The mean QTc (Bazett) and change before and after administration of the first hour, 12 hours and 24 hours of intravenous artesunate were tabulated in Table 2. No significant change in the mean QTc was observed during the 1 hour observation period ($P > 0.05$), independent of the correction method used. No patient had an increase of QTc from baseline of > 25% after first bolus dose. The mean maximum increase in mean QTc (Bazett) after the first dose of artesunate was 5.8 ms (95% CI: 10.4–22.0 ms) at 1 hour. In addition to artesunate, the patient also received antibiotic coverage as twice daily like intravenous ceftriaxone (1 g) Piperacillin tazobactum, levofloxacin, ofloxacin and other supportive measure as per patient symptomatology. The next dose of intravenous artesunate was given on 12 hours after admission. The QTc (Bazett) was borderline at 0.499 seconds before receiving the first dose of artesunate and increased 6% to 0.531 seconds by 24 hours after administration of 2.4 mg/kg intravenous artesunate There were no arrhythmias or changes in axis and no significant changes in JT interval, PR interval, or QRS duration after administration of either the first or last dose of artesunate.. There was no significant change in mean heart rate or blood pressure after administration of either the first or last dose of artesunate. Mean heart rate was significantly lower in patients receiving their last dose (89.0 beats/minute; 95% CI, 85.2–92.7 versus 113 beats/minute ; 95% CI, 109–118; $P < 0.0001$), but mean systolic blood pressure was the same throughout (108 mm of Hg; 95% CI, 104–112 versus 111 mm of Hg; 95% CI, 108–115; $P = 0.1$).

DISCUSSION

The importance of evaluating potential cardiotoxic effects of newly introduced anti-malarial drugs has been highlighted with discovery of the cardiotoxicity of new anti-malarial drugs like artesunate after its registration and introduction into clinical practice [12]. Although Plasmodium falciparum sequesters in the myocardial microvasculature, significant myocardial dysfunction or arrhythmias caused by the disease are unusual in severe malaria. The quinoline antimalarials all have potent cardiovascular effects, but the effects of the artemisinin derivatives have been unclear [13,14]. This study evaluated the cardiovascular effects of intravenous artesunate and its effects on ECG changes (QT interval) in patients of falciparum malaria. Artesunate is given as a bolus injection as per guideline, so high blood levels of drug artesunate occur at the end of the injection and its effects on cardiac conduction times can be assessed over a short time period, relatively independent of the changes in disease state. Even these very high plasma concentrations would be expected to be associated with the greatest cardiovascular effects. However, there were no consistent cardiovascular or electrocardiographic effects after first dose of artesunate injection.

In the acute phase of malaria, the QTc is commonly short because of increased sympathetic tone from arousal, stress, discomfort, anxiety, and usually fasting and elongates with recovery when the patient is relaxed, comfortable, supine in bed, and has often resumed eating. All studies of antimalarial drugs (including sulfadoxinepyrimethamine, which has no cardiac activity at all) report some prolongation of the QT interval in the days after the start of treatment with artesunate [15-19]. In this study, the QTc interval was not significantly affected by high doses of intravenous artesunate given at different time intervals. Apart from this, no significant effect was observed on the JTc or PR interval, QRS width, blood pressure, or heart rate.

There are many reasons underlying fluctuation in the QT interval in the acute phase of managing a life-threatening disease. It has been noted that administration of the last dose of artesunate to one patient increase the QTc time (10 ms) and in some other patients, QT not changes immediately after artesunate injection. Of the antimalarial drugs, the quinolines, quinine, quinidine, chloroquine, and halofantrine, can cause significant prolongation of the QT interval[20,21].

QT prolongation by 25% occurs in ~10% of patients given high-dose intravenous quinine. Halofantrine induces consistent dose-dependent prolongation of the QTc interval, and its use in patients with malaria has been associated with arrhythmias and sudden death. There were no arrhythmias or adverse cardiovascular effects in this study. The effects of recovery from severe malaria and any drug activity on ventricular repolarization could not be distinguished. Studies on oral administration of artemether, including in combination with lumefantrine, to both malaria patients and healthy volunteers did not show any significant electrocardiographic abnormalities including evidence of QTc prolongation[22–24]. Compared with artesunate and artemether, artesunate has a more favorable toxicity profile, even though plasma concentrations of the parent compound and the common metabolite DHA after intravenous injection are an order of magnitude higher. Considerably higher doses of artesunate are needed to produce neurotoxicity in animals [22,23]. No effects on the ECG in dogs receiving the equivalent of the standard human dose of 2.4 mg/kg intravenous artesunate was observed and in other studies, doses several orders of magnitude higher than those used to treat malaria were required to cause negative inotropy in isolated guinea pig heart and hypotension in rabbits[24], all suggesting a very wide therapeutic ratio, and this is in line with the negative findings in this study.

This study had limitations. The sample size was small and only three ECGs per patient were performed. Performing several ECGs at each time point to reduce the intra individual variation would have been more informative. We were not able to perform 24 hour Holter monitoring which would have yielded more data. Pharmacokinetics studies are also needed.

CONCLUSION

This study showed that intravenous artesunate does not have significant cardiovascular effects (QTc interval) in patients with severe falciparum malaria. The artesunate regimen appears to be relatively safe patients in this limited study, but further studies in a larger cohort are warranted for conclusive evidence on safety.

ACKNOWLEDGEMENTS

We sincerely thank the patients who participated in the study.

Conflict of interest: We declare that there is no conflict of interest

Source of Funding: None

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DOI Number: 10.5958/j.2320-608X.1.2.034

Evaluation of Psychomotor Performance of 2nd MBBS Students after Exposing them to Lectures During Pre and Post Lunch Session

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ABSTRACT

Background: In India, didactic lectures are important part of medical education. It is said that concentration levels never remain same during entire one hour lecture leading to impairment in cognitive performance. Therefore, we planned this study to evaluate the effectiveness of lectures at various time intervals by assessing the status of psychomotor performance.

Materials and Method: Twenty 2nd MBBS students of RIMS Adilabad were included in the study. Psychomotor performance was evaluated using Digit Symbol Substitution Test (DSST) and Six Digit Cancellation Test (SDCT) and Visual Analogue Scales (VASs). Tests were carried out before and after exposing the volunteers to lectures of 8 A.M. to 9 A.M., 1 P.M. to 2 P.M. and 3 P.M to 4 P.M.

Results: Significant ($p > 0.05$) impairment in the performance of DSST and SDCT were observed when 8 to 9 theory class was compared with 3 to 4. Post 3 to 4 lecture performance was significantly improved ($p > 0.05$) in both the tests.

Conclusion: Psychomotor performance of 2nd MBBS students in our set up is better during the post lunch theory classes. Whenever teaching activities are planned local factors must be considered and optimum learning atmosphere should be provided to the students.

Keywords: *Lectures, Psychomotor Performance, Learning*

INTRODUCTION

In India, undergraduate medical education is directed towards training students so that they can undertake the responsibilities of a physician. It is expected from them that they will look after the preventive, curative and rehabilitative aspects of medicine [1]. In India, students learn medicines and clinical skills for four and half years with additional one year internship [2]. During this entire period, they were taught using various methods like didactic lectures, demonstration, tutorials, and laboratories practical and clinical postings[3]. Globally many new trends and innovations are emerging which include self directed learning, problem based learning (PBL), integrated teaching, community orientation[4] and web based learning [5]. But in India, didactic lectures are still very important part of medical education. The system of lecture was established centuries ago as a teaching method in various countries [6]. The main purpose of this system is to deliver the information. In it the teacher speaks for a specified period of time and the students listen and record. Participation of students is generally minimal. But the advantage is teaching can be done in any size and often large classes[7]. These are one hour theory classes which are usually arranged in between other methods of teaching since morning 8 A.M. to 4 P.M[3].

It is said that concentration levels never remain same during entire one hour (theory class) lecture leading to impairment in cognitive performance. It is because, learning style itself is a complex thing and the models of learning focus on different aspects of

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the learner like cognitive personality style or information processing style or instructional preferences[7]. Moreover, status of performance in students might be different at different hours of the day in the hectic academic schedule.

In Rajiv Gandhi Institute of Medical Sciences (RIMS) Adilabad, 2nd MBBS students have to attend 8 to 9 morning theory class followed by 9 to 12 clinical posting, lunch, 1 P.M. to 2 P.M lecture and 2 to 4 practical or 2 to 3 and 3 to 4 lectures. This excessive work might impair their learning ability during lecture classes. Therefore, we planned this study to evaluate the effectiveness of lectures at various time intervals by assessing the status of psychomotor performance using psychometric paper pencil tests.

MATERIALS AND METHOD

RIMS Adilabad is a medical college located in north Telangana region of Andhra Pradesh, India with intake capacity of 100 students each year. This work is based on the data taken from the academic year 2010-2011. A total of 20 (n=20) volunteers from second MBBS students of RIMS Adilabad were included in the study after taking informed consent and permission from the institutional authorities. Subjects receiving drugs like sedatives, antianxiety or antihistamines were excluded from the study[8]. None of the subjects was dependent on alcohol, tobacco or other drugs. The volunteers were asked to refrain from smoking, drinking alcohol or taking any medication one day prior to the study [9, 10, 11, 12]. Each volunteer acted as his own control.

Psychomotor performance was evaluated using Digit Symbol Substitution Test (DSST) [8, 13] and Six Digit Cancellation Test (SDCT) [8, 13]. In DSST the subjects were required to insert a symbol above each digit during two minutes time period for odd, even and zero numbers on a given sheet of 200 randomized digits. While in SDCT volunteers were asked to cancel as many target digits as possible within two minutes time period with given key of six digits in a sheet consisting of 1200 randomized digits. Visual Analogue Scales (VASs)[14, 15] were used for assessment of subjective performance. The subjects were asked to indicate the state of their current feeling by marking on a 100mm horizontal line. The midpoint of each scale was taken as normal state. The semantic opposites were wide awake/ extremely sleepy, calm/ excited and attentive/ dreamy. Performance studies were carried out before and after exposing the volunteers to lectures of 8 A.M. to 9 A.M., 1 P.M. to 2 P.M. and 3 P.M to 4 P.M.

Paired't' test was applied for pre and post class performance analysis of each class. One way ANOVA followed by post- hoc Newman- Keuls multiple comparison test was used for the comparison of post class performance of various classes held at different time intervals using Prism software, version 5.03 (Trial).

RESULTS

Statistically significant ($p > 0.05$) impairment in the performance of DSST was observed when 8 to 9 theory class was compared with 3 to 4 and 1 to 2 theory class. But there were no significant differences in the scores of DSST when 1 to 2 and 3 to 4 theory classes were compared with each other (Table 1). Significant differences were not observed between pre and post 8 to 9 class and pre and post 1 to 2 classes but the performance was significantly improved ($p > 0.05$) after attending the 3 to 4 class (Table 2).

Table 1: Comparison between various theory classes

Test	Lectures	Mean Difference	F value	P value
DSST	8 to 9 Vs 3 to 4	-27.8*	11.96	<0.0001*
	8 to 9 Vs 1 to 2	-25.7*		
	1 to 2 Vs 3 to 4	-2.1		
SDCT	1 to 2 Vs 3 to 4	-67.7*	9.613	0.0003*
	1 to 2 Vs 8 to 9	-4.4		
	8 to 9 Vs 3 to 4	-63.3*		
VAS- 1	3 to 4 Vs 8 to 9	-18.75	2.606	0.0826
	3 to 4 Vs 1 to 2	-14.75		
	1 to 2 Vs 8 to 9	-4		
VAS-2	8 to 9 Vs 3 to 4	-12.75	1.529	0.2254
	8 to 9 Vs 1 to 2	-1		
	1 to 2 Vs 3 to 4	-11.75		
VAS- 3	3 to 4 Vs 8 to 9	-16.75	2.198	0.1203
	3 to 4 Vs 1 to 2	-14.75		
	1 to 2 Vs 8 to 9	-2		

*= $p < 0.05$

Table 2: Pre and Post class comparison

Test	8 to 9 Lecture		1 to 2 Lecture		3 to 4 Lecture	
	Mean(SD)		Mean(SD)		Mean(SD)	
	Pre Class	Post Class	Pre Class	Post Class	Pre Class	Post Class
DSST	99.65(17.0)	104.8(18.9)	129.3(24.3)	130.5(18.2)	114.7(22.3)	132.6(22.7)*
SDCT	186.8(48.9)	191.7(47.8)	220.3(58.9)	187.3(48.0)*	210.5(48.0)	255(66.1)*
VAS- 1	84.5(15.0)	68.75(29.5)	74.45(28.7)	64.75(29.4)	47.25(31.8)	50(22.7)
VAS- 2	64.25(32.2)	58.75(29.3)	60.50(25.4)	59.75(22.4)	71.25(25.2)	71.5(24.8)
VAS- 3	77(25.1)	59.25(30.7)*	74(25.8)	61.25(25.3)	44.25(25.1)	44.5(26.5)

SD= Standard deviation, *= $p< 0.05$

In SDCT, significant difference were observed between 8 to 9 and 3 to 4 and 1 to 2 and 3 to 4 classes but the results were nonsignificant between 8 to 9 and 1 to 2 classes (Table 1). Post 3 to 4 class performance was better than pre class performance it was impaired in the post 1 to 2 class and non significant in 8 to 9 class (Table 2).

On subjective rating scales, the performance (shifting of VASs towards right or left side) was statistically nonsignificant on all the three VASs when each scale was compared between 8 to 9, 1 to 2 and 3 to 4 theory classes (Table 1). Pre and post classes performance was also non significant in all the three subjective rating scales but post 8 to 9 class performance was significantly impaired on VAS- 3 ($p < 0.05$) as the state of feeling was indicated more towards dreamy side since the VAS- 3 was shifted towards right side (Table 2).

DISCUSSION

To assess the psychomotor performance, psychometric paper pencil tests included in the study were DSST and SDCT. Psychomotor performance is the result of co-ordination between sensory and motor nervous system by the integrative and organizational process of brain. Perception, recognition and recoding are the important components of sensory activity. Perception component can be assessed using a letter or number cancellation task like SDCT while recoding and recognition component of sensory information can be assessed using DSST. In central nervous system, analysis of sensory stimulus occurs which is responsible for coordinated behavioral response [8]. Thus impairment in the performance can cause difficulties in learning activity of the students. Stone BM [13] reviewed the literature on pencil and paper tests and concluded that pencil and paper tests are useful for detecting psychomotor performance and letter cancellation, arithmetic, DSST are most sensitive tests.

Our results shows that psychomotor performance is significantly better during hours of post lunch theory classes as performance on DSST and SDCT were improved specifically in 3 P.M. to 4 P.M. Class. We expected that performance will be better in morning 8 A.M. to 9 A.M. lecture but contrary to that opposite results were observed.

It is assumed that students attend the morning lectures after adequate overnight sleep and mild to moderate breakfast. So they are fresh and ready to do the whole day assignments. These are the probable reasons why in morning hours performance of the students should be better. After getting such types of results we closely monitored and inquired about the twenty four hours activities of the students in college and hostels for few days. It was ethically permissible since one of the authors is hostel warden and it is part of his duties to monitor the student's activities.

We found that most of the students wake up around 7 A.M. in the morning, get themselves ready to attend the morning 8 A.M. to 9 A.M. class. But due to limited number of bathrooms and toilets, all are not able to take bath. Student's mess contractor is not providing breakfast before 8.30 A.M. in the morning so they have to attend the class without breakfast. After 9 A.M. class they return in the hostels, some of them takes bath and all the students takes moderate breakfast. After taking some rest they attend the clinical postings around 10 A.M. and return from the hospital around 12 A.M. again they take some rest followed by lunch and then attend the 1P.M. to 2 P.M. lecture. After that they attend 2 P.M. to 4 P.M. practical class or 2 P.M. to 3 P.M. lecture followed by 5 minutes break and 3 P.M. to 4 P.M. lecture.

In the hostels they take rest in between 4.15 P.M. to 5 P.M. followed by tea and some snacks. After that they play either volleyball or play some outdoor games upto 6. 30 P.M. followed by bath. Around 7 P.M. they start

reading their subjects till 8.30 P.M. then take dinner and again start reading till 1 A.M. to 2 A.M. or some students upto 4 A.M. Then they take sleep upto 7 A.M. and wake up.

Such a heavy daily schedule indicates that they are more exhaustive during morning hour lectures in comparison to post lunch classes. Moreover, they are getting some physical rest and are more relaxed during post lunch session. Before 3 P.M. to 4 P.M. class they are also getting some sort of diversion from the lecture. These are the probable reasons why we observed impaired performance during morning hours in comparison to post lunch classes. Weinger et al [16] in their study also observed that cognitive performance is affected due to sleep deprivation in physicians leading to adverse impact on their clinical performances.

We have not observed any correlation between objective tests and subjective scales although post 8 A.M. to 9 A.M. performance was significantly impaired. Subjectively students did not felt any performance impairment. It might be due to failure to describe accurate state of feeling by the students. Further, there is limitation of analogue system since words may fail to describe the exactness of the subjective experience [14].

Maxwell [15] evaluated the sensitivity and accuracy of the visual analogue scale by a psycho-physical classroom experiment and summarized that visual analogue scale is simple to use and even large differences can also be treated safely by parametric tests and the t-test is very robust. But Nicholson [17] described that subjective assessments cannot stand alone on their own and statistical methods do not convert the uncertainties of subjective assessment to 'truth'. The proportional scores may be more sensitive but still erroneous results can persist.

CONCLUSION

We conclude that psychomotor performance of 2nd MBBS students in our set up is better during the post lunch theory classes. Lectures during the post lunch sessions are useful since unimpaired performance may increase their learning abilities. Furthermore, whenever teaching activities/ theory classes are planned local factors must be considered and optimum learning atmosphere should be provided to the students.

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DOI Number: 10.5958/j.2320-608X.1.2.035

Comparative Study of effect of Slow and Fast Suryanamaskar on Work Load of Heart in Normal Human Subjects

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ABSTRACT

Objective: To compare the work load on heart by slow and fast suryanamaskar.

Background: Suryanamaskar, an integral component of yoga is an excellent practice that stretches and tones the whole body. Various schools of yoga differ in the practice of suryanamaskar (SN). Some schools advocate performance in a slow manner in tune with slow breathing, while others advocate a rapid method of performing multiple rounds in a fast manner similar to physical exercise. It has been suggested that SN at different speeds provides different benefits. In the present study, we planned to determine the immediate effect of slow and fast suryanamaskar on heart rate and blood pressure of normal young volunteers.

Method: Thirty healthy school children were randomly divided into two groups of 15 each. Group I underwent training in fast suryanamaskar while group II were given training in slow suryanamaskar. Blood pressure and heart rate were determined before and immediately after the practice of suryanamaskar in both the groups.

Result: Fast suryanamaskar produced a significant increase in systolic pressure, pulse pressure and rate pressure product. On the other hand, slow suryanamaskar produced a significant decrease in diastolic pressure but there was no significant change in systolic pressure or rate-pressure product. Thus it was evident that the cardiovascular response to suryanamaskar depends on the manner in which it is performed. Slow suryanamaskar is non-taxing to the heart and hence can be prescribed to hypertensive patients and for rehabilitation of cardiac patients.

Conclusion: It is recommended that slow suryanamaskar may be used as a lifestyle component for school children and also for subjects with pre and stage I hypertension and mild degree cardiac patients undergoing rehabilitation.

Keywords: *Suryanamaskar, Fast and Slow, Rate Pressure Product, Work Load*

INTRODUCTION

India has a long and rich tradition of yogic practices and yoga is a system of physical, mental and spiritual discipline developed by ancient rishis of India. Now-a-days, yoga is gaining a lot of attention from healthcare professionals from all over the world. With increasing scientific research in yoga, its therapeutic aspects are also being explored.

Suryanamaskar (SN), salutation to the sun, is an integral component of Indian traditional yogic practices. Each cycle of suryanamaskar is a flowing series of 12 postures, performed in synchrony with breathing. The sequence is such that each posture is complementary to the subsequent posture. During

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suryanamaskar, the muscles of the entire body are stretched alternately and therefore it gives more benefits with less expenditure of time. It is claimed that the suryanamaskar practice improves cardio-respiratory fitness in healthy subjects. Since time is often seen as a limiting factor when exercising, a daily practice of suryanamaskar can be a perfect solution for time constrained individuals.

Madanmohan et al and Bera and Rajapurkar have demonstrated that yoga training improves cardiovascular response to exercise [1,2]. Yogic techniques have sound scientific basis and produce consistent physiological changes [3,4,5]. Regular practice of suryanamaskar has been shown to lower heart rate and blood pressure [6,7]. On assessing various hatha yoga practices for meeting the minimum recommendation for physical activity that can increase health Hagins M et al concluded that yoga practice incorporating sun salutation postures exceeding the minimum bout of 10 minutes may contribute some portion of sufficiently intense physical activity to improve cardio-respiratory fitness in unfit or sedentary individuals [8]. Sinha and colleagues had concluded that SN is an ideal form of aerobic exercise having static, stretching and dynamic muscular movements involving all major joints [9].

Various schools of yoga differ in the practice of SN. Some schools advocate performance in a slow manner in tune with slow breathing, while others advocate a rapid method of performing multiple rounds in a fast manner similar to physical exercise. It has been suggested that SN at different speeds provides different benefits and that when it is done rapidly it warms up the body and acts as cardio tonic, whereas when done slowly it strengthens and tones the musculature and enhances functioning of internal organs.

Madanmohan et al have demonstrated that two months of yoga training produces a decrease in resting blood pressure, heart rate, rate-pressure product (RPP= heart rate x systolic pressure x 10^{-2}) and double product (DoP = heart rate x mean blood pressure x 10^{-2}) in normal healthy subjects [2]. Rate-pressure product and double product are indices of myocardial oxygen consumption and work load on the heart [10]. After yoga training, a given level of exercise produces a much less cardiovascular response, suggesting an improved exercise tolerance. A reduction in exercise-induced stress on cardiovascular system has physiological significance as well as clinical applications. The improved cardiovascular response induced by yoga training indicates a state of parasympathetic dominance.

MATERIALS AND METHOD

The study was approved by Annamalai University and the study was started after getting ethical clearance from the Ethics committee for human studies in Annamalai University. A comparative study of the immediate effects of fast and slow suryanamaskar was conducted on 30 healthy school children of either gender. Their age was between 14-16 years, weight 50-60 Kg, and height 150-160 cm. They were randomly divided into group I and group II of 15 each. They were briefed about the study protocol and purpose of the study. Group I and Group II received 4 days training in performance of fast suryanamaskar (FSN) and slow suryanamaskar (SSN) respectively. Fast suryanamaskar subjects were trained to perform suryanamaskar in fast manner so that all of the 12 poses were completed in 2 minutes and each pose was held for 10 seconds. On the other hand slow suryanamaskar subjects were trained to perform suryanamaskar in a slow manner so that each of the 12 poses was held for duration of 30 seconds. Each round took 6 minutes to complete and 5 such rounds were performed for both types. On the day of testing, the subjects reported at the laboratory at 9 AM, about 2 hours after light breakfast.

Following parameters were recorded before and immediately after the fast and slow suryanamaskar in the respective group:

1. Systolic pressure (SP)
2. Diastolic pressure (DP)
3. Heart rate (HR)
4. Pulse pressure (PP)
5. Mean pressure (MP)
6. Rate-pressure product (RPP)

Systolic pressure, diastolic pressure, mean pressure and heart rate were recorded by non-invasive semi-automatic blood pressure monitor (Press-mate 8800, Colin Corporation, Japan). Pulse pressure (PP = SP-DP) and RPP (RPP = HR x SP x 10^{-2}) were calculated.

All the recordings described above were taken before (B) and immediately after (A) the practice of suryanamaskar. The data were subjected to statistical

analysis using students't' test. P value of less than 0.05 was considered as indicating a statically significant difference between the compared values

RESULTS

The results of the present study are given in tables 1 and 2. Table 1 gives the cardiovascular effects of practicing suryanamaskar in a fast manner. Before the practice of suryanamaskar the resting systolic pressure was 111.67 ± 10.38 mmHg (mean±SD) and the diastolic pressure was 68.20 ± 6.93 mmHg. Immediately after the fast suryanamaskar practice, systolic pressure was 125.20 ±13.12 mmHg, that is significantly higher than the resting value (P<0.01). In contrast, the diastolic pressure which was not significantly different after the suryanamaskar practice. Fast suryanamaskar increased the pulse pressure significantly to 57.57 ± 19.20 mmHg from the resting value of 43.47 ±8.90 mmHg (P<0.02), while increase in mean pressure was insignificant from 82.69 ± 7.09 mmHg to 87.02 ± 11.77 mmHg. Heart rate was higher after suryanamaskar practice (101.53 ± 24.56 vs. 89.07 ± 11.46 beats/ min). However, this increase was not statistically significant. Rate-pressure product registered an appreciable increase to 127.99 ± 36.77 form the resting value of 99.61 ± 16.53, the increase being statistically significant (P<0.02).

Table 1: Systolic pressure, diastolic pressure, pulse pressure, mean pressure, heart rate and rate-pressure product before and after fast suryanamaskar (n=15)

Parameters	Before	After	P value
Systolic pressure	116.7±10.38	125.20±13.12	0.0004
Diastolic pressure	68.20±6.93	67.93±15.64	0.9460
Pulse pressure	43.47±8.90	57.27±19.20	0.0059
Mean pressure	82.69±7.09	87.02±11.7	0.1650
Heart rate	89.07±11.46	101.53±24.56	0.0517
Rate-pressure product	99.61±16.53	127.99±36.77	0.0067

Data presented as mean ± SD. Analysis done by students paired t test

The effect of practicing suryanamaskar in group II in a slow manner is given in table 2. Resting systolic pressure in them was 117.20 ± 17.91 mmHg and immediately after the slow suryanamaskar session, it became 120.27 ±16.54 mmHg. However, this increase was not statistically significant. After the slow suryanamaskar practice, the diastolic pressure lowered significantly to 62.27 ± 6.31 mmHg as compared to the resting value of 72.80 ± 14.61 mmHg (P<0.02). Pulse pressure was higher after the practice session (58.00 ±14.19 mmHg vs. 44.40 ± 14.84 mmHg), the increase being statistically significant (P<0.02). After the slow suryanamaskar practice, mean pressure decreased to 81.60 ± 8.54 from the basal value of 87.60 ± 14.15. However this decrease was not statistically significant. Heart rate was insignificantly higher after the session of slow suryanamaskar (89.27 ± 10.48 vs. 84.27 ± 15.53 beats / min). Rate-pressure product was also insignificantly higher after the session of slow suryanamaskar (107.88 ± 23.13 vs 100.15 ± 30.14).

Table 2: Systolic pressure, diastolic pressure, pulse pressure , mean pressure, heart rate and rate-pressure product before and after slow suryanamaskar (n=15)

Parameters	Before	After	P value
Systolic pressure	117.20±17.91	120.27±16.54	0.4741
Diastolic pressure	72.80±14.61	62.27±6.31	0.0064
Pulse pressure	44.40±14.84	58.00±14.19	0.0036
Mean pressure	87.60±14.15	81.60±8.54	0.0738
Heart rate	84.27±15.53	89.27±10.48	0.1922
Rate-pressure product	100.15±30.14	107.88±23.13	0.2638

Data presented as mean ± SD. Analysis done by students paired t test

DISCUSSION

To the best of our knowledge, this type of study has not been reported earlier. Our study shows that the immediate cardiovascular response to the practice of suryanamaskar depends on the manner of performing it. When suryanamaskar is performed in a fast manner, there is statistically significant increase in systolic pressure, pulse pressure and rate- pressure product. On the other hand, slow suryanamaskar produces an insignificant increase in systolic pressure and rate-pressure product. It is interesting to note that while diastolic pressure did not change significantly after the fast suryanamaskar practice, it decreased significantly after the slow suryanamaskar. A decrease in diastolic pressure can be explained on the basis of a reduction in sympathetic activity [11]. Rate-pressure product is an index of myocardial oxygen consumption and load on the heart [10]. Insignificant increase in load on the heart means that one can safely perform suryanamaskar in a slow manner. Hence, slow suryanamaskar may be prescribed as a rehabilitative means to heart patients of mild severity and elderly subjects. Since slow suryanamaskar did not produce significant increase in systolic pressure (Table 2) it can safely be prescribed to patients of mild to moderate hypertension also. Sinha B et al concluded that as an aerobic exercise SN seemed to be ideal as it involves both static stretching and slow dynamic component of exercise with optimal stress on the cardiorespiratory system[9].

Suryanamaskar-induced increase in pulse pressure was significant in fast as well as slow suryanamaskar groups. Pulse pressure represents the stroke volume. Muscle contraction and deep breathing during suryanamaskar promotes blood flow and venous return to heart. As a result of increased blood flow to the heart, there is increase in its output (stroke volume), resulting in increase in pulse pressure. This relationship between ventricular filling and stroke volume is explained by the "Starling's law of heart". An insignificant increase in heart rate immediately after the suryanamaskar indicates that suryanamaskar is not a straining exercise, but a heart-healthy exercise. It is clear from the study that suryanamaskar, especially slow suryanamaskar is a non-straining exercise and can be safely prescribed to elderly subjects and for rehabilitation of patients recovering from cardiovascular disease of mild degree

Conflict of Interest: Nil

Source of Funding: Nil

Acknowledgements: we would like to thank the participants of this for their cooperation

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DOI Number: 10.5958/j.2320-608X.1.2.036

Serum Total Estradiol Level is Associated with Waist Circumference in Adult Males

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ABSTRACT

Obesity is becoming pandemic and in developing country like India problem of obesity is also growing at a very fast rate. In men Estradiol (E2) is important must be kept in balance for good health. Serum estradiol changes with Body weight. This study was conducted to see the association of serum total estradiol (E2) level with the waist circumference in adult males. It was a cross sectional study, conducted on 89 adult males (aged 18-50 years). Anthropometric measurement i.e. waist circumference (cm) was taken as a criteria for classifying normal weight and overweight & obese males. The morning venous blood sample was drawn between 8-11 A.M. from each subject and serum was separated. Serum Total estradiol was measured using ELISA. When compared with waist circumference, serum total estradiol in normal weight "Group A" with W.C. < 90cm, was 19.61±8.56pg/ml and in overweight and obese subjects, "Group B" with W.C. ≥ 90cm it was 52.10±29.83 pg/ml. Thus it was concluded that Serum Total Estradiol level significantly increased in "Group B" (W.C. ≥ 90cm) as compared to subjects with" Group A" (W.C.< 90cm).Therefore we can delineate that serum total estradiol might increase significantly because of increased abdominal fat mass in overweight and obese subjects i.e. subjects who had increased waist circumference(≥ 90 cm)

Keywords: *Obesity, (W.C.) Waist Circumference (cm), Serum Estradiol (E2)*

INTRODUCTION

The incidence of obesity is rapidly rising in almost every region of the world. Obesity is a chronic disease and has become widespread both in developed as well as developing countries, and is targeting both children as well as adults. The World Health Organization has described obesity as one of today's most neglected public health problems, affecting every region of the globe. It is a medical condition in which excess body fat, or white adipose tissue, accumulates in the body to the extent that this accumulation of fat might adversely affect health, potentially reducing life expectancy and or increased health problems. The past decade has been attempting to identify key hormones and other signals that influence body weight. Obesity is also associated with multiple alterations in the endocrine system, including abnormal blood hormone concentration which can be due to changes in pattern of their secretion and /or metabolism, altered hormone transport and /or action at the level of target tissues.

Males and females differ in terms of how and where they store body fat, the hormones they secrete in proportion to their fat, and the way their brains respond to signals that regulate food intake and body weight (Clegg HYPERLINK "#R27"et al[HYPERLINK "#R27"1]HYPERLINK "#R27"., 2003; Clegg HYPERLINK "http://www.ncbi.nlm.nih.gov/pubmed/16567519"et al[HYPERLINK "http://www.ncbi.nlm.nih.gov/pubmed/16567519"2]HYPERLINK "http://www.ncbi.nlm.nih.gov/pubmed/16567519".HYPERLINK "http://www.ncbi.nlm.nih.gov/pubmed/16567519", 2006).

Estradiol is necessary but must be kept in balance for good male health. High levels of estradiol (more

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than 30pg/ml) are dangerous to male health. Excess estradiol put men at risk for cardiovascular issues and prostate problems. In addition excess estradiol levels will inhibit the normal male production of testosterone which leads to a myriad of probable health concerns.

The distribution of body fat specifically in the central abdominal region has also been used to diagnose a patient as obese and currently waist circumference is believed to be a more accurate marker of obesity. Therefore we did a study to find out, if there is any relation, particularly with the waist circumference and serum total estradiol level in males.

Serum testosterone associated independently inversely, while serum E2 associated independently directly with total body fat mass, total body fat percentage and trunk fat mass (Vandenput et al[3]., 2010).

MATERIAL AND METHOD

The present work entitled "Serum total estradiol level is associated with waist circumference in adult males" was conducted on adult males (n=89) of 18 to 50 years age group at G.S.V.M. medical college Kanpur. We studied 89 adult males, after taking permission from the institutional ethical committee. The subjects were briefed about the study and their proper written consent was taken.

Inclusion Criteria

All subjects were healthy adult males , Having no personal or family history of Diabetes, Hypertension, Tuberculosis, Heart Diseases and history of any endocrine or chronic disease and any kind of drug intake particularly steroids.

Exclusion Criteria

Subjects with the history of chronic disease, endocrinopathy or subjects taking any serum testosterone or estradiol altering medicine, alcoholics and smokers were excluded from the study.

Detailed physical examination of each subject was done.

Anthropometric measurement

The Waist Circumference (WC) of each subject was taken in centimeters to the nearest 0.1 cm, at the level of umbilicus, at the end of expiration.

The subjects were divided into two broad groups

Group A: consists of subjects with their waist circumference (W.C. <90 cm.)

Group B: consists of subjects with their waist circumference (W.C. e"90 cm.)

The present study was done with the aim of comparing serum total estradiol level in normal weight and overweight & obese subjects according to their Waist Circumferences.

Serum Total estradiol was measured using Enzyme-linked immunosorbent assay (ELISA).

Method of Serum Total Estradiol Estimation

The serum total estradiol was measured by Enzyme-linked immunosorbent assay (ELISA) in the department of Pathology, G.S.V.M. medical college, Kanpur. The DRG Estradiol ELISA kit manufactured by DRG Instruments GmbH, Germany was used.

Statistical Analysis: For the statistical analysis the independent T-test was applied using the spss software package version 16(spss16) was used for both data management and analysis. The mean, standard deviation, and coefficient of correlation were calculated using the spss 16 software.

Conflict of Interest: Nil

Source of Funding: Self Financed

RESULTS

Table 1. No. of Subjects, Anthropometric Values, Age Distribution & Serum Estradiol in The Anthropometric Groups (A) & (B)

	No. of Subjects (n=89)	Anthropometric Values(cm)	Age Distribution (Years) (Mean +S.D.)	Serum Total Estradiol level (Pg/ml)
WC(cm) • <90	n = 45	81.32 +4.71	23.76 +4.02	19.61 + 8.56
• >90	n = 44	96.52 ± 6.52	29.02 +8.70	52.10 +29.83

{(S)*=Significant}

GRAPH 1 :-W.C. Vs. ESTRADIOL in all subjects

DISCUSSION

Overweight and obesity have become a serious matter of concern worldwide. Obesity is not only the predisposing factor for many diseases but WHO now consider obesity, itself as a chronic disease. In the developing world the prevalence of overweight and obesity is increasing at alarming rates and in some countries has reached levels observed in the developed world.

The obesity is also one of the common problem in our country, India, due to changes in life style related factors, diet and increasing urbanization. As Waist Circumference (WC) is one of the major determinants of obesity and an increasing waist line due to deposition of excessive fat may influence the estradiol level in men. The aim of the present study was to compare the serum total estradiol (E2) levels in overweight and obese adult males and non-obese adult males according to their waist circumference (WC).

Both the groups are almost comparable as all 89 subjects are of same race, non-smokers, non-alcoholics, non-exercisers and more or less of comparable age group.

Waist Circumference (WC) and Serum Total Estradiol (E2)

When compared according to waist circumference, the Group A consists of subjects with their waist circumference < 90 cm and Group B consists of subjects with their waist circumference > 90 cm.

We have found a significant increase ($p<0.05$) in serum Total Estradiol (E2) level in overweight and obese males as compared to non-obese however both the groups were having some values within normal range. Our results coincide with the results of previous study of Muller[4] et al (2003),who also confirmed in their data that obesity in males is accompanied by a significant decline in testosterone and SHBG levels and an increase in serum total estradiol (E2) levels. According to them an increasing waist circumference, considered to be a more accurate reflection of abdominal adipose tissue than the waist hip ratio (Visscher[5] TL et al.,2001), is also associated with a reduction in testosterone and SHBG and an increase of E2.However, after adjusting for BMI, it was only additionally associated with increased E2 levels. The same finding has been reported by Vermeulen[6] et al (2002), that E2 levels are highly related to body fat mass and more specifically to subcutaneous abdominal fat. We also confirm from results of our data that waist circumference is having strongly associated, coefficient of correlation (r = + 0.840) with the increase in serum E2 levels.

Thus, it can be concluded that Waist Circumference (WC) is correlated positively with serum total estradiol level (r=+ 0.840) and was found significantly raised in adult males. So, Obesity i.e. Adiposity, particularly abdominal fat have been found associated with increase in serum total estradiol level. But the larger & follow-up studies would be needed to see the long term effects of the increased estradiol level on the health of men.

Though the Waist Circumference (WC) is one of the major determinants of obesity and an increasing waist line exhibit the deposition of excessive fat, but more accurately the regional or total body fat mass can be measured by advanced techniques like DEXA (Dual X-RAY Energy Absorptiometery), IRMA (Infra Red mass absorptiometry), CT-SCAN, etc. There are fewer studies and inference should not be drawn with these findings alone.

ACKNOWLEDGEMENT

We want to thank our colleagues, juniors and students who have contributed in this work.

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DOI Number: 10.5958/j.2320-608X.1.2.037

Effect of BMI on Lactate Threshold of Overweight and Obese Individuals in a Population of Eastern UP

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ABSTRACT

Background: In this article we report our findings on correlation between body mass index (BMI) and lactate threshold (LT) during an aerobic exercise. Total 30 male subjects of age in the range of 20-40 years, classified into three different categories, normal, overweight and obese, performed a treadmill exercise as per Bruce Protocol and their respiratory parameters were recorded. We analyzed our experimental data for each of the three groups individually as well as altogether. Statistical data analysis revealed that LT decreases with increase in BMI. This trend was found to be consistent within and across the groups.

Materials and Method: All participants in this study were first medically examined to confirm that they did not have any cardiorespiratory complications; and their BMI was calculated. Based on their BMI, they were classified into three-normal, overweight obese groups and subjected to a treadmill exercise with Bruce Protocol.

Result: Lactate threshold decreases with increase in BMI within and across the groups.

Conclusion: This study establishes a correlation between lactate threshold and BMI of individuals that suggests that with increased BMI, lactate threshold decreases resulting into a decrease in respiratory fitness level.

Keywords: *Lactate Threshold, Respiratory Fitness, Exercise, Obesity*

INTRODUCTION

Several health consequences of overweight and obesity have been recognized and studied. It's been reported that BMI ranges that are defined to categorize individuals in different groups are based on the relationship between body weight and disease and death.[1] In present study, to assess respiratory endurance of different BMI individuals, exercise testing was done on a treadmill using Bruce Protocol [2] and LT along with other respiratory parameters were recorded. Lactate threshold is the exercise intensity at which lactate (more specifically, lactic acid) starts to accumulate in the blood stream. The lactate threshold is a useful measure for deciding exercises intensity for training and racing sports (e.g. long distance running, cycling, rowing, swimming, cross country, skiing etc.) varies for individuals and can be increased with training. Interval training takes advantage of the body being able to temporarily exceed the lactate threshold, and then recover (reduce blood-lactate) while operating below the threshold and while still doing physical activity. There are previous studies that suggest that, following respiratory endurance training, the reductions in lactate concentration at any given intensity may be due to a decrease in lactate production and an increase in lactate clearance. [3,4]

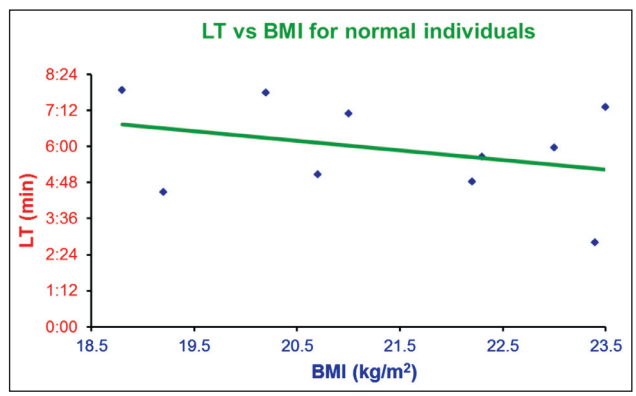

Fig. 1. LT vs BMI for normal individuals

MATERIALS AND METHOD

The subjects of all the three groups were lab medical students, technician students and paramedical staff of Nehru Hospital in B.R.D. Medical College, Gorakhpur. They were all healthy males with age in the range of 20-40 years. Based on their BMI, subjects were categorized into three groups specified as (i) normal :BMI in the range of 18.5 kg/m^2 -24.9 kg/m^2 ;(ii) overweight : BMI in the rage of 25 kg/m^2 - 29.9 kg/m^2 (iii) obese: BMI greater than 30 kg/m^2. The individuals in normal or control group were chosen such that they did not have any cardiorespiratory abnormalities. Subjects of all the three groups were lab medical students, technician students and paramedical staff of Nehru Hospital in B.R.D. Medical College, Gorakhpur. Normalcy of the subjects were decided by their respiratory history and through clinical and radiological examinations. Each subject underwent a detailed physical detailed physical examination i.e. built, height, weight, pallor, icterus, weight loss, anorexia, and clubbing, pedal edema, cyanosis, and lymph node examinations. Smokers, alcoholics and persons with any history of disorder such as acute myocardial infarction, unstable angina, hypertension, chest pain, bronchitis, pneumonia, uncontrolled asthma, syncope, and other systemic anomaly such as hepatomegaly and/or splenomegaly etc. at the time of study were excluded from the exercise testing. Subjects reported at the lab in the morning after a light breakfast. They were allowed to rest before the treadmill exercise trial began. For treadmill exercise, Bruce protocol was followed in which after every three minutes elevation was increased by 2 degrees and speed was increased. Lactate threshold readings and other respiratory parameters were recorded and analysed. To check statistical significance of the data student T-test was performed.

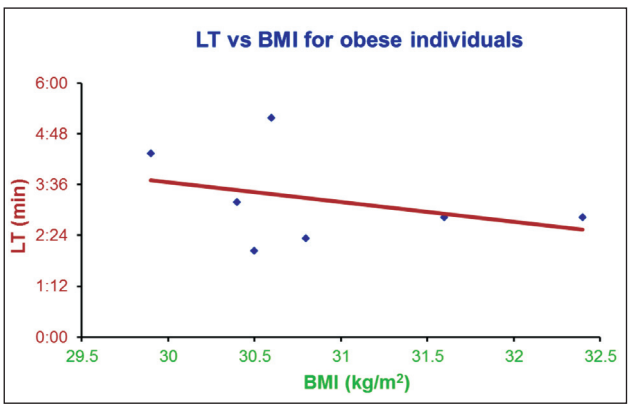

Fig. 2. LT vs BMI for overweight individuals

RESULTS

The plot of lactate threshold and BMI of normal group individuals as shown in Figure .1 shows that, in general, within the normal group LT decreases with an increase in the BMI of normal group individuals. The average lactate threshold of normal group individuals was found as (05:53 ± 01:39) min. Similar to the normal group subjects, LT values were recorded for overweight subjects and analyzed critically. The plot shown in figure 2 suggests that LT decreases with increase in BMI. Also, when compared to the mean LT of normal group, it was found that mean LT for overweight subjects in smaller than that of the normal group individuals. Recorded LT values were

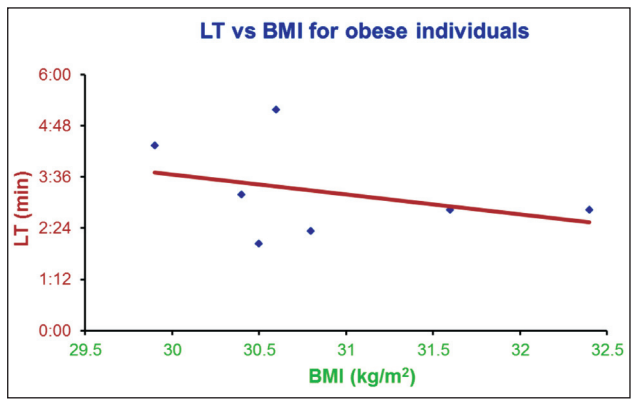

Fig. 3. LT vs BMI for obese individuals

plotted against BMI of obese group individuals. Since there were several individuals with same BMI, while plotting the plot the average value of same BMI individuals were considered. The plot and the trend of LT vs BMI within the same group is as shown in figure 3. In this plot too, it is clear that within the group, in general, LT decreases as BMI increases. The average lactate threshold of figures 1, 2 and 3 are for each one of the three normal, overweight and obese groups show a general trend that lactate threshold decreases with an increase in the BMI of the subjects. Subjects with lower BMI have higher and those greater lactate threshold whereas the subjects with greater BMI have lower lactate threshold. For normal, overweight and obese groups, the time at which lactate formation starts (i.e. lactate threshold) were recorded for each and every individual of all three groups. Similar trend as shown in figure 4 was observed across the groups when LT vs BMI was plotted for all 30 individuals subjected to the study. It was found that the average lactate thresholds for normal, overweight and obese groups were (05:33±01:39)min, (03:19±01:23) min and (03:00±01:19) min respectively. From these LT values

it is clear that the lactate threshold of normal subject is the maximum and that of obese subjects is the least, which suggests that lactate threshold decreases with an increase in the BMI. Lactate formation in obese individuals starts much sooner than that in normal and overweight individuals. When intergroup comparison of LT was done, changes in the LT from normal to overweight BMI group was found to be significant ($p < 0.05$). If we compare overweight to obese BMI group, changes in LT was again found to be significant ($p < 0.05$). If we compare normal to obese BMI group, changes in LT was very highly significant ($p < 0.001$).

DISCUSSION

In this study it was observed that the lactate threshold decreases with an increase in BMI within the group as well as among the three different groups.. For normal individuals LT was found to be (05:53 ± 01:39) minutes whereas LT for overweight and obese group were (03:19 ± 01:23) min and (03:00 ± 01:19) min respectively. There is a wide range of studies on the effect of LT with intensity of aerobic exercises in both normal

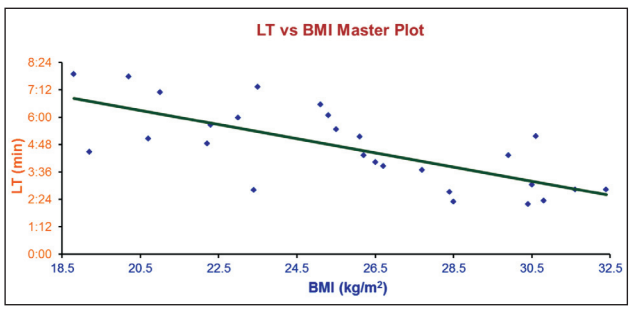

Fig. 4. Master plot of LT vs BMI for all 30 individuals involved in study.

individuals and athletes and various aspects of age, sex, height have been reported in literature[5,6,7] but the relation between lactate threshold and BMI has not been studied much. Here in this paper, our results reported about the relation of BMI on LT in normal, overweight and obese individuals give an insight of how physical fitness depends on BMI. Similar to the finding of LT vs BMI in present study, it has previously been reported that lactate threshold decreases as obesity becomes severe provides us a qualitative as well as a quantitative information of a relation between respiratory fitness and the body mass index, which in turn would help us understand prevalent health complications across the globe and find a suitable solutions to the problem.

ACKNOWLEDGEMENT

We thank all medical students and paramedical staff members who participated in this study. Technical support from Mr. Avanish (Technician, Department of T.B. & Chest) is acknowledged.

Ethical Clearance: Ethical clearance on this study was taken from institutional committee.

Source of Funding: None.

Conflicts of Interest: The authors declare no conflicts of interest.

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