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

Volume 2 / Number 1 / January-June 2014

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

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Volume 02 Number 01 January-June 2014

DOI Number: 10.5958/j.2320-608X.2.1.001

Hormonal Influence on the Adaptability of the Pulmonary System to Exercise in Short Term Smokers

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ABSTRACT

The role of hormones on PFT was well known in the normal course exercise. This study was intended to see the limitations of the pulmonary system in adaptability to exercise in short term smokers. It was observed that exercise per se does not cause a statistically significant change in dynamic lung function parameters MMEF, PEFR, MEF 25% to 75% in either of the groups. This finding supports the hypothesis that the respiratory system is not normally the most limiting factor in the delivery of oxygen even under the predominant influence of stress hormones which is further accentuated by exercise.

Keywords: *Short Term Smokers, PFT, Adaptability*

INTRODUCTION

Hormones have an influence on the healthy pulmonary system in delivering oxygen to meet the demands of various degrees of exercise. There are conflicting reports that the respiratory System is not normally the most limiting factor in the delivery of oxygen to the muscles during maximal muscle aerobic metabolism whereas others do not subscribe to this[1]. Stress is associated with an increase in level of various hormones.Within this context it is appropriate to study the effect of on ventilatory functions after exercise in short term smokers.

Mechanical constraints on exercise hyperpnoea have been studied as a factor limiting performance in endurance athletes' [2]. Others have considered the absence of structural adaptability to physical training as one of the "weaknesses" inherent in the healthy pulmonary system response to exercise [3]

Ventilatory functions are an important part of functional diagnostics [4], aiding selection and optimization of training and early diagnosis of sports pathology. Assessment of exercise response of dynamic lung functions in the healthy pulmonary system in the trained and the untrained has a role in clearing gaps in the above areas especially a special group like short term smokers.

MATERIAL AND METHOD

The present study was conducted as a part of cardio-pulmonary efficiency studies on two groups of controls (n=10) and short term smokers of 2-5 years duration (n=10) comparable in age & sex.

Informed consent was obtained and clinical examination to rule out any underlying disease was done. Healthy young adult males between 42-45 years who regularly undergo training and participate in competitive middle distance running events for at least past 3 years were considered in the study group whereas the control group were similar but non smokers. Clinical evidence of anemia, obesity, involvement of cardio-respiratory system was considered as exclusion criteria.

Detailed procedure of computerized spirometry was explained to the subjects.

Dynamic lung functions were measured in both groups before exercise was evaluated following standard procedure of spirometry using computerized spirometer Spl-95.

After exercise, the assessment of dynamic lung functions was repeated. All these set of recordings were done on both the study as well as the control groups.

Statistical analysis was done using paired students t-test for comparing parameters within the group before & after exercise testing and unpaired t-test for comparing the two groups of subjects.

A p-value of < 0.05 was considered as significant.

RESULTS

Table No. 1: Comparison of anthropometric data & VO2 max of study & controls with statistical analysis.

Parameter	Control	Study	P- value	Remarks
Age (Yr)	44.50 ± 2.62	44.46 ± 2.84	< 0.10	NS
Height (cm)	159.71 ± 7.50	155.92 ± 7.24	< 0.10	NS
Weight (kg)	52.66 ± 5.64	55.43 ± 6.26	<0.05	NS
BMI (kg/m²]	22.02 ± 2.47	21.60 ± 1.75	< 0.10	NS
VO2 max(lit/min)	2.49±0.16	2.95±0.27	< 0.001	HS

NS=Not significant

P< 0.01 Significant

P< 0.001 Highly Significant

Table No. 2: Comparison of Dynamic Lung Functions of study before exercise testing (BE) & after exercise testing (AE) with statistical analysis. Study (n=10)

Parameter	BE	AE	P- value	Remarks
FVC (L)	3.11 ± 0.52	3.02 ± 0.56	< 0.10	NS
FEV1 (L)	3.11 ± 0.50	2.98 ± 0.05	< 0.05	NS
FEV1/FVC	0.95	0.96		
MMEF (L/S)	4.04 ± 1.31	4.06 ± 1.46	< 0.10	NS
PEFR (L/S)	7.01 ±1.78	6.72 ±1.96	< 0.10	NS
MEF 75(L/S)	6.10 ±1.94	5.55 ±1.74	< 0.10	NS
MEF 50(L/S)	5.63 ± 1.44	5.61 ± 1.63	< 0.10	NS
MEF 25(L/S)	3.42 ± 1.16	3.68 ± 1.47	< 0.10	NS

NS = Not Significant

P< 0.05 is considered significant

Table No. 3: Comparison of Dynamic Lung functions ofcontrols before exercise testing (BE) & after exercise testing (AE) with statistical analysis. Controls (n=10)

Parameter	BE	AE	P- value	Remarks
FVC (L)	3.32 ± 0.39	3.11 ± 0.30	< 0.05	NS
FEV1 (L)	3.21 ± 0.30	3.10 ± 0.30	< 0.05	NS
FEV1 /FVC	0.99	0.99		
MMEF (L/S)	7.02 ± 1.21	7.44 ± 1.07	< 0.1	NS
PEFR (L/S)	8.74 ±1.09	8.49 ± 0.84	< 0.1	NS
MEF 75(L/S)	8.28 ±1.28	8.12 ±1.13	< 0.1	NS
MEF 50(L/S)	6.28 ± 1.20	6.73 ± 0.92	< 0.1	NS
MEF 25(L/S)	4.35 ± 1.11	5.00 ± 1.05	< 0.05	NS

NS = Not Significant

P< 0.05 is considered significant

DISCUSSION

Considerable information can be obtained by studying the exercise response of dynamic lung functions in study and control subjects.

Intra group comparison is helpful in noting the exercise response and inter-group comparison in evaluating adaptations of the respiratory system to training.

On comparing the anthropometric data of the two study groups it is clear that the age & sex matched subjects have no statistically significant difference in height, weight & BMI taking a p- value of <0.01 as significant.

Forced vital capacity (FVC) is the volume expired with the greatest force and speed from TLC and FEV1 that expired in the 1st second during the same maneuver. The FEV1 was initially used as an indirect method of estimating its predecessor as the principal pulmonary function test, the maximal breathing capacity.5

On comparing the response of exercise within the two study groups and in between them, there is no statistically significant difference in FVC & FEV1 under any condition.

A normal FEV1/FVC ratio is observed always.

Another way of looking at forced expiration is to measure both expiratory flow and the volume expired. The maximum flow obtained can be measured from a flow –volume curve is the peak expiratory flow rate (PEFR). The peak flow occurs at high lung volumes and is effort dependent. Flow at lower lung volumes is effort independent. Flow at lower lung volumes depends on the elastic recoil pressure of the lungs and the resistance of the airways upstream or distal to the point at which dynamic compression occurs. Measurements of flow at low lung volumes, mid expiratory flow [MEF 25% to 75%] are often used as indices of peripheral or small airways resistance. 5

On examining Table 2 & Table 3 it is clear that exercise per se does not cause a statistically significant change in dynamic lung function parameters MMEF, PEFR, MEF 25% to 75% in either of the groups. This finding supports the hypothesis that the respiratory system is not normally the most limiting factor in the delivery of oxygen.

Thirty minutes of exercise at 74% of VO2 was found to cause a significant increase in both progesterone (37%) and estradiol (13.5%), whereas no change in plasma FSH & LH was observed7 .; others have confirmed these findings [8]. This finding supports the hypothesis that the respiratory system is not normally the most limiting factor in the delivery of oxygen even under the predominant influence stress hormones which is further accentuated by exercise.

Acknowledgement: Authors are sincerely grateful to Prof. N.Veeranna for his able guidance

Conflict of Interest: Nil

Source of Funding: Self

Ethical clearance: Institutional ethical committee

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DOI Number: 10.5958/j.2320-608X.2.1.002

Peak Expiratory Flow Rate as a Function of Anthropometric Variables in Tribal School Children

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ABSTRACT

Background: Peak Expiratory Flow Rate (PEFR) is a simple and easy way to assess the ventilatory function of lungs. This study aims at correlating PEFR of age-matched tribal boys and girls of Odisha with certain anthropometric parameters like body surface area (BSA), waist circumference (WC), hip circumference (HC) and waist hip ratio (WHR).

Method: It is a cross-sectional study conducted at a residential school in Bhubaneswar during October 2011 - January 2012. Of the 1000 children examined, 868 (464 - boys and 404 - girls) participants were included after exclusion. The above mentioned anthropometric parameters and PEFR were measured using standard procedures.

Results: Statistically significant differences in the HC in centimetres (70.87 ± 5.6 vs 72.77 ± 6.5, $P < 0.05$), WHR (0.96 ± 0.04 vs 0.94 ± 0.04, $P < 0.005$) and PEFR in L/ min (255.3 ± 65.6 vs 210.6 ± 55.7, $P < 0.005$) between boys and girls were observed; boys showed stronger correlation with the variables than the girls did. There was a negative correlation between PEFR and WHR which was significant in boys. The sub-tribes of Santala, Munda and Kandha showed statistically significant positive correlation between PEFR and other parameters except WHR which showed a significant negative correlation with PEFR in the Munda sub-tribe. WC and HC were best correlated with PEFR in the Bonda group.

Conclusions: The mean observed PEFR and the predicted PEFR are in good agreement statistically.

Keywords: *PEFR, Waist Circumference, Hip Circumference, Waist Hip Ratio, Tribe*

INTRODUCTION

Ventilatory function tests provide a good understanding of functional changes in the lungs [1]. Peak Expiratory Flow Rate (PEFR) which reflects the calibre of the bronchi and larger bronchioles is one of the simplest and reliable indices of pulmonary function test to assess the ventilatory function of lungs [2]. The portability of the peak flow meter and the simplicity of the PEFR test make it particularly suitable for epidemiological studies of respiratory function. PEFR is dependent on many independent variables, of which age, weight (wt), height (ht), chest circumference, and body mass index (BMI) are well studied in different parts of India [3, 4, 5] and also globally [6, 7, 8]. Other anthropometric variables such as body surface area (BSA), waist circumference (WC), hip circumference (HC), and waist hip ratio (WHR) are less studied. Though there are a few studies in adults with controversial results [9, 10], scanty information regarding the influence of these parameters on PEFR of children is available [11], especially from eastern part of India, Odisha. The present study aims at correlating PEFR of age-matched tribal boys and girls of Odisha with certain parameters like BSA, WC, HC, and WHR.

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MATERIALS AND METHOD

It was a cross-sectional study conducted in age-matched tribal school children of a residential school at Bhubaneswar, Odisha during October 2011 - January 2012, with institutional ethical committee clearance from KIMS and permission from the Head of the residential school. The objective and procedure of the study were explained to the individual participants and their informed consent was obtained. Children with history of (h/o) any febrile illness in the last 3 weeks, upper respiratory tract infections (URTI)-like symptoms in the past 3 weeks, acute or chronic respiratory diseases, any major systemic disease like cardiac or renal problems, h/o any drug intake which can affect PEFR, h/o any allergy, h/o bone deformity of chest or spine and any muscular weakness were excluded from the study. Above information was obtained from a questionnaire filled in by the caretaker of the children; such information was further confirmed by oral interview and clinical examination of each child. Clinical examination of all children was performed by the same group of assigned Paediatricians.

Of the 1000 children examined, 868 (boys - 464, girls – 404) were included in the study. Ht was measured in centimetres with a standard height measuring rod; wt was measured in kilograms (Kg) with a calibrated weighing scale. BSA was computed from weight and height using Dubois formula [12].

WC was measured using a measuring tape for each child with minimal clothing and with feet about 25–30 cm apart; measurements were taken in a plane perpendicular to the long axis of the body at the level of umbilicus without compressing the skin. HC was similarly measured across the greater trochanter with legs and feet together. WHR was derived.

PEFR was measured using a Mini Wright digital peak flow meter. Recordings were taken for each subject seated straight nearly at the same time of the day, between 4 pm – 5 pm, to avoid diurnal variations. Instructions and method of carrying out the test were demonstrated individually. Each subject was asked to inspire deeply and then blow into the instrument's mouthpiece with nostrils closed; each made at least three attempts and the best of the values was considered for analysis.

From the information gathered, the tribal children were sub-grouped into seven sub-tribes for convenience; as the number of children was less in some of the sub-tribe groups, such children belonged to the "others" sub-group.

Statistical analyses were done using SPSS Software version 16. Correlation coefficients (r and r^2) were determined between anthropometric parameters and PEFR. P value < 0.05 was considered to be statistically significant.

RESULTS

Table 1 describes the mean, standard deviation and standard error of the anthropometric variables of boys and girls. There was a statistically significant difference in the HC, WHR and PEFR between boys and girls. Table 2 shows the correlation coefficients of PEFR with anthropometric parameters among both the groups. Boys showed a stronger correlation with the variables than the girls. There was a negative correlation between PEFR and WHR which was significant in boys. Correlation coefficients of PEFR with anthropometric parameters of the sub-tribes are shown in Table 3. The sub-tribes Santala, Munda and Kandha showed statistically significant positive correlation between PEFR and other parameters except waist hip ratio which discernibly showed a significant negative correlation with PEFR in the Munda sub-tribe.

Table 1: Mean, SD and SE of Anthropometric parameters in Boys and Girls

	Boys			Girls			
Parameter	**Mean**	**SD**	**SE**	**Mean**	**SD**	**SE**	**P value†**
Age (yrs)	9.87	1.6	0.16	9.75	1.1	0.12	0.55
Ht (cm)	139.3	9.4	0.93	137.9	9.3	1.0	0.304
Wt (kg)	30.08	6.1	0.60	30.28	5.9	0.64	0.817
BSA (m^2)	1.09	0.13	0.013	1.08	0.13	0.014	0.828
WC (cm)	67.7	4.4	0.43	68.21	6.2	0.67	0.508
HC (cm)	70.87	5.6	0.55	72.77	6.5	0.71	0.033#
WHR	0.96	0.04	0.004	0.94	0.04	0.004	0.002*
PEFR (L/min)	255.3	65.6	6.46	210.6	55.7	6.04	0.000*

#P < 0.05, *P < 0.005, † P values pertain to the difference in mean values of boys and girls

Table 2: Correlation Coefficients (r) of PEFR with Anthropometric parameters

	Height	Weight	BSA	WC	HC	WHR
Boys	0.633*	0.665*	0.694*	0.548*	0.598*	-0.26#
Girls	0.507*	0.560*	0.558*	0.446*	0.459*	-0.02

#P < 0.01, *P < 0.001

Table 3: Correlation Coefficients (r) of PEFR with anthropometric parameters in the sub-tribes

Sub-tribe (n)	Ht	Wt	BSA	WC	HC	WHR
Santala (180)	0.61*	0.60*	0.62*	0.43*	0.39#	0.011
Soura (76)	0.36	0.47	0.43	0.59#	0.56#	- 0.111
Munda (72)	0.83*	0.72*	0.78*	0.35	0.59#	- 0.630#
Kandha (260)	0.42*	0.46*	0.48*	0.33#	0.31#	0.024
Bonda (64)	0.58	0.62	0.62	0.71	0.68	0.037
Pho (68)	0.49	0.60	0.58	0.90*	0.52	0.294
Others (148)	0.63*	0.58*	0.65*	0.39#	0.45*	- 0.194

#P < 0.05, *P < 0.005

Table 4: Computed values of statistical constants, observed and predicted PEFR of Boys

	a#	Significance of a	b*	Significance of b	r	r^2	Predicted PEFR	Mean Observed PEFR
Height	4.42	.000	-360.8	.000	.633	.401	254.8	255.3
Weight	7.12	.000	41.06	.096	.665	.443	255.2	
BSA	327.8	.000	-102.5	.007	.694	.482	254.8	
WC	8.19	.000	-299.0	.001	.55	.3	255.5	
HC	6.99	.000	-240.0	.000	.6	.36	255.3	
WHR	-403.9	.008	641.9	.000	.26	.068	255.4	

a – constants, *b - constants

Table 5: Computed values of statistical constants, observed and predicted PEFR of Girls

	a#	Significance of a	b*	Significance of b	r	r^2	Predicted PEFR	Mean Observed PEFR
Height	3.04	.000	-208.6	.009	.507	.257	210.5	210.6
Weight	5.31	.000	49.78	.065	.560	.314	210.6	
BSA	226.0	.000	-35.1	.387	.558	.312	211.2	
WC	4.01	.000	-63.21	.3	.45	.2	210.3	
HC	3.91	.000	-74.2	.225	.46	.211	210.4	
WHR	-28.64	.857	237.5	.115	.020	.000	210.6	

a – constants, *b - constants

The dependence of PEFR on various anthropometric parameters can be interpreted in terms of a statistical equation as: $y_i = f(x)_i = a\,x_i + b$, where '$y_i$' or '$f(x)_i$' refers to PEFR, '$x_i$' refers to individual anthropometric parameters mentioned above, 'a' and 'b' are constants with respective units. Table – 4 and Table – 5 describe the computed values of the statistical constants along with their significance for boys and girls respectively. The predicted values of PEFR, on the basis of the above equation, are compared with the observed mean PEFR values of respective parameters of boys and girls.

DISCUSSION

Peak expiratory flow is one of the easiest means of objectively assessing and monitoring the airways function [13]. PEFR is a measure of several factors such as airway resistance, maximal voluntary muscular effort and the possible compressive effect of the manoeuvre on thoracic airways [14]. Hence the simplicity of the manoeuvre, cheap and portability of the device and its feasibility in non-specialized centres have encouraged the tool in epidemiologic studies [13]. As mentioned earlier, PEFR may be dependent on one or

more variables, often with complexity, on anthropometric parameters, ethnicity, gender, environment and such others. The present study attempts at finding link between PEFR and anthropometric parameters like ht, wt, BSA, WC, HC and WHR, among the age-matched tribal boys and girls of Odisha, India.

The mean ht, wt and BSA of the boys [15] and of the girls [16] in South Indian studies were less than that of the present study; the respective mean PEFR values were somewhat higher in these studies. In a study conducted in north western India [17], the results showed significantly lower PEFR values for the same age, ht, wt and BSA in boys and girls compared to the PEFR values of both the groups in this study. Our results are different from a Korean study [18] wherein it was found that values of height followed by BSA were the best predictors of PEFR; the age-matched Korean children had a higher ht, wt, BSA and also higher PEFR values. There was not much difference in the ht, wt, BSA and PEFR of age-matched Nepalese children from the children of the present study [11].

Insignificant difference in the mean PEFR values of boys and girls was found with respect to ht, wt and BSA up to 150 cm, 35 kilogram and 1.1 m^2 respectively in Srilankan children [19]. Though there was no significant difference in ht between boys and girls of Libiya, the mean PEFR value was higher in the boys than that of the girls [20]. The mean PEFR of Turkish boys was slightly different from that of the boys of the present study; however, the same of Turkish girls [21] was significantly higher than the age-matched girls of this study, in spite of similar ht and wt. In the present study, the mean PEFR of boys is higher than that of the girls in spite of insignificant differences in all anthropometric variables between both the groups except the HC and WHR; the higher PEFR in boys may most probably be due to their higher maximal voluntary muscular effort. Thus it would very much appear that the variations/ dependences of PEFR with anthropometric parameters are no less region-dependent.

In the present study, the boys showed a stronger correlation with the anthropometric variables than those of the girls. Similarly, the mean PEFR of boys was significantly higher than that of the girls. In the boys, BSA is found to be the best predictor of PEFR among anthropometric variables, while both BSA and wt were better predictors of PEFR than ht in the girls.

The sub-tribes Santala, Munda and Kandha showed statistically significant positive correlation between PEFR and other anthropometric parameters except WHR which discernibly showed a significant negative correlation with PEFR in the Munda sub-tribe. WC and HC were best correlated with PEFR in the Bonda group. Though all the participants in the present study were from a similar socio-economic status and nutritional background, the PEFR was best correlated with ht, wt and BSA in the Munda compared to all other sub-tribes.

The anthropometric variables such as WC, HC and WHR which are the markers of adiposity affect significantly the PEFR in adults; from the present study it is obvious that PEFR has significant but weak correlation with these anthropometric variables. The weak correlation may be attributed to the fact that all children in this study are from low socio- economic status.

The statistical equation appears to effectively provide a good methodology for judging the mean PEFR- anthropometric variable dependence, as can be seen from good agreement in values of mean observed PEFR with the predicted PEFR. The significance of constants 'a' and 'b', in the equation, can be imagined in terms of predictability of the PEFR values. Confirmation of the contentions held here can be supplemented by further probes involving other lung function tests and a larger sample size covering all age groups.

In summary, this study highlights that the age-matched tribal boys do have a significant higher mean PEFR value than those of the tribal girls in spite of insignificant differences in other anthropometric parameters like ht, wt, BSA, and WC in both the groups. Boys showed better correlation with the mentioned anthropometric parameters than the girls did. WC and HC were best correlated with PEFR in the Bonda group. The PEFR was best correlated to ht, wt and BSA in the Munda compared to all other sub-tribes. The mean observed PEFR and the predicted PEFR, in terms of a statistical equation, are in good agreement.

Acknowledgements: We are thankful to all the staff and teachers of KISS for their help and co-operation.

Conflict of Interests: Nil

Funding Source: Nil

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DOI Number: 10.5958/j.2320-608X.2.1.003

Effect of Yoga on Aerobic Power, Anaerobic Power and Audio-Visual Reaction Time in Healthy Individuals

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ABSTRACT

This study was done to assess the effects of selected yoga practices and pranayama on cardiorespiratory fitness in terms of aerobic and anaerobic power and reaction time as an indicator of rate of processing sensory signals by central nervous system, in young, healthy students. Study group consisted of 60 students of Ayurveda medical college, 17-22 years of age. The control group consisted of 60 age-matched students of medical college.

In both the groups, aerobic capacity, anaerobic capacity and audio-visual reaction time was measured at the beginning. Study group participated in yoga training program including pranayama, 1hour/day for six days a week for six months, in the Physiology department. Control group didn't undergo any training. All the tests were repeated after six months in both the groups. Results were analysed statistically by using student's t-test.

After six months of yoga and pranayama, there is a significant increase in aerobic power and decrease in anaerobic power in the study group indicating improved cardiorespiratory fitness. Audio-visual reaction time was reduced in the study group indicating improved signal processing of central nervous system. No significant change in parameters were seen in control group subjects.

Keywords: *Yoga, Aerobic Power, Anaerobic Power, Reaction Time*

INTRODUCTION

The word "yoga" is derived from the sanskrit root "yuj" means to bind, join, attach and yoke. Yoke means to direct and concentrate ones attention on and to use and apply.[1]

Yoga is a science practised in India over thousands of years. With increased awareness of health and natural remedies, yogic techniques including asanas and pranayama are gaining more importance in general population and are becoming increasingly acceptable even to the scientific community.[2]

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Yoga training is believed to contribute to all aspects of physical fitness including cardiorespiratory efficiency, flexibility, muscle power and agility. This helps the body to combat today's stressful life especially in urban areas.

Today's younger generation is living in a very competitive and challenging world and is subjected to physical and mental stress.

Yoga with its known non-pharmacological therapeutic approach has its own beneficial effects. Few of them are established scientifically. Yoga is found useful to keep healthy, improve concentration on work and to balance psychic faculties.[2]

It is also proved that mental concentration is improved by yoga practices and immune mechanism is also enhanced enhanced.[3]

Hence the present study was planned to assess the effects of selected yoga practices and pranayama on

cardiorespiratory fitness in terms of aerobic power and anaerobic power in young healthy students. As reaction time is an indicator of the rate of processing of sensory stimuli by the central nervous system and its execution in the form of a response, our study was also aimed to assess the effects of yoga on central nervous system functions in the form of audio-visual reaction time.[4]

MATERIAL AND METHOD

This study was conducted in the Department of Physiology, Bharati Vidyapeeth University Medical College, Pune between Sept 2006 to April 2007. Study group consisted of 60 students of Ayurveda college, 30 boys and 30 girls in the age group of 17-22 years. Control group consisted of age matched 60 students of Medical college, 30 boys and 30 girls. Students suffering from any respiratory and cardiovascular diseases or major systemic illness like Diabetes Mellitus, smokers, unwilling students and students attending gymnasium or other sports events were excluded from the study. After routine medical check up written consent was taken from all the students. In both groups, aerobic capacity, anaerobic capacity and audio-visual reaction time was measured at the starting of the project.

All tests were done at 9am in the Department of Physiology.

Aerobic power was measured in terms of VO_2max after giving a standardized exercise by Harvard step test. For males, the step was of 40 cms height and for females 30 cms. The speed of the test was adjusted at 30 steps per minute with the metronome.

Resting pulse rate and post exercise pulse rate was measured and then VO_2max was measured by using Astrand's nomogram.[5]

Anaerobic power was measured using Sargent's jump-reach test. Subject was asked to jump vertically up without any start. His vertical jump was measured. His height and weight were also measured. Three readings were taken and the best one was considered asobservation. Anaerobic capacity was measured by using Lewis nomogram.[6] Auditory reaction time was measured with reaction time apparatus using sounds of high and low frequency. Three trials were taken and best of them was considered as observation. Visual reaction time was measured by using red and green coloured lights by reaction time apparatus. Three readings were taken and best of them was considered as observation.

Study group participated in yoga practices for one hour per day, six days a week for six months. Every day four asanas were performed for about five minutes each and four pranayama were performed for about ten minutes each.The yogasanas performed were, Padmasana, Vajrasana, Dhanurasana and Gomukhasana.

The pranayama performed were, Surya bhaden, Kapalbhati, Sitali and Bhastrika. The yogasanas and pranayama were performed according to Swami Dayanand Saraswati's publication titled "Asana, Pranayama, Mudra and Bandha".[7]

The control group did not undergo any exercise training. All tests were repeated in both the groups after six months. Results were analysed statistically using student's t-test.

FINDINGS

Anthropometric parameters of control group and study group are shown in Table 1. Comparison of the parameters of aerobic power and anaerobic power in male subjects of control group and study group is given in Table 2 and comparison of audio-visual reaction time in male subjects of control group and study group are shown in Table 3.

Comparison of the same parameters in female subjects of control group and study group are mentioned in Table 4 and Table 5.

There was significant increase in aerobic power in terms of VO_2 max and significant decrease in anaerobic power in the study group after six months of yoga training.

Auditory and visual reaction time was significantly reduced after yoga practice in the study group. Control group didn't show change in any of the parameters after six months.

Table 1 : Demographic distribution of control group and study group

	Control Group(n=60)		Study Group(n=60)	
	Male(n=30)	Female(n=30)	Male(n=30)	Female(n=30)
Age (Years)	18.5± 0.73	18.4 ± 0.42	18.6 ± 0.56	18.2 ± 0.61
Weight (Kg)	74.2 ± 2.43	58.4 ± 2.47	73.4 ± 3.11	57.2 ± 2.78
Height (cms)	170.3 ± 3.12	156.4 ± 2.43	171.4 ± 2.17	155.3 ± 2.43
BMI (Kg/m^2)	28.2 ± 0.34	25.4 ± 0.31	27.6 ± 0.31	25.2 ± 0.37

Table 2 : Comparison of aerobic power, anaerobic power, in control group and study group (Males) before and after six months

Group	Parameter	Before	After6 months	t value	p value
		Mean ± S.D.(n=30)	Mean ± S.D.(n=30)		
ControlGroup	VO_2 max(Lit/min)	2.88 ± 0.48	2.86 ± 0.46	1.99	> 0.05
Study Group	VO_2 max(Lit/min)	2.68 ± 0.37	2.98 ± 0.48	10.82	< 0.0001 *
ControlGroup	Anaerobic power(Kg.m/s)	102.63 ± 24.89	103.4± 26.19	1.18	> 0.05
Study Group	Anaerobic power(Kg.m/s)	95.83 ± 18.23	84.17 ± 18.03	9.71	<0.0001 *

Table 3: Comparison of audio-visual reaction time in control group and study group(males) before and after six months

Group	Parameter	Before	After6 months	t value	p value
		Mean ± S.D.(n=30)	Mean ± S.D.(n=30)		
ControlGroup	Visual RTRed Light	234.93 ± 15.68	233.57 ± 15.55	2.22	> 0.05
Study Group	Visual RTRed Light	233.3± 5.03	187.63 ± 5.91	33.67	< 0.0001 *
ControlGroup	Visual RTGreen Light	245.43 ± 16.30	244.3 ± 16.78	1.64	> 0.05
Study Group	Visual RTGreen Light	242.63 ± 6	194.17 ± 4.53	33.6	< 0.0001 *
ControlGroup	Auditory RTHigh Pitch	164.4 ± 9.27	163.5 ± 9.59	1.07	> 0.05
Study Group	Auditory RTHigh Pitch	175.27 ± 7.75	140.83 ± 4.65	20.29	< 0.0001 *
ControlGroup	Auditory RTLow Pitch	173.17 ± 7.22	171.83 ± 5.14	1.78	> 0.05
Study Group	Auditory RTLow Pitch	182. 27 ± 4.71	158. 07 ± 4.76	19.78	< 0.0001 *

*- Statistically Significant (Students 't' test)

Table 4 : Comparison of aerobic power, anaerobic power, in control and study group (Females) before and after six months

Group	Parameter	Before	After6 months	t value	p value
		Mean ± S.D.(n=30)	Mean ± S.D.(n=30)		
Control Group	VO_2 max(Lit/min)	2.31 ± 0.47	2.33 ± 0.46	1.73	> 0.05
Study Group	VO_2 max(Lit/min)	1.99 ± 0.40	2.24 ± 0.36	7.63	< 0.0001*
Control Group	Anaerobic power(Kg.m/s)	69.43 ± 19.98	73.6 ± 28.62	0.99	> 0.05
Study Group	Anaerobic power(Kg.m/s)	61.43 ± 11.66	56.93 ± 11.98	4.38	<0.0001*

Table 5 : Comparison of audio-visual reaction time in study group and control group (females) after six months

Group	Parameter	Before	After6 months	t value	p value
		Mean ± S.D.(n=30)	Mean ± S.D.(n=30)		
Control Group	Visual RTRed Light	237.33 ± 6.98	235.37 ± 7.71	1.07	> 0.05
Study Group	Visual RTRed Light	230.9 ± 4.57	188.6 ± 4.43	45.58	< 0.0001*
Control Group	Visual RTGreen Light	247.4 ± 8.76	246.2 ± 6.87	1.05	> 0.05
Study Group	Visual RTGreen	238.9 ± 5.27	196.33 ± 4.92	37.17	< 0.0001*
Control Group	Auditory RTHigh Pitch	164± 5.83	162.93 ± 6.06	1.76	> 0.05
Study Group	Auditory RTHigh Pitch	171.67 ± 8.32	144.37 ± 6.22	13.77	< 0.0001*
Control Group	Auditory RTLow Pitch	173.47 ± 6.91	171.09 ± 4.57	1.12	> 0.05
Study Group	Auditory RTLow Pitch	183.53 ± 4.23	160.67 ± 4.69	19.82	< 0.0001*

*- Statistically Significant (Students 't' test)

CONCLUSION

Aerobic power is the ability of the individual to release energy by aerobic pathway and depends on efficiency of slow twitch fibres. It is required for exercise of long duration eg. marathon run.

Anaerobic power is an individual's capacity to produce energy at the local muscle site, independent of oxygen and blood supply. It is required for exercise of short duration eg. 100m dash run. The slow twitch (ST) and fast twitch (FT) muscle fibres are classifiedfurther according to their metabolic activity into slow oxidative (SO), fast glycolytic (FG) and intermediate type fast oxidative glycolytic (FOG).The slow oxidative (SO) fibres contribute to aerobic power, the fast glycolytic (FG) fibres are reponsible for anaerobic power whereas the fast oxidative glycolytic (FOG) fibres have the capacity for aerobic as well as anaerobic power.

Various researchers in this field have studied the effect of yoga on aerobic and anaerobic power.

Table 2 and 4 show increase in aerobic power (both males and females) after yoga training in study group . It also shows decrease in anaerobic power in study group (both males and females) after yoga training. Both results are statistically significant.

Yoga practices are found to increase aerobic power and decrease anaerobic power in other studies. B. Balasubramanian and M.S. Pansare[8] documented that after six weeks yoga training there was increase in aerobic power (VO_2 max) and decrease in anaerobic power. The increase in VO_2 max was attributed to increase in oxygen consumption by the muscles as a result of increase in blood flow. This may be due to generalized decrease in vascular tone after yogic training causing vasodilatation in muscles. The percentage of slow oxidative (SO) fibres increase in endurance training. There is conversion of fast twitch (FT) fibres into slow twitch (ST) fibres observed in endurance training. It is suggested that this conversion takes place mainly in the intermediate fibres (FOG) which improves the oxidative capacity and may contribute to increase in aerobic power. Perhaps a similar mechanism must be taking place in muscles after yoga training to increase aerobic power. Consequently, the total FT fibre activity must be decreasing leading to decrease in anaerobic power.

Similar finding were observed by Bera and Rajapurkar in their study.[9] This effect was observed by them after one year of yoga training.

They have also attributed their findings to a "balanced conversion" taking place between three fibre types (FOG,SO,FG). Malathi et al[10] have also reported similar findings after 3 months of yoga training. Ray et al[11] have also shown similar findings after 6 months of yoga training in army personnel. Mathew[12] J. Taylor et al have shown increase in aerobic power but decrease in anaerobic power after six months of yoga training. Physiologically speaking pranayama practices are basically deep breathing exercises. They are known to increase vital capacity of the individual. These practices also cause thinning of respiratory membrane causing increase in diffusion capacity of oxygen. They also increase efficiency of respiratory muscles and improve pulmonary ventilation.

These breathing practices are also known to increase venous return to heart. They also increase vagal tone and stroke volume. Thus cardiac output increases even though resting heart rate is reduced.

Thus improved respiratory and cardiac function must be making more oxygen available for all body tissues including muscles. This could be another reason for increase in aerobic capacity of muscles after pranayama practices. Similar results are observed by B. Balsubramanian[8] et al, Bera[9] et al, Malathi et al[10], Mathew[12]et al. They all have attributed their result for increase in cardirespiratory efficiency. However these physiological alterations are probably not affecting the anaerobic power. It indicates that anaerobic energy system in muscle tissue is not affected by cardio respiratory efficiency.

Reaction time is an indicator of the rate of processing of sensory stimulus by the central nervous system and its execution in the form of a response.[4]

In the present study we have observed decrease in visual and auditory reaction time after yoga training in the study group (both males and females) (table 2 and 3).

Similar findings are observed by Borker et al[13], Malathi et al[10], Madan Mohan et al[14] and Bhogal et al[15]. This improvement in central nervous system function could be due to greater arousal.

Due to yoga and pranayama practices there is stimulation of proprioeceptors and pulmonary strech receptors. This sensory input to reticular formation could be the main cause of arousal.

Arousal makes information processing fast and also improves concentration on a specific task. Improved cardiorespiratory function may also be responsible for better processing in the nervous system.

Some of the limitations of our work are small sample size, duration of course was only 6 months and only few asana were included in the study. Other investigations like echocardiography, blood lactate level, muscle biopsy, nerve conduction studies and other psychomotor studies may confirm our findings.

ACKNOWLEDGEMENTS

We are grateful to our Institution, Bharti Vidyapeeth Medical College, Pune, for permitting us to conduct our study successfully and for providing us the infrastructure, subjects and staff required to carry out our study.

Conflict of Interest: None

Source of Funding: Self

Ethical Clearance: Taken from College Ethical Committee.

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DOI Number: 10.5958/j.2320-608X.2.1.004

Prevalence of Primary Dysmenorrhea among the Undergraduate Medical Students and its Impact on their Performance in Study

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ABSTRACT

Background: Primary dysmenorrhea is the most common gynaecological problem associated with menstruation among the adolescent girls. It represents the leading cause of periodic work absenteeism among that population.

Aims & Objectives: To evaluate the prevalence of dysmenorrhea and its severity in female medical students and its effects on their daily routine activities.

Material & method: this is a cross-sectional study conducted on 101 female medical students; all the participants were given a questionnaire to complete: questions were related to menstruation elucidating variation in menstrual problems, history of dysmenorrhea & its severity (according to visual analogue scale) and absenteeism from college/class.

Results: the prevalence of dysmenorrhea was 85.15%. Most of the girls (63.95%) had dysmenorrhea of grade 3-4 according to visual analogue scale and 70.93% girls did not take pain medication for it. College/class absenteeism was present in 10.47% girls having dysmenorrhea there was no significant association of dysmenorrhea with age of menarche, menstrual cycle regularity, BMI, blood groups and diet (vegetarian/nonvegetarian) (P> 0.05).

Conclusion: Dysmenorrhea is highly prevalent among female medical students. It affects their quality of life. Maximum girls do not seek medical advice. The path of solution of this painful problem might be paved out by mental preparation and by appropriate change in life style like de-stressing the person through relaxation exercise, yoga and breathing exercises (pranayama)

Keywords: *Primary Dysmenorrhea, Menarche, Sickness Absenteeism*

INTRODUCTION

Dysmenorrhea or painful menses is a common gynaecological disorder among women in the reproductive age groups. Dysmenorrhea in adolescents is usually primary and is associated with normal ovulatory cycles and with no pelvic pathology whereas secondary dysmenorrhea is painful menstruation that is frequently associated with pelvic pathology. Risk factors for primary dysmenorrhea include nulliparity, heavy menstrual flow, smoking, poor mental health and social support and young age.[1-4] Among the battery of causes, mental stress is one of the major risk factor of dysmenorrhea.[5,6] Various studies in India revealed that prevalence of dysmenorrhea varies from 33% to 79.67%.[7-11] According to studies dysmenorrhea is interrupting girl's educational & social life.[12] Due to dysmenorrhea sickness absenteeism (28-48%) and perceived quality of life losses are prevalent among adolescent girls.[7-10]

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medical students are constantly under pressure of studies and are deprived of psychological support and counselling, living in hostels away from their homes. This study done to assess the prevalence of dysmenorrhea as well as to determine the sickness absenteeism due to dysmenorrhea among the undergraduate medical students.

MATERIAL & METHOD

This is a cross-sectional study, conducted in the department of Physiology over a period of three months from July to September 2011. A total of 101 unmarried, female medical students of first year and second year MBBS course (aged between 18-25 years) having no pelvic pathology (as suggested by history & examination) were included in this study. A baseline questionnaire was used to note the information about: age, weight, blood group, history of menstrual cycle, use of medication for menstrual problems, dietary habits and family history of dysmenorrhea. Questions related to menstruation elucidated variation in menstrual pattern like length of cycle, duration of bleeding period, blood loss per cycle, history of dysmenorrhea and its severity (severity determined by Visual Analogue Scale), associated symptoms absenteeism from college/class due to dysmenorrhea. Married female students or those who were suspected of having pelvic pathology were excluded from the study. The participation was purely on voluntarily basis and written consent was taken before initiating the data collection. The study was approved by ethical committee of the College. Data were analysed by chi-square test.

RESULTS

The average age of participants was a 19.86±2.27 year ranging from 17-30 years. (Table I). Most of the subjects fell within the age group of 17-20 years (Figure I). The prevalence of dysmenorrhea was very high with 85.15% (n=86) (Table II). Most of the dysmenorrheic girls (63.95%) had dysmenorrhea of grade 3-4 according to visual analogue scale (Table III). The mean age of Menarche was 13.888±1.44 years (Table II). Most of the participants i.e. 52.5% (n=53) started menstruating between 13-14 years (Figure II). 70.93% (n=61) of the dysmenorrheic girls didn't any medication for dysmenorrhea while 29.07% (n=25) were taking pain medication (Table III). Among the 86 dysmenorrheic girls 67.44% (n=58) continued their normal daily routine during dysmenorrhea while class & college absenteeism was present in 10.47% and 22.09% of dysmenorrheic girls respectively (Table III). Dysmenorrhea is most prevalent in the girls having history of menarche at 13-14 years (86.79%) as compared to those having menarche at <13 years of age (81.25%) and menarche at age of >14 years (84.37%) but it was statistically insignificant (x^2=0.85, p>0.05).

Out of 101 students, 85 students had regular menstrual cycles. We did not find any significant association between menstrual cycle regularity and dysmenorrhea (x^2=0.77, p>0.05).

The mean BMI of the participants was 20.75±3.72 kg/m^2 ranging from 15.1 to 38.4 kg/m^2. (table I) Majority of the subjects (n=69) had their BMI within normal range (18.1-24.99 kg/m2). Out of total 101 subjects 60 were vegetarian and 41were Nonvegetarian. The most common blood group in the study group was B+ blood group (n=41) followed by O+ (n=34), A+ (n=16) and AB+ (n=10). No one was found to be Rh negative in our study group. In underweight category 90.48%, while in overweight category 90.91% subjects were suffering from dysmenorrhea and in normal weight subjects, 80.62% were dysmenorrheic (Table IV). Although not significantly associated it was found that underweight and overweight girls more likely to suffer from dysmenorrhea when compared to normal weight girls (x2=0.57, p>0.05).

41 participants in this study had blood group B^+, 34 had O^+, 16 had A^+ and10 had AB^+. Among all the subjects, dysmenorrhea was found in 100% A^+ blood group subjects, while prevalence of dysmenorrhea in all other blood group subjects was almost same. (Table IV) and there was no significant difference (x^2=o.33, p> 0.05)

Out of total participants 60 were pure vegetarian and 41 were Nonvegetarian. There was no significant difference in the prevalence of dysmenorrhea in vegetarian and Nonvegetarian subjects. (x^2=0.27, p >0.05)

DISCUSSION

Dysmenorrhea is the most common gynaecological problem worldwide. It is one of the most distressing problems associated with menstruation among the undergraduate medical students which affects the daily routine. It cases prolonged resting hours and inability to study.[13] in our study, 85.1% of the girls reported dysmenorrhea. Several other studies reported its prevalence as 73.83%[14], 67.5%[15] and 62.02%[16]. The

mean age of menarche was 13.88(±1.44) years while in another study it was 12.5(±1.52)years.[14] maximum patients had dysmenorrhea of grade 3-4 according to the visual analogue scale while 17.44% had 5-6 and only 2.32% had grade 7-8 dysmenorrhea. If we consider grade 3-4 as mild 5-6 as moderate and 7-10 as severe, then most of the girls in our study had mild type of dysmenorrhea. Similar results were found in the study done by Jerry et al[17] who showed that 14% severe, 38% moderate and 49% subjects mild sufferers. Some studies[14,15] showed the significant correlation between early age of onset menarche and dysmenorrhea but we didn't find any significant correlation between dysmenorrhea and age of menarche. Pawloski[18] also did not find any difference in the age of menarche between dysmenorrheic and nondysmenorrheic women. In our study 67.44% of dysmenorrheic girls reported normal daily routine and 32.56% reported class and college absenteeism. In a study done in Morocco[19] , menstrual pain was often cited as the main single cause of school absenteeism among the adolescent girls. Pain is often disregarded by many women who consider pain to be a part of the menstrual cycle. Thus many women fail to report their pain to physician. In our study, about 70.93% of dysmenorrheic girls took no medication for pain and 29.07% girls took pain medication by themselves without consulting the physician. The problem of absenteeism from college was also under-appreciated. In several studies of young women, rates of absenteeism ranged from 34% to 50%[19, 20, 22]. We also studied the correlation of dysmenorrhea with BMI, diet (veg/nonveg), blood groups and menstrual cycle regularity but we didn't able to find any significant correlation of dysmenorrhea with these factors. Some other researchers[15, 22] have also studied the correlation between dysmenorrhea and BMI and found no significant correlation.

Table 1. Baseline characteristics of the study group

Variables	Mean±SD (n=101)
Age(yrs)	19.86±2.27
Weight(Kg)	15.68±8.58
Height(cm)	156.68±8.12
BMI(kg/m²)	20.75±3.72
Age at menarche(yrs)	13.88±1.44

Table 2. Prevalence of Dysmenorrhea among the study group

Dysmenorrhea	No. of subject	Percentage (%)
Present	86	85.15%
Absent	15	14.85%
Total	101	100%

Table 3. Variables of dysmenorrhic subjects of study group

variables	No. of dysmenorrhic subjects		Percentage (%)
Grades of dysmenorrhea	0-2	14	16.28
	3-4	55	63.95
	5-6	15	17.44
	7-8	02	2.32
	9-10	00	00
Self medication	Yes	25	29.07
	No	61	70.93
Sickness absenteeism	Normal daily life	58	67.44
	Class absenteeism	09	10.47
	College absenteeism	19	22.09

Table 4. Comparison of different variables in study group

Variable		Dysmenorrhea present(%) n=86	Dysmenorrhea absent(%) n=15	Total
BMI	≤18	19 (90.48%)	02 (09.52%)	21
	18.1-24.99	57 (82.60%)	12 (17.39%)	69
	≥25	10 (90.91%)	01 (11.67%)	11
Diet	Veg	53 (88.33%)	07 (11.67%)	60
	Nonveg	33 (80.49%)	08 (19.51%)	41
Blood group	A	16 (100%)	00 (00.00%)	16
	B	34 (82.93%)	07 (17.07%)	41
	AB	08 (80.00%)	02 (20.00%)	10
	O	28 (82.35%)	06 (17.65%)	34
Menstrual cycle regulating	Regular	72 (84.71%)	13 (15.29%)	85
	Irregular	14 (87.50%)	02 (12.51%)	16
Age at menarche	<13	13 (81.25%)	03 (18.75%)	16
	13-14	46 (86.79%)	07 (13.21%)	53
	>14	27 (84.37%)	05 (15.63%)	32

CONCLUSION

Dysmenorrhea is common among the female medical students and it is the major problem representing the leading cause of college/class absenteeism. Health education on menstrual problem by health care providers can help prevent absenteeism. It may be time to test new therapeutic options to relieve dysmenorrheic pain and examine ways to reduce the social, economical and college impact produced by dysmenorrhea in medical students. Etiologic relationships between dysmenorrhea, BMI, dietary habits, blood groups and menstrual cycle regularity have been proposed.

ACKNOWLEDGEMENT

I would like to thank Dr R.K. Shrivastava M.S., PhD. (Anatomy), Principal Rama Medical College, Hospital & Research Center for his support and encouragement during this study. I also thank the student participants for their cooperation and Chitra Rani Chauhan, statistician for helping me in doing the statistical analysis.

Conflict of Interest Statement: We certify that there is no conflict of interest

Source of Funding: No funds were required in this study.

Ethical Clearance: The study was approved by ethical committee of Rama Medical College.

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DOI Number: 10.5958/j.2320-608X.2.1.005

A Study on the Gender Difference in the Induction of Duodenal Ulcer by Cysteamine Hydrochloride in Mice

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ABSTRACT

Duodenal ulcers were induced in adult male and female mice using cysteamine hydrochloride under various experimental conditions. Under these experimental conditions, orchidectomized adult mice strikingly decreased sensitivity to ulcer induction but orchidectomized mice and testosterone propionate administration to orchidectomized adult mice shows increased sensitivity to ulcer induction. This change in ulcer sensitivity reflected from histological, histochemical and biochemical studies. The result showed that ulcer severity was more in ovariectomyzed - cysteamine treated mice than normal male and orchidectomized and treated mice. The histological studies showed that orchidectomy decreased or did not show any change in the ulcer sensitivity considering Cryptus Lieburkuhn and Brunner's glands, but reverse was found in ovariectomyzed and cysteamine treated mice. The same result reflected by differential intensity in the staining property of the Brunner's gland. The biochemical study also showed the same trend in ulcer induction. These findings prove that estrogen and testosterone of booth exogenous and endogenous augment the ulcer pathogenesis in cysteamine induced ulcer but estrogen it is more protective than testosterone.

Keywords: *Duodenal Ulcer, Orchidectomy, Ovariectomy, Cysteamine, Sex Hormones, Ulcer Index, and Brunner's Gland*

INTRODUCTION

Among the various diseases gastric ulcer and peptic duodenal ulcer is one of the serious health problems worlds over. Medical evidences suggests that duodenal ulcer is due to multiple causes, including infection of *Helicobacter pylori*, gastric acid, pepsin, and "defensive" factors such as duodenal mucosal bicarbonate secretion and sex hormones[1-4]. Peptic ulcer occurs more frequently in men than in women[5]. The sex differences are less marked after 45 years of age probably because the incidence of ulcer increases in post menopausal women[6-7].The general assumption is that ulcer differences between sexes are related in some way to sex hormone, estrogen, protect against ulceration[6]. The mucosal injury in duodenal ulcer was prevented by orchidectomy and by the treatment with the antiandrogens, cyprotetrone acetate[4]. Treatment of testosterone in oophrectomized rat shows enhanced peptic ulcer within 24 hours, but HCl and pepsin output were not affected by androgen treatment. Bilateral castration of the male rats showed significant reduction in acid gastric secretary responses to carbachol but not to histamine[8]. When castrated rats were given short-term-treatment with 17β-estradiol, there was reduction in acid gastric secretion[8]. The enhancement of ulcer by female sex hormone also reported[9]. To substantiate the controversial effect of testosterone on duodenal ulcer we performed a study on the effect of testosterone propionate on duodenal ulcer induced by cysteamine in adult female mice, orchidectomized mice, old male mice and old orchidectomized mice.

MATERIALS AND METHOD

Experimental animals

There are 120 mice (Swiss albino mice (Mus musculs)) were used in the present study. The mice were divided into two groups-adult (60 two month old) female, n= 10 control, n=10 cycteamine treated, n=10 ovariectomized, n=10 ovariectomized-estradiol injected, n=10 ovarietcomized-cyetamine treated, n=10

ovariectomized-cysteamine treated-estradiol injected, male (60 2 month old), adult (60 two month old) male, n= 10 control, n=10 cycteamine treated, n=10 orchidectomized, n=10 orchidectomized –testosterone injected, n=10 orchidectomized -cyetamine treated, n=10 orchidectomized -cysteamine treated-testosterone injected.

Castration and administration of testosterone

The bilateral orchidectomy and ovariectomy was done under mild ether anesthesia. The five orchidectomized and ovariectomyzed cysteamine treated mice were injected testosterone and estradiol-17ß in olive oil . On the 4th day of the 1st injection, cysteamine treated operated and cysteamine treated operated and sex hormone administered mice and the only operated mice were used for duodenal ulcer index calculation[10].

Duodenal ulcer index

The duodenal ulcer index were critically evaluated with respect to percentage incidence, number of ulcers per mice and severity of ulcers were graded according to scale from 0 to 3 based on microscopic observations and later confirmed by sectioning and staining of the ulcer regions.

Ulcer index = Mean severity + Incidence (i.e. positive/ total) × 2

Histology

The tissues were fixed in 10% neutral buffered formalin, washed and routinely processed for histological technique. The sections were stained with haematoxylene-eosine[11].

Histochemistry

To study the changes in the duodenal mucosa glycoprotein of crypts of Lieberkuhn, goblet cells, pyloric gland cells and Brunner's glands in all groups, PAS techniques[12] was used.

Biochemistry

The glycoprotein from Brunner's gland was isolated by the method of Satakopan and Kurup[13].To study various constituents of glycoprotein biochemical estimations of fucose[14], hexose [15](Dubois et al., 1956), sialic acid[16] and protein[17] were used.

Data analysis

Statistical analyses were performed using the Statistical Package for Social Science (version 13.0, SPSS, Inc) software. Results were expressed as means + SE (standard Error). All reported p-values were made on the basis of 2-sided tests and compared to a significance level of 5%, differences were considered statistically significant at $p< 0.05$.

RESULT

The ovariectomyzed mice and orchidectomized mice showed little ulceration (Ulcer index 2.6) or no ulceration. The ovariectomyzed + estradiol- 17ß injected mice showed very low ulceration compared to the ovariectomized mice (ulcer index 1.64) (Table 1), but in the case of the orchidectomized + testosterone propionate injected mice showed ulceration higher than orchidectomized mice (ulcer index 2.50) (Table.2). The ovariectomyzed and orchidectomized + Cysteamine administered mice showed higher ulceration (Ulcer index 6.2) (Table 1and 2). While, The administration of testosterone to cysteamine injected orchidectomized mice showed ulceration (Ulcer index 5.9) higher than cysteamine treated orchidectomized male mice (UI 5.2).The administration of estradiol- 17ß to cysteamine injected ovariectomyzed mice showed little recovery of ulceration (Ulcer index 4.2) (Table No.1and 2).

Table1: Ulcer severity in normal female mice with and without administration of estradiol17β

Group	Experimental Mice	Ulcer (In %)					
		Percentage incidence	Superficial	Deep	Perforating	Mean severity	Ulcer Index
Adult female mice	O	100	93	05	O2	0.12±0.10	2.6
	O+ E	100	97	02	01	0.82+0.12	1.64
	O + C	100	10	70	20	3.1+ 0.10	6.2
	O + C + E	100	30	60	10	2.20+0.06	4.2

O: Overiectomized; E: Oestrogen injected; C: Cysteamine injected

Table2: Ulcer sensitivity in adult male mice with and without Administration of Testosterone

Group	Experimenatl mice	Ulcer (%)					
Two Month Old Mice		% Incidence	Superficial	Deep	Perforating	Mean Secerityy	Ulcer Indexx
	O	100	60	-	-	02.05±0.14	2.06
	O + T	100	70	20	05	3.01±1.2	2.50
	O + C	100	10	60	30	3.10±0.05	5.2
	O + C + T	100	30	60	10	2.40±0.13	5.9

O: Overiectomized; T: Testosterone injected; C: Cysteamine injected

Table3: Carbohydrate and protein contents of soluble glycoprotein isolated from Brunner's glands of feamle mice

Group	Hexose	Fucose	Sialic acid	Protein	P-value	
N	73.9 ± 0.831	4.1±0.127	0.31±0.0913	20.2±0.119	1:2 p<0.05	13:14 p<0.05
N + C	20.5 ± 0.252	1.5±0.128	0.1±0.0114	14.9±0.320	3:4 p<0.05	15:16 p<0.05
O	63.0± 0.743	3.7±0.049	0.4±0.0115	19.2±0.0421	5:6 p<0.05	17:18 p<0.05
O + C	11.2±0.294	0.5±0.0710	0.1±0,0116	12.5±0.222	7:8 p<0.05	19:20 p<0.05
O + E	81.25± 0.245	3.8±0.0711	0.3±0.0117	22.0±0.223	9:10 p<0.05	21:22 p<0.05
O + C + E	35.7±0,976	2.18±0.0312	0.4±0.318	14.4±0.324	11:12 p<0.05	23:24 p<0.05

- Values are means+ Standard deviation, p< 0.05 is significant
- O: Overiectomized; E: Estrogen injected; C: Cysteamine injected

The histology of duodenum of normal, cysteamine treated and ovariectomized mice are shown (Fig. 1 to 3). The histology of ovariectomized and cysteamine treated mice showed that the pyloric glands were simple tubular and situated deeply in the sub mucosa. The duodenal villi were tall, leaf like and uniformly arranged with desquamation intermittently. The crypts of Lieburkuhn and Brunner's glands were unaffected. The cysteamine administration to the ovariectomized mice (Fig. 4) causes pyloric glands with dilated lumen and picnotic nuclei and increased eosinophilia. The pyloric villi showed fissures and ramifications, and ulcer formation. The goblets cells were less in number. The Brunner's gland acini showed reduced height, dilated lumen and nuclei with abnormal size and shape. The histochemistry showed strong PAS reaction in pyloric glands, Brunner's glands in ovariectomized mice but less in pyloric pit (Fig. 4).

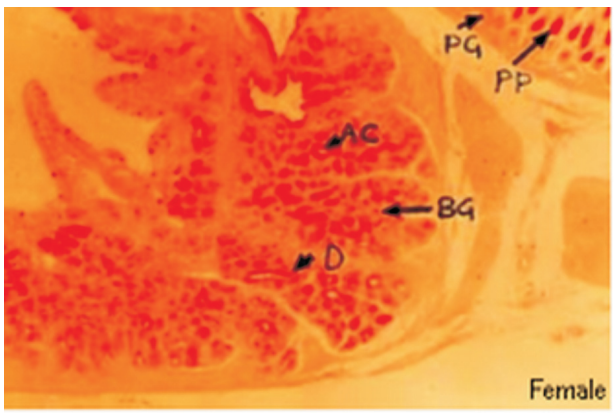

Figure 1. Micrograph of duodenum of Normal mice
PP-pyloric pit, D-Duct, PG-Pyloric gland
BG- Brunner's gland

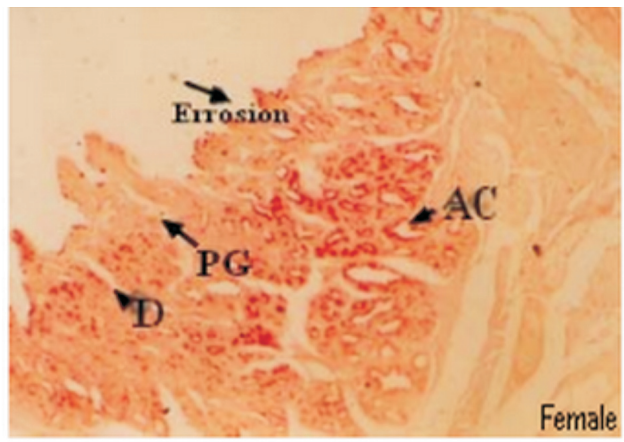

Figure 2. Micrograph of duodenum of cysteamine Treated mice
AC-Acihi R-Duct, PG-Pyloric Gland

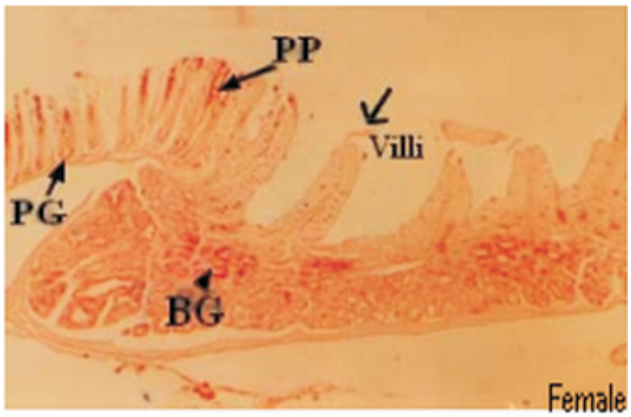

Figure 3. Micrograph of duodenum of Ovariectomized mice
PP-Pyloric Pit, PP-Pyloric gland
BG-Brunner's gland

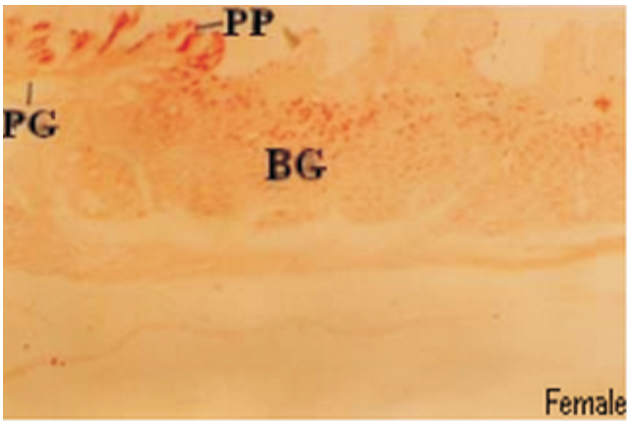

Figure 4. Micrograph of duodenum of Ovariectomized-cysteamine Injected Mice
PP-Pyloric Pit, PP-Pyloric gland
BG-Brunner's gland

In the ovariectomized-estrogen treated mice the duodenal histology (Fig. 5) shows simple tubular pyloric glands. The pyloric glands and pyloric pit are intensely stained. The Crypts of Lieberkuhn are simple and tubular. Brunner's gland and ducts were esinophilic. The villi are leaf like at many places and a few are desquamated. In ovariectomized-hormone treated- cysteamine injected mice the duodenum histology (Fig. 6) shows pyloric glands, acinar cells and ducts reduced in PAS staining. Goblets cells reduced in number. The erosion was more and pyloric pit was diffused.

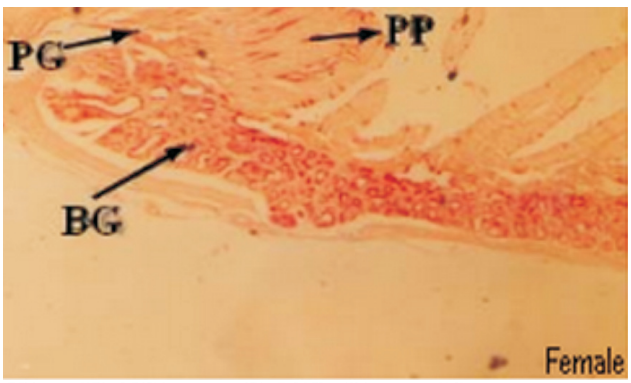

Figure 5. Micrograph of duodenum of Ovariectomized Hormone treated Mice
PG-Pyloric gland, PP-Pyloric pit, BG Brunners gland

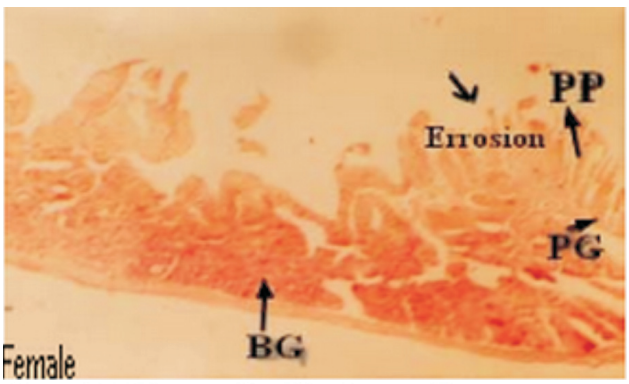

Figure 6. Micrograph of duodenum of Ovariectomized-Hormone injected - Cysteamine treated Mice
PP-Pyloric pit, BG-Brunners gland, PG-Pyloric gland

The duodenal villi showed PAS activity but other cells were PAS negative. The cysteamine treated ovariectomized mice showed reduction in PAS reactivity in all cells of pyloric glands, pyloric pits, goblet cells and Brunner's glands (Fig. 4). The biochemical studies showed that the hexose contents reduce 3 fold in cysteamine injected mice compared to the normal (Table 3). In the ovariectomized group, it was less than that of normal but more than that of cysteamine treated mice. But in ovariectomized cysteamine treated mice it was 6 times less than that of normal mice. The fucose, sialic acid and protein contents (Table 3) also showed the same trend as hexose. The histology of normal, cysteamine treated and orchidectomized *mice shown in (Fig 1-3).*

In orchidectomized mice the pyloric glands was simple branched, tubular glands situated deep in the sub mucosa. The pyloric pit occupies greater part of the sub mucosa. The gland cells were normal. The villi were tall and uniform. The epithelial covers showed columnar cells and goblet cells arranged on basement

membrane. The Crypts of Leiberkuhn stained more intensely with Haematoxylene-Eosin. The Brunner's glands showed parenchyma of gland, divided into lobules. The acinar cells and tubules acini were made up of pyramid shaped cells. The nuclei were basally situated and lumen was very narrow. On cysteamine administration to orchidectomized mice showed disturbed pyloric pit (Fig 4). The pyloric glands decreased with enlarged lumen. The duodenal villi showed sign of destruction. The lamina propria showed inflammation the Crypts of Leiberkuhn showed irregular and picnotic nuclei and increased eosinophilia. The Brunner's glands also showed increased eosinophilia. The cells of acini and tubulo acini showed decreased acini and dilated lumen. Testosterone treated orchidectomize*d male mice showed the histology similar to adult mice with (Fig 5).*Upon administration of testosterone propionate in orchidectomized cysteamine treated mice the pyloric pit and pyloric glands showed more disturbances (Fig 6). The pyloric pit showed enlargement and pyloric gland showed increased eosinophilia, a sign of inflammation with more mast cells and mucosa showed erosion. The Crypts of Leiberkuhn also showed increased eosinophilia. The Brunner's gland, the shape and size of the acinar cells are changed, the height of the cells were reduced. The acini cells were dilated. The lumen of ducts also showed dilation.

The histochemistry of orchidectomized-testosterone treated mice (Fig 1-8) showed strong PAS (Periodic Acid Schiff Reaction) reaction in pyloric pit, pyloric gland and goblet cells, Crypts of Leiberkuhn and Brunner's gland than orchidectomized-cysteamine treated mice (Fig 1-8).Up on administration of testosterone propionate in orchidectomized-cysteamine treated mice the PAS activity was reduced to bottom (Fig 1-8). The reaction was observed in pyloric pit cells, but it was not properly localized, indicating destruction of the structure. The goblet cells also showed poor PAS reaction.

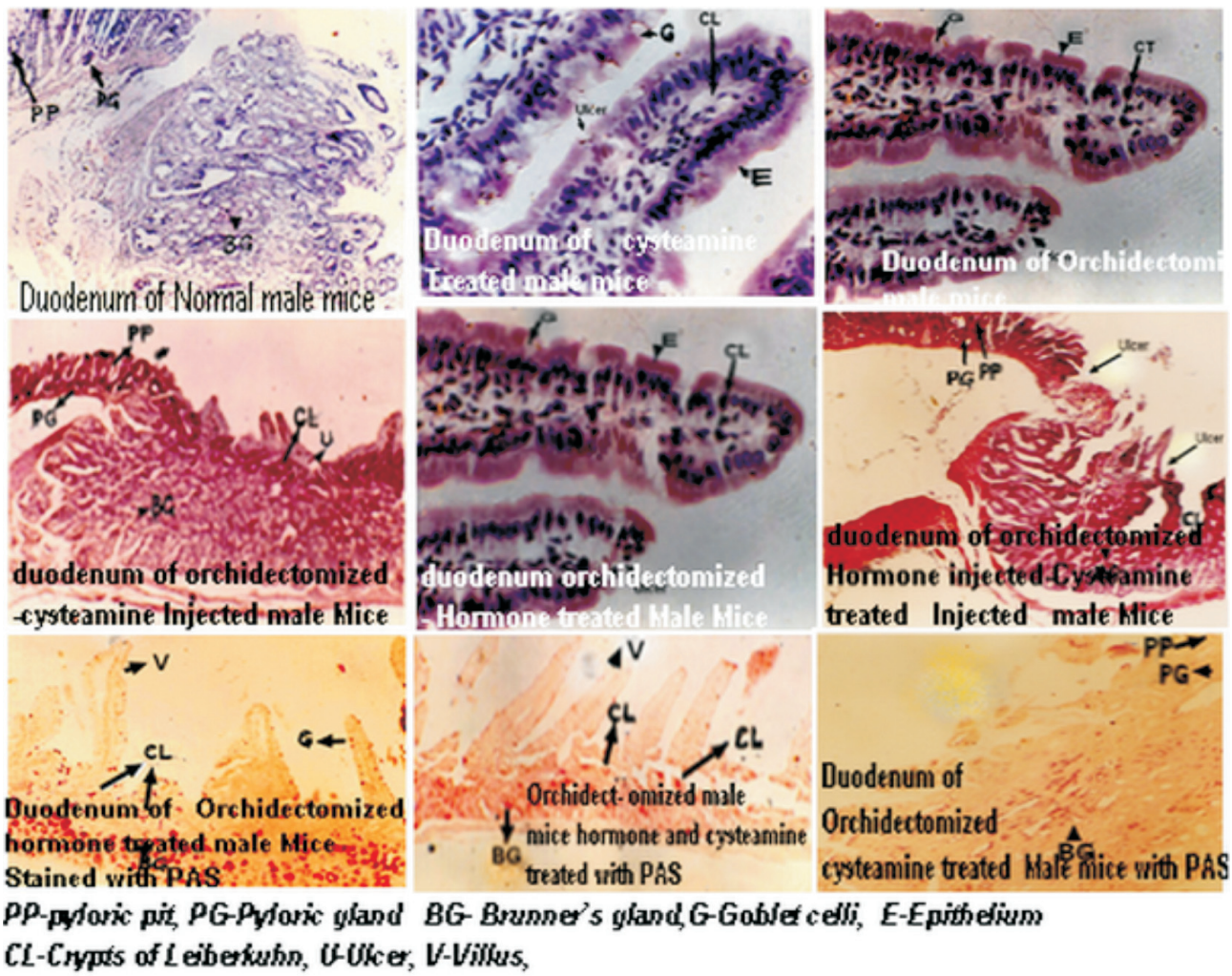

Fig. 1-8. Duodenum of male mice histochemical studies

Crypts of Leiberkuhn showed reduced staining intensity. The PAS activity was diffused in both Crypts of Leiberkuhn and Brunner's gland.

Carbohydrates and protein contents of soluble glycoprotein isolated from Brunner's glands of male mice were evaluated. It was more in orchidectomized mice comparing to normal. Maximum loss found in orchidectomized-cysteamine treated- testosterone administered mice. The hexose content of normal mice was (78.21± 0.21) and in orchidectomized mice it is (80.21± 0.35). In orchidectomized- cysteamine treated-testosterone administered mice it was reduced to (28.96± 0.15). The maximum reduction was observed in orchidectomized-cysteamine treated-testosterone administered mice.

DISCUSSION

Gastric ulcers and Peptic duodenal raise serious health problems and significant global economic cost[1-2]. It is estimated that approximately 500,000 new cases and 4.5 million people suffering from these diseases each year in USA[18]. Duodenal ulcer is three times more common than gastric ulcer. Available evidence suggests that duodenal ulcer most likely results from an imbalance between "aggressive" factors, such as infection of *Helicobacter pylori (H pylori),* gastric acid and pepsin, and "defensive" factors, such as duodenal mucosal bicarbonate (HCO) secretion (DMBS) and sex hormones. It has long been observed that the ratio between men and women[18] who develop duodenal ulcer is 1.9:1 in the US, whereas in Europe and in Asia this ratio is 2.2: 1 and 3.1: 1[19], respectively. As far as sexual differences are concerned, sex hormones have been often evaluated as the causative factors. For example, numerous studies have suggested a protective role of estrogen in the development of various diseases including cardiovascular diseases[20], cerebral damage and mortality[21], and osteoporosis[22]. In contrast sex hormone protection by duodenal ulcer is also challenged[23]. In rats it is also reported that estrogen can protect liver and intestines against sepsis induced injury[24]. The present investigation showed that cysteamin induced duodenal ulcer severity decreased on the administration of estrogen. But estrogen failed to recover the ulcer incidence in old females[1-2]. Anders et al[9] revealed the gender specific duodenal protection by estrogen in terms of HCO secretion and the underlying molecular mechanisms of estrogen stimulation of DMBS that is linked to ER-Ca +-CFTR and Cl-/HCO exchanger pathways. We observed that the incidence of duodenal ulcer is more or less identical in ovariectomized –cysteamine injected females and normal adult male and orchidectomized and orchidectomized mice treated with testosterone *propionate.* Sugars from glycoprotein of Brunner's gland were depleted in cysteamine treated females. These findings indicate that the estrogen is able to protect the duodenal mucosa from damaging effects of cysteamine. It has been established that glycoprotein containing bicarbonate is mainly responsible for the protection of duodenal mucosa. The glycoprotein and bicarbonate are mainly secreted by Brunner's glands. Secretion of glycoprotein of other exocrine cells of the duodenum is also influenced by the estrogen.

ACKNOWLEDGEMENT

We would like to thank Dr.Ashok Babar, Principal P.V.P.College, Kavathe Mahankal, lab in-charge Willington College, Sangli for their permission to utilize departmental animal house and other facilities required for this study.

Conflict of Interest: None

Source of Funding: Self funded study

Ethical clearance: From Committee for the Purpose of Control and Supervision of Experiments on Animals [*CPCSEA*]

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DOI Number: 10.5958/j.2320-608X.2.1.006

Effectiveness of Relaxation Techniques in Reducing Stress Levels by Measuring Heart Rate Variability

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ABSTRACT

Stress can be defined as a phenomenon that occurs when people feel they are unable to manage the demands placed on them . It occurs when the demands of a situation outweighs the body's ability to cope with it. Experimental evidence for an association between a propensity for lethal arrhythmias and signs of either increased sympathetic or reduced vagal activity has encouraged the development of quantitative markers of autonomic activity. Heart rate variability (HRV) represents one of the most promising such markers.Mind-body medicine is the most widely used domain of complementary and alternative medicine for treatment of medical conditions. Examples of mind- body medicine include meditation, yoga, relaxation, visual imagery, biofeedback, cognitive- behavioral therapies, support groups, tai chi and spirituality.

Keywords: *Stress, Heart Rate Variability, Mind Body Medicine*

INTRODUCTION

Stress is defined as a mismatch between perceived demands and perceived capacities to meet those demands[1]. It occurs when the demands of a situation outweighs the body's ability to cope with it.[2] Since the nineties, markers of stress and other psychosocial factors are associated with coronary disease[3]. In contrast with other lifestyle risk factors, no consensus about stress exists with respect to either definition or measurement[4]. It affects many physiological parameters in human body and may lead to work related illness directly or indirectly[5].

Stress is a common experience in our daily lives that is blamed for causing coronary artery disease(CAD).Stress is associated with an increased risk of cardiovascular disease (CVD) but little is known about the mechanisms that underlie this connection.[6]

Experimental evidence for an association between a propensity for lethal arrhythmias and signs of either increased sympathetic or reduced vagal activity have encouraged the development of quantitative markers of autonomic activity. Heart rate variability (HRV) represents one of the most promising such markers.[7]

Yet most of the clinical guidelines relevant to the interface between the workplace and the patient's cardiovascular system continue to focus upon levels of physical exertion[8]. More complex analysis involving the power spectral components of heart rate can be used to predict risk of cardiovascular diseases. These components were used to predict risk due to job strain.[9]

Heart rate variability (HRV) represents one of the most promising of such markers. Heart rate variability (HRV), the variation over time of the period between consecutive heartbeats, is predominantly dependent on the extrinsic regulation of the heart rate (HR) [10].HRV is thought to reflect the heart's ability to adapt to changing circumstances by detecting and quickly responding to unpredictable stimuli. HRV analysis is the ability to assess overall cardiac health and the state of the autonomic nervous system (ANS) responsible for regulating cardiac activity.[11]

The apparently easy derivation of HRV has popularized its use. As many commercial devices now provide automated measurement of HRV, the cardiologist has been provided with a seemingly

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simple tool for both research and clinical studies[10]. The clinical relevance of heart rate variability was first appreciated in 1965 by Hon and Lee. Twenty years ago, Sayers and others focused attention on the existence of physiological rhythms imbedded in the beat-to-beat heart rate signal[13]

Akselrod et al. introduced power spectral analysis of heart rate fluctuations to quantitatively evaluate beat-to-beat cardiovascular control[14]. These frequency–domain analyses contributed to the understanding of the autonomic background of RR interval fluctuations in the heart rate record. The clinical importance of HRV became apparent in the late 1980s when it was confirmed that HRV was a strong and independent predictor of mortality following an acute myocardial infarction[10]

Moreover, it is a simple and powerful noninvasive methodology having enormous practical advantages with a minimum of technical constraints, which makes it useful in many applications. Spectral analysis of HRV is characterized by three main components:[10]

1. High frequency (HF) component(0.15Hz-0.40 Hz): Predominantly parasympathetic,
2. Low frequency (LF) component (0.04Hz – 0.15 Hz): Predominantly sympathetic.
3. LF/HF ratio: Sympathovagal balance

Research suggests that certain segments of the working population is at a higher risk of cardiovascular diseases due to physical and mental stress induced by higher job demands placed on them[15] .Examples where physical stress is induced are repetitive motions for a long period of time and postural distortions during manual material handling, long work hours requiring patient transfers in health care etc. Mental stress could be induced by cognitive work immediately after manual work, impossible deadlines, lack of sleep etc[16].

Several studies have suggested link between negative emotions and reduced HRV. Kawachi et al reported a cross sectional association between anxiety and reduced HRV.[17] Reduced HF power was documented among 33 healthy volunteers who scored high on Cooke Medley Hostility scale.[18]

Also, it is documented in literature that removing stress helps to increase a person's health. The different relaxation techniques often lead to specific psychological and physiological changes termed the 'relaxation response' (RR). The RR is identified as the physiological opposite of the stress or 'fight-or-flight response'. The RR is associated with instantly occurring physiological changes that include reduced sympathetic nervous system activity, reduced metabolism, lowered heart rate, reduced blood pressure, and decreased respiratory rate[19]..

Stress management can be defined as any behavioral or psychological procedure offered or undertaken that deliberately attempts to alter beneficially any aspect of the stress process including altering the environment and the subjective behavioral and physiological responses to the stressful experience[20]

Different strategies and methods for stress management involve the physical, social, environmental, and psychological aspects of stress.[21].

Mind-body medicine is the most widely used domain of complementary and alternative medicine for treatment of medical conditions. Examples of mind-body medicine include meditation, yoga, relaxation, visual imagery, biofeedback, cognitive- behavioral therapies, support groups, tai chi and spirituality.[22]

Yoga and meditation, an ancient cult of Indian heritage when adopted as a way of life is claimed to bestow the practitioner with ideal physical, mental, intellectual and spiritual health. It has been found useful in alleviating the stress induced disorders and have become a panacea for health.

It is recognized that different meditation techniques have widely differing methodologies and all techniques do not show the same effects. Meditation has been a practice among people for centuries. Meditation is a speciûc state of consciousness characterized by deep relaxation and internalized attention[23]. According to Hart, there are two kinds of meditation. The first one is concentrative meditation. This method is used for people to try and block out some of the outside world of sensory stimuli. The second kind of meditation is external awareness mediation. This type of meditation is exactly the opposite of concentrative meditation.. Meditation, using either method, is useful in reducing stress because it directs people to reduce their fast-paced way of living and also teaches people to have more control over their thoughts.[24]

Raj yoga meditation is a complete system of self culture which aims at inter-related harmonious development of body, mind and psychic potencies[22].

Meditation relaxes both mind and body.. The cardio protective effects appear to be mediated through an interaction between the autonomic nervous system and the endocrine system. It is reported to produce an increase in cerebral perfusion, alpha activity of EEG and skin resistance besides increasing vascular resistance, blood levels of cortisol, catecholamine and lactate.. The body appears to move in to state of analogous to many but all aspects of sleep, while subjects remain responsive and alert. [25]

Yogic practices also increase cardiorespiratory performance, psychological profile and melatonin secretion. The effect of yogic practices appears to be mediated through an interaction between autonomic nervous system and the endocrine system, wherein pineal secretion of melatonin may play an important role. Melatonin not only induces sleep-wake cycle but also demonstrated to cause sleep induced relaxation, lower cholesterol level and is one of the most potent antioxidant hormone. Walton has stated that yogic practices increase serotonin levels also which correlate with improvement in psychological profile. Melatonin is known to inhibit sympathetic activity thereby relaxing all body systems during sleep.Circulating levels of epinephrine, nor epinephrine, dopamine and cortisol showed a marked decline in stress hormone levels.Stress hormones decrease further with increase in duration of intervention.[25]

At a biochemical level, the practice of yoga has been shown to have beneficial effects on levels of stress hormones, cholesterol and blood pressure and has been used with some success in the relief of stress related diseases.

Yoga Relaxation and HRV following a low velocity, low impact technique involving movements, called Wai Tan Kung. Wai Tan Kung is a traditional Taiwanese conditioning exercise. The effect of Wai Tan Kung was studied on autonomic nervous modulation in elderly volunteers The immediate effect of practicing Wai Tan Kung was to enhance vagal modulation and to suppress sympathetic modulation[26]. Cyclical Meditation practice includes yoga postures (which involve stretching) and guided relaxation. When a body-mind training program, which included meditative stretching and guided relaxation, was practiced by persons with chronic toxic encephalopathy for eight weeks, they showed improved physical and mental relaxation as indicated by lower electromyograph activity, higher alpha percentage, and reduced state anxiety [27]

In another practice of a sitting yoga posture (virasana)[28,] an increased metabolic rate and increased sympathetic activity, which suggested that this practice is a "form of mild exercise"[29] Similarly the yoga postures may have caused an increase in LF power, as the immediate effect of (mild) exercise .[30]

Zen meditation, in which deep relaxation and increased internalized attention coexist, increasing HF power, and decreasing the LF/HF ratio during the meditation .[23]

Yoga Nidra relaxation produces favorable changes in measures of HRV by favorable shift in autonomic balance to the parasympathetic branch of the ANS for both conditions whether alone or preceded by a bout of Hatha yoga.[31]

Transcendental meditation (TM) involves mentally repeating a string of words (a mantram) with eyes closed and returning attention to it whenever attention wanders.[32] A Mantra is a sound repeated over and over until it integrates into your consciousness - frees the mind from its constant doing, and elevates you to an altered state of awareness. During repeat meditation sessions in "Om" meditators there was a simultaneous reduction in heart rate (possibly related to increased vagal tone with reduced cardiac sympathetic activity) and ûnger plethysmogram amplitude (decreased sympathetic vasomotor activity)[33]. TM came to be described as a "wakeful hypo-metabolic physiologic state" with reductions in mass sympathetic discharge during meditation.. The shift of brain activity towards alpha dominance may be responsible for shifting of autonomic balance towards relative parasympathetic predominance[32].

In mindfulness meditation (Vipassana), changes in the heart rate variability spectrum (as an indicator of the sympathovagal balance) are evaluated during different phases of meditation[34]. The 30 minutes of meditation practice consisted of three 10-minute phases. The ûrst phase was for breath awareness; the next phase was for awareness of sensations from the rest of the body; and, during the last phase, the subjects were given speciûc philosophical concepts to think about mentally (e.g., relating to feelings of universality and good will). A decrease in low frequency (LF) power and in the low frequency to high frequency power (LF/HF) ratio, with a trend toward an increase in high frequency (HF) power, was seen during the breath awareness phase of Vipassana meditation[34]. This suggested a shift in the autonomic balance toward

vagal dominance during the breath awareness phase of Vipassana meditation. Also, during the breath awareness phase of Vipassana mindfulness meditation, there was a decrease in the LF/HF ratio.

Cyclic meditation (CM) was found to reduce oxygen consumption and breath frequency, but to increase tidal volume as compared to a comparable period of supine rest (SR) in the corpse posture, that is, Shavasana[35]. The decrease in the LF power and the LF/HF ratio after the practice of CM suggests a shift toward vagal dominance. [36]

There is a complex relationship between psychological processes and autonomic control. Although, there is commendable progress in the field of psychophysiology, but an interdisciplinary approach from psychology to organ to cellular level is the need of the hour.[20]

Although preliminary, the findings and studies suggest that measurements of acute HF-HRV changes during meditation show promise as a non-invasive biomarker and predictor of treatment modalities.

Thus, more comprehensive and realistic models are necessary for interactions of autonomic system with neurobehavioral, neuroendocrine and immune mechanisms. This will lead to better understanding of relations between mind, body and heart.

Acknowledgement: Nil

Source of Funding: Nil

Conflict of Interest: Nil

Ethical Clearance: Not required, as it is a review article

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DOI Number: 10.5958/j.2320-608X.2.1.007

Effect of Short Term Yoga on Respiratory Parameters in Middle Aged Females

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ABSTRACT

Aim: The present study was done to evaluate the effects of short term yoga on peak expiratory flow rate and breath holding time in middle aged females.

Settings and Design: The present study was a prospective study consisting of 34 female subjects in the age group of 30-40 years.

Material and Method: Participants fulfilling the inclusion and exclusion criteria underwent 60 minutes daily yoga program for 8 weeks taught by certified yoga teacher. Pre and post yoga respiratory functions were assessed by measuring breath holding time and peak expiratory flow rate. The parameters were analyzed by Student's 't' test.

Results: There was significant increase in breath holding time and peak expiratory flow rate compared to pre yoga practice.

Conclusion: This study showed beneficial effects of short term (8 weeks) regular yoga and pranayama practice on peak expiratory flow rate and breath holding time in middle aged females.

Keywords: *Breath Holding Time, Pranayama, Yoga, Peak Expiratory Flow Rate, Respiratory Centers*

INTRODUCTION

Hatha yoga is practiced through three main techniques namely asanas, pranayama and meditation. It focuses more on isometric exercise and stretching than on aerobic fitness.[1]

Various studies have reported effect of yoga on respiratory parameters.[2,3] Makwana et al studied the effects of short term yoga practice on ventilatory lung function tests [4]. It has been reported that yoga practice an hour/day, for 12 weeks resulted in significant increase in peak expiratory flow rate (PEFR).[5] In a study with subjects between the ages of 40 to 60years with no previous yoga experience, 80 % showed improvement in breath holding time after the completion of an intensive yoga program.[6,7]All these studies are done on different age group subjects.

The present study has been done exclusively on middle aged females working in a professional institute. This study has been designed to explain and ascertain the promotive aspects of health and yoga.

MATERIAL AND METHOD

The study was carried out at the, Department of Physiology in a local Medical College. Total 34 middle aged females in the age group of 30 to 40 years

volunteered as subjects. An informed consent was obtained from all the members. Subjects having diabetes, hypertension and chronic respiratory diseases like asthma were excluded. None of them was engaged in any type of exercise and was not doing yogasanas prior to this study.

The health of the subject was assessed by noting the present, past, family and personal history and also by a thorough general and systemic examination.

Their physical characteristics like height, weight and age, which have a role to play in determining the respiratory parameters were recorded.

All the subjects used to do yoga practice daily during lunch hour for about 60 minutes for a duration of 8 weeks. The yogic schedule consisted of asanas, pranayam and meditation. The exercise regimen included different yogic asanas viz : Padmasana, Yoga Mudra, Matsyasana, UthanaPadhasana, Pavanmuktasana, Paschimotasana, Gomukhasana, Viparita Karani, Sarvangasana, Karna Peedasana, Bhujangasana, Bakasana, anulomvilom and Shavasana.

All the subjects had to do pranayam essentially for about 5 to 10 minutes.

Pranayam schedule included the deep breathing, abdominal (diaphragmatic) breathing and alternate nostril breathing.

Breath holding time was measured in seconds from the time of holding breath after deep inspiration till the breaking point of the held breath by using a stop watch. The maximum value of three similar trials at 5 minutes interval was noted.[8] The Peak Expiratory Flow Rate is considered as a sensitive indicator of of patency of small airways. It is subjectd to wide variability and is effort dependent. PEFR was measured in liters per minute by mini Wright's peak flow meter. The subject was asked to take a deep breath, place the mouthpiece of the peak flow meter firmly between the teeth and lips and then to blow out with a short sharp blast without blowing cheeks. The reading on the scale was noted. Each subject was given such three readings at an interval of 5 minutes and the maximum reading was noted. [8]

Statistical analysis - The results of PFT are presented as mean ± S.D. The data were analyzed using student's 't' test. P values <0.05 were considered significant.

OBSERVATIONS AND RESULTS

As shown in Table I the physical characteristics were recorded at the beginning of yoga practices. PEFR and breath holding time was recorded at the beginning and at the end of yoga practices. The mean PEFR and mean breath holding time were statistically significant at end of 8 weeks yoga practices.(Table II)

Table I : Physical characteristics of subjects

Parameter	Mean ± SD(N=34)
Age (years)	30 ± 4.5
Height(cm)	157.3 ± 3.5
Weight (Kg)	60 ± 3.3

Table II: Comparison of respiratory parameters before and after yoga practices

Parameter	Before (Mean ± SD)	After (Mean ± SD)
PEFR(lit/min)	348.5 ±61.82	421.5 ±50.1*
Breath holding time (min)	30.27 ± 4.12	36.60 ± 5.14*

*p <0.05 statistically significant

DISCUSSION

On analyzing the effect of 8 weeks of regular Yoga practice and pranayama in the present study, it was found that there was statistically significant increase in PEFR and breath holding time.

A number of studies have been done to show the beneficial effects of yoga on healthy individuals.[2,3,4] Madanmohan et al have documented effect of yoga on respiratory endurance and muscle strength. [9]

Improved breath holding time and PEFR could be due to efficient use of diaphragmatic and abdominal muscles for inspiration and expiration [4]. Lung inflation near to total lung capacity simulates release of surfactant and prostaglandins into alveolar spaces which increase lung compliance. This also reduces bronchial smooth muscle tone. [9,10]

Normally quite breathing is not a conscious event. Respiration is controlled by nervous as well as chemical factors. Nervous regulation is considered to be influenced by respiratory centers located in pons and medulla. Their activity is modified by supra pointine centers which is considered as voluntary control. Basic rhythm is controlled by RAMP signal which is discharged from dorsal respiratory group of

neurons. Pnumotaxic center regulates rate and depth of respiration by controlling dorsal respiratory group of neurons. The increased PEFR is due to regular practice of yoga and pranayama. It has been observed that during daily practice of pranayama the basic activity of the bulbopontine complex is modified. [11,12] Also by deep inspiration and expiration, the respiratory muscles are stretched to their full extent. As maximal capacity of the lungs is reached it automatically causes increased lung volumes.[13] Regular practice of slow and deep breathing exercises causes hypertrophy of inspiratory and expiratory muscles which improves muscle strength.[14] Caliber of airways is modulated due to reflex relaxation of smooth muscles of larynx and tracheo-bronchial tree. It is due to stimulation of pulmonary stretch receptors during maximum inflation of the lungs. This mechanism reduces airway resistance. Thus opening of small airway and reduced airway resistance increases PEFR.[14]

The significant increase in BHT in the present study is consistent with previous studies.[6,7,8] After normal inspiration stretch receptors in alveoli are stimulated. Afferent fibers carry information to the respiratory centers located in medulla and expiration occurs. But in pranayama under strong voluntary control there is continuation of the phase of inspiration . The lungs are expanded and the walls of the alveoli are stretched to the maximum extent. Chest continues to expand under suprapontine control. The stretch receptors are thus trained to withstand more and more stretching. This helps in holding the breath for a longer time. [15,16,17]

It has also been reported that, breath holding time during pranayama is gradually increased by practice. Inspite of higher concentration of carbon dioxide in the alveoli and the blood respiratory centers are stimulated for longer duration. In addition, fatigue in muscles of inspiration and expiration is also delayed due to increased muscle size and endurance due to regular practice of pranayama. So breath holding time is prolonged .[17]

Thus in a nutshell, with this study, it is proved that regular practice of yoga and pranayama for 8 weeks is beneficial in improving the respiratory functions even in middle aged women.

The results of this study would certainly make us aware to incorporate yoga as part of our lifestyle in promoting health and thereby preventing age related respiratory diseases.

Limitations of the study

The limitations of the present study are less subjects and lack of measurement of other respiratory parameters.

ACKNOWLEDGMENT

Authors thank all the volunteers who have participated in the study for their cooperation and valuable time.

Conflict of Interest: None

Source of Funding: From resources of the authors

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DOI Number: 10.5958/j.2320-608X.2.1.008

Effect on Muscle-Power, Aerobic Capacity and Emotional State after Practice of Suryanamaskar

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ABSTRACT

Introduction: Suryanamaskar is a part of Yoga whose origin lies in the worship of surya. It consists of a sequence of twelve asanas. According to Yoga literature during Suryanamaskar, muscles of the entire body experience alternate stretch and pressure[1]. Certain poses requiring sustained contractions builds strength whereas the certain others improves the flexibility with static stretching[7]. Suryanamskar also give optimal stress on cradio-respiratory system[10]. It increases the movement of diaphragm and abdominal breathing leading to better oxygenation and a lower respiratory rate[2]. It works equally on mind, body and soul[8]. While performing Suryanamaskar brain needs to concentrate on each asana[17]. Thoughtless state of mind contains no stress, depression or anxiety[8]. Thus aim of this study is to quantify effects of Suryanamaskar on aerobic capacity, muscle-power and emotional state of healthy individuals.

Methodology: Cross-sectional study design with 30 healthy young individuals in the age group of 18-35years.Individuals who are practicing yoga or involved in any other form of aerobic training or fitness regimen were excluded.

Procedure: Each subject was informed and a written consent was taken. Assessment using Vertical jump test, Queen's college step test and DASS [Depression, Anxiety and Stress Scale] done.Subject was introduced to do the 12 steps (asanas) with breathing, a warm-up session & a cool down session included. The numbers of Suryanamaskars were gradually increased from 4 in the first session to 24 in the last session.Post 3 weeks assessment repetated.

Results: Significant increase in muscle power [p value < 0.0001],aerobic capacity (P value < 0.0001) seen. Also improvement noted in the DASS score [p value < 0.0001] post 3 weeks.

Conclusion: Suryanamaskar can be considered as an integral part of muscle strengthening as well as aerobic conditioning programme.

Keywords: *Suryanamaskar, Muscle-Power, Emotional State*

INTRODUCTION

Suryanamskar is sequence of poses that can be practiced on varying levels of physical awareness. This is a complete sadhana which incorporates asana, pranayama, mantra and chakra meditation.[9]

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A full round of suryanamaskar is considered to be two sets of the twelve poses with change in the second set to moving the opposite leg first.[1]

The asanas[6] are as follows:

1) Pranamasana [prayer pose)
2) Hasta uttanasana [raised arm pose)
3) Hastapadasana [standing forward bend pose)
4) Aekpaadprasarnaasan [equestrian pose)

5) Dandasana [four limbed staff pose)

6) Ashtanga namaskar [salute with eight limbs pose)

7) Bhujangasana [cobra pose)

8) Adho mukha svanasana [dog pose)

9) Ashwa sanchalanasana [equestrian pose)

10) Uttanasana [standing forward bend pose)

Certain studies and statistics carried out on suryanamaskar have shown positive effects on health. Through our study we want to quantify the effects of Suryanamaskar on aerobic capacity, muscle-power and emotional state.

METHODOLOGY

- **STUDY SETUP:** It was carried out in the physiotherapy department of Physiotherapy in Padmashree Dr. D.Y.Patil University.
- **Study Type:** Cross-sectional Study.
- **Sample Size: 30**
- **Duration Of Study:** 3 **Weeks**
- **Study Population:**

  Inclusion criteria: Normal healthy young individuals in the age group of 18-35.

Exclusion criteria

Young individuals who are practicing yoga , involved in any other form of aerobic training or fitness regimen.

Individuals with symptomatic musculoskeletal pain.

- **Study Procedure**

Each subject was informed about the purpose of the study and a written consent was taken. Pre and post assessment of subject's muscle-power, aerobic capacity and emotional state using Vertical jump test, Queen's college step test and DASS [Depression, Anxiety and Stress Scale) respectively.

Each subject was made to do the 12 steps (asanas) with breathing, after a warm-up session [stretching exercises, spot marching) and were followed by a cool down session [shavasana and relaxation techniques were taught). The numbers of Suryanamaskars were gradually increased from 4 in the first session to 24 in the last session.

The technique of Suryanamaskar is incorporated with 12 asana, pranayama, mantras and chakra meditation.

PRACTISE

- Suryanamaskar is performed on a yoga mattress. It is performed after 1 hour fasting. Mantras are pronounced at the start of each suryanamaskar.

The tests used are described below

Vertical Jump Test (Sargent Jump, Vertical Leap)[18]

This procedure describes the method used for directly measuring the height jumped.

Equipment required: Measuring tape or marked wall, chalk for marking wall.

Procedure: The subject stands side on to a wall and reaches up with the hand closest to the wall. Keeping the feet flat on the ground, the point of the fingertips is marked or recorded. This is called the standing reach height. The subject then stands away from the wall, and leaps vertically as high as possible using both arms and legs to assist in projecting the body upwards. The jumping technique can or cannot use a counter movement. Attempt to touch the wall at the highest point of the jump. The difference in distance between the standing reach height and the jump height is the score. The best of three attempts is recorded.

Queens College Step Test [18]

The Queens College Step test used to determine aerobic fitness.

Purpose: This sub-maximal test provides a measure of cardiorespiratory or endurance fitness.

Equipment required: 16.25 inches / 41.3 cm step, stopwatch, metronome or cadence tape.

Procedure: Subject steps up and down on the platform at a rate of 22 steps per minute for females . The subjects are to step using a four-step cadence, 'up-up-down-down' for 3 minutes. Subject stops immediately on completion of the test, and the heart beats are counted for 15 seconds from 5-20 seconds of recovery. Multiply this 15 second reading by 4 will give the beats per minute (bpm) value to be used in the calculation below.

Scoring: an estimation of VO2max can be calculated from the test results, using this formula (McArdle et al.,1972).

women: VO2max (ml/kg/min) = 65.81 - 0.1847 x heart rate (bpm).

- The DASS is a set of three self-report scales designed to measure the negative emotional states of depression, anxiety and stress. It's a 42-item questionnaire.

RESULTS

Table 1 . Changes in vertical jump distance

Parameter vertical displacement (m)	Mean
Pre	0.25
Post	0.28
P value < 0.0001	Extremly significant

Table 2 . Changes in average muscle power

Parameter Avg. Muscle Power (Watts)	Mean	SD
Pre	298.47	50.15
Post	330.11	56.71
	P value < 0.0001	Extremly significant

Table 3 . Changes in VO_2 Max.

Parameter VO_2 Max. (ml/Kg/min)	Mean	SD
Pre	46.47	2.39
Post	47.95	2.55

Table 4 . Changes in DASS scores.

Parameter	Mean	SD
Pre Depression Score	7.84	1.53
Post Depression Score	6.74	1.46
Pre Anxiety Score	16.81	2.57
Post Anxiety Score	14.29	2.74
Pre Stress Score	19.13	2.78
Post Stress Score	16.19	2.66
Pre DASS (total)	43.77	5.69
Post DASS (total)	37.16	5.80

DISSCUSION

30 subjects participated in the study, which were healthy young females around 22 years of age. Muscle-power improved from a mean average of 298.47 to 330.11with a P value<0.0001 which is considered extremely significant. The muscle-power was assessed using Vertical Jump Test as it goes with spinal mobility. It involves extension of spine along with the use of lower limb and upper limb muscles. Also the test is performed with full power in one bout of action i.e. a jump. Height achieved on vertical jump has a direct corelation with the amount of force that is produced by muscle fibres. The improvement in muscle-power is attributed to the dynamic postures assumed by the subjects while performing suryanamskar in which muscles of the entire body experience stretch and contractions alternately.1 Many of its poses build strength because it requires sustained contractions of many muscle groups; which is comparable to resistance training. Also, there is weight bearing on UL, so there is more utilization of upper body muscles and thus strengthening of UL and trunk muscles.4

In the present study we also assessed the effect of suryanamaskar on aerobic capacity using Queen's college step test and observed significant improvement. Queen's college step test correlates closely to VO2 Max. A drop in 15 sec recovery HR from a mean of 26.16 to 24.09 and a P value < 0.0001 which is extremely significant is observed. The improvement in the VO2 Max. value from a mean of 46.47 to 47.95 is observed. A drop in RPE value from a mean of 26.16 to 24.09 is obtained with a P value < 0.0001 for both which is considered extremely significant. This can be attributed to the following factors: With practice of suryanamaskars the exercise pressor reflex which controls the cardiovascular system is altered. There is reduced activation of the sympathetic nervous system, altering the HR values.3 There is increased blood circulation to the vital organs, better oxygenation and improved blood circulation to the skeletal muscles. This improves overall cardiovascular endurance with cardiac conditioning and thus leads to an increased aerobic capacity.8 It also increases the movement of the diaphragm and enhances abdominal breathing thus leading to better oxygenation and a lower HR and greater VO2 Max values.3

The emotional states of the subjects were assessed in this study using DASS [depression, anxiety and stress scale). We observed significant improvement in the emotional states of our subjects. A reduction in the DASS scores from a mean of 43.77 to 37.16, 7.84 to 6.74 in depression, 16.81 to 14.29 in anxiety and 19.13 to 16.19 in stress levels with a P value < 0.0001 for all, which is extremely significant . This improvement can be explained as follows:

Suryanamaskar works equally on mind, body and soul. While performing suryanamaskar, brain thinks nothing and concentrates on each asana.Thoughtless

state of mind contains no stress, depression or anxiety.[17]This results in better emotional state and also a sense of well being and improved quality of life.[17]Also the control of breath observed while performing suryanamaskar, has a tranquilizing effect on nervous system and calms the mind.[8] Also the retention of breath (kumbakha) practiced in certain asanas of suryanamaskar, for 4-6 counts energizes the body, while longer retention (from 6 counts to full capacity) has a calming effect on the body.8

Thus to conclude Suryanamaskar can be considered as an integral part of muscle strengthening and exercise protocol. It can be used as an adjuvant measure to improve aerobic capacity and cardiovascular endurance.

It can also be used for bringing down the stress, depression and anxiety levels in people by including it in regular exercise programme.

ACKNOWLEDGEMENTS

We are heartily thankful to the staff & student of Dept. Of Physiotherapy, Pad.Dr.D.Y.Patil University, who supported us from the preliminary stages of the project.

Conflict of Interest: We, Phadke S,Joshi R , Yardi S state that there is no conflict of interests with other people or organizations about our work.

Ethical Clearance: Padmashree Dr. D. Y. Patil University ethic committe clearance taken .

Source of Funding: Study was self funded.

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DOI Number: 10.5958/j.2320-608X.2.1.009

Immediate effect of Different Pranayam on Short Term Heart Rate Variability in Health Care Students - A Preliminary Study

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ABSTRACT

Introduction: Yoga produces consistent physiological changes and have sound scientific basis. Heart rate variability (HRV) has come to be widely used as a non-invasive tool to assess autonomic function in physiological as well as disease states. In view of this, the present study was aimed to study the effect of suryanadi(SNP) and chandranadi pranayams(CNP) on HRV in healthy young volunteers.

Methodology: 11male volunteers aged between 20-30yrs were assigned to a sequence randomly. Each volunteer was taught both SNP and CNP by trained yoga teacher and made to practice under direct supervision between 4-6.30 pm in ACYTER lab, JIPMER. HRV was recorded by using BIOHARNESS AcqKnowledge 4.1 version and analyzed by Kubios HRV 2.00 software. Basal resting parameters and HRV were recorded for 5 minutes after that SNP was performed in six cycles per minute for 5 minutes followed by 5 min rest. Three such sessions (before, during and after) HRV were recorded. The same procedure and recording ware followed for CNP.

Results: The time domain analysis of SNP revealed an increased heart rate with a decreased RMSSD, However the SDNN was increased. Frequency domain analysis, increased LF power and decreased HF power and LF/HF ratio increased after the intervention. In CNP, the time domain analysis, showed decreased heart rate and an increased pNN50. The frequency domain analysis revealed an increased HF power with decreased LF/HF ratio.

Discussion: SNP increase the sympathetic activity and CNP increases the parasympathetic activity and these can be appropriately advocated in many chronic cardiovascular diseases where the autonomic imbalance is one of the primary derangements.

Keywords: *Suryanadi Pranayam, Chandranadi Pranayam , Heart Rate Variability*

INTRODUCTION

The ancient Indian science of Yoga makes use of voluntary regulation of the breathing to make respiration rhythmic and to calm the mind[1, 8]. This practice is called Pranayama. Nadisuddhi pranayama means "purification of subtle energy paths", inhalation and exhalation are through alternative nostrils for successive respiratory cycles.

Surya Anuloma Viloma Pranayama means "heat generating breathing particle" when the respiratory cycle of inhalation and exhalation is completed through the right nostril exclusively. When completed through the left nostril alone the practice is called "

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Chandra Anuloma Viloma Pranayam" which means a heat dissipating or cooling liberating practice[2,3]

Heart rate variability (HRV) has come to be widely used as a non-invasive tool to assess autonomic function in a variety of physiologic as well as disease states[4]. However, there is paucity of literature on immediate effect of suryanadi and Chandranadi pranayam on HRV.In view of this, the present study was aimed to study the immediate effect of suryanadi and chandranadi pranayams on HRV in healthy young volunteers.

MATERIALS AND METHOD

Materials

HRV was recorded by using BIOHARNESS AcqKnowledge 4.1 version and analyzed by Kubios HRV 2.00 software. Blood pressure and heart rate were recorded with the subject seated comfortably, using the noninvasive automated BP monitor (NIBP).

Methods & procedure

Study involves human subjects only

Inclusion criteria

- Subjects aged between 20-30years males
- Willing for learning pranayam technique

Exclusion criteria

- Subjects with history of previous or current organic diseases.
- Subjects currently receiving yoga therapy including meditation & biofeedback.

The present study was conducted on 11male volunteers' 20-30yrs. after obtaining ethical clearance from the institutional Human Ethics Committee. All consenting subjects meeting inclusion and exclusion criteria of the study will be selected and informed written consent will be obtained after thoroughly explaining the procedure.

Their height, weights were recorded and BMI was calculated. Each volunteer was taught both suryanadi (SNP) and chandranadi pranayam (CNP) by trained yoga teacher and made to practice under direct supervision until they were familiar. The procedures and recordings were carried out in lying down posture for all volunteers between 4-6.30 pm in ACYTER lab, JIPMER.Basal resting parameters and HRV were recorded for five minutes followed by

Day 1: SNP (only right nostril breathing) was performed in six cycles per minute (each cycle consists of five seconds for each inspiration and expiration) for five minutes followed by five min rest. Three such sessions (before, during and after) HRV were recorded.

Day 2: The same procedure and parameters were recorded for CNP (left nostril breathing only).

Statistical analysis:

Statistical analysis was done using SPSS version 16 (Repeated measures of ANOVA followed by post hoc analysis with Benferroni adjustment) and the level of statistical significance is considered at a p value < 0.05.

RESULTS

The results of our study were much in accordance with the previous studies. The time domain analysis of SNP revealed an increased heart rate with a decreased RMSSD, the index of short term HRV. However the SDNN which is considered the index of long term HRV increased. Also, in the frequency domain analysis there is an increased LF power and decreased HF power.

The index of sympathovagal balance as reflected by LF/HF ratio increased i.e. from 1.8 to 2.2 after the intervention. All the observation showed that SNP is sympathomimetic. In CNP, the time domain analysis of HRV revealed a decreased heart rate and an increased pNN50. The frequency domain analysis revealed an increased HF power with decreased LF/HF ratio i.e. from 2.1 to 1.5. The observations of CNP clearly indicated that CNP is an activator of the parasympathetic activity.

Table 1: Shows the effect of Suryanadi pranayam on short term heart rate variability parameters before, during & immediate after the procedure.

Parameters	Before	During	After	P Value	F/df
Time domain					
Mean RR	867.16±21.262	826.04±18.264**	868.17±19.798	0.007	6.361/(2,10)
SDNN	27.7673±1.386	40.918±2.088***	29.609±0.976££	0	20.964/(2,10)
Mean HR*	69.79±1.758	73.27±1.644**	69.70±1.618	0.004	7.310/(2,10)
STD HR	2.956± 0.189	4.159± 0.289**	3.331± 0.281	0.005	6.989/(2,10)
RMSSD	26.736±1.276	22.327±0.870**	25.200±1.165*	0.005	6.926/(2,10)
NN50	23.455±3.987	13.364±1.557**	18.364±3.336**	0.021	4.728/(2,10)
pNN50	6.755± 1.179	3.655± 0.460*	5.20± 0.941**	0.013	5.496/(2,10)
RR triangular index	8.096± 0.365	11.246± 0.657**	8.677± 0.266£	0	11.552/(2,10)
TINN	139.09±6.634	194.54±12.293**	147.727±5.367£	0	12.373/(2,10)
Frequency domain					
VLF (0"0.04 Hz)	119.27±47.703	115.09±36.784	148.72±32.618	0.811	0.212/(2,10)
LF (0.04"0.15 Hz)	406.72±85.557	1415 ±170.840***	468.445±62.848£££	0	24.56/(2,10)
HF (0.15"0.4 Hz)	271.909±34.034	122.909±34.784**	267..909±40.423£	0.002	8.760/(2,10)
Total power	797.909±113.806.557	1653 ±143.30**	885.09±81.267££	0	18.321/(2,10)
LF/HF ratio	1.886± 0.458	32.878± 15.796	2.287± 0.512	0.041	3.765/(2,10)
Percentage power					
PVLF (0"0.04 Hz)	12.127± 3.340	7.755± 2.829	15.236± 2.742	0.231	1.579/(2,10)
PLF (0.04"0.15 Hz)	48.155± 4.950	81.264± 5.662***	51.527± 4.632£	0	16.462/(2,10)
PHF (0.15"0.4 Hz)	39.70± 6.425	10.99± 5.439**	33.245± 5.615	0.002	8.247/(2,10)
Normalized units					
NLF (0.04"0.15 Hz)	56.09± 6.195	88.382± 5.680**	61.51± 5.755£	0.001	10.711/(2,10)
NHF (0.15"0.4 Hz)	43.90± 6.195	11.618± 5.680**	38.482± 5.755£	0.001	10.711/(2,10)

Values are expressed as Mean ± SEM. . *P d" 0.05 **P d" 0.01 ***P d" 0.001

* comparison of during the technique with before SNP

* Comparision of after the technique with before

£ comparison of after the technique with during

Changes during the test and after the test were both compared with pretest values by Student's paired't' test. The two P values reported are for the pretest vs. during and pretest vs. after comparisons respectively.

Table 2: Shows the effect of Chandranadi pranayam on short term heart rate variability parameters before, during & immediate after the procedure.

Parameters	Before	During	After	P Value	F/df
Time domain					
Mean RR	853.58±21.564	816.14±25.84	852.98±23.05	0.026	4.426/(2,10)
SDNN	28.39±1.38	43.12±1.608***	29.20±0.951£££	0	32.645/(2,10)
Mean HR*	70.99±1.835	74.629±2.409	71.06±2.014£	0.016	5.136/(2,10)
STD HR	3.33± 0.228	4.615± 0.376	3.156± 0.150££	0.002	8.748/(2,10)
RMSSD	26.66±0.799	23.04±0.877*	26.49±1.165£	0.004	7.324/(2,10)
NN50	22.27±2.78	14.09±1.988	24.09±4.303£	0.025	4.455/(2,10)
pNN50	6.155± 0.825	3.809± 0.579	6.755± 1.298£	0.024	4.51/(2,10)
RR triangular index	8.386± 0.241	10.769± 0.437***	8.390± 0.280££	0	20.134/(2,10)
TINN	140.00±7.717	221.81±16.614**	145.90±4.662££	0	13.895/(2,10)
Frequency domain					
VLF (0"0.04 Hz)	140.09±44.05	123.54±41.908	74.27±13.163	0.419	0.419/(2,10)
LF (0.04"0.15 Hz)	427.18±90.69	1460 ±83.51***	434.45±40.127£££	0	85.351/(2,10)
HF (0.15"0.4 Hz)	244.09±25.208	131.09±16.017**	305..09±36.914£££	0	20.190/(2,10)
Total power	811.182±119.583	1714 ±113.450***	813.90±67.840£££	0	29.026/(2,10)
LF/HF ratio	2.166± 0.630	13.659± 2.317**	1.582± 0.171£££	0	25.214/(2,10)

Table 2: Shows the effect of Chandranadi pranayam on short term heart rate variability parameters before, during & immediate after the procedure. (Contd.)

Parameters	Before	During	After	P Value	F/df
Percentage power					
PVLF (0"0.04 Hz)	12.127± 3.340	6.482± 1.702	9.273± 1.756	0.074	2.978/(2,10)
PLF (0.04"0.15 Hz)	48.155± 4.950	85.627± 1.419***	53.60± 2.183£££	0	41.374/(2,10)
PHF (0.15"0.4 Hz)	39.70± 6.425	7.900± 1.038***	37.136± 3.159£££	0	33.244/(2,10)
Normalized units					
NLF (0.04"0.15 Hz)	56.09± 6.195	91.655± 1.024***	59.44± 2.896£££	0	41.908/(2,10)
NHF (0.15"0.4 Hz)	43.90± 6.195	8.345± 1.024***	40.536± 2.897£££	0	41.823/(2,10)

Values are expressed as Mean ± SEM. *P d" 0.05 **P d" 0.01 ***P d" 0.001

* comparision of during with before

* comparision of after with before

£ comparison of after with during

Changes during the test and after the test were both compared with pre-test values by Student's paired't' test. The two P values reported are for the pre-test vs. during and pre-test vs. after comparisons respectively.

DISCUSSION

The present study evaluated the effect of SNP and CNP on HRV in three different sessions (before, during & after). Heart rate variability has come to be widely used as a non-invasive tool to assess autonomic function in a variety of physiologic as well as disease states [4]. HF component predominately a consequence of vagal activity. LF component probably due to combination of sympathetic and parasympathetic activity.

LF/HF ratio has been used as a non-invasive index of sympathovagal balance. Our studies show that SNP revealed an increased heart rate with a decreased RMSSD, the index of short term HRV. Frequency domain analysis there is an increased LF power and decreased HF power. The index of sympathovagal balance as reflected by LF/HF ratio increased. All the observation showed that SNP is sympathomimetic.

CNP, the time domain analysis of HRV revealed a decreased heart rate and an increased pNN50. The frequency domain analysis revealed an increased HF power with decreased. The observations of CNP clearly indicated that CNP is an activator of the parasympathetic activity. It seems possible that mechanical receptors in the nasal mucosa are activated with air flow in to the nostril and this signal is unilaterally transmitted to the hypothalamus[5].This indicates that the practice of slow breathing exercise improves vagal activity. Practice of pranayam has been known to modulate cardiac autonomic status with an improvement in cardio-respiratory functions [6].

A long-term improvement in autonomic balance as well as in respiratory, cardiovascular and brain function can be achieved if mechanical forces are applied to the body with the aim of reducing existing imbalances of mechanical force vectors. This technique implies continually Controlling the body functions for precise timings like in Pranayamic breathing techniques. [7]

The hypothalamus is considered the highest center for autonomic regulation. SNP increase the sympathetic activity and CNP increases the parasympathetic activity and these can be appropriately advocated in many chronic cardiovascular diseases where the autonomic imbalance is one of the primary derangements. The beneficial effect of SNP and CNP can be applied to all school children to improve the physical health and sports activities of the students.

Limitation

All participants were right hand dominant used to manipulate the nostrils. There was no separate control for this study.

Recommendation

- Sample size has to be increased
- Female can be include to find out the gender difference.
- To compare the immediate effect with long term training.

ACKNOWLEDGMENT

The authors thank Dr. E.S.Prakash, Associate Professor of Physiology, Division of Basic Medical Sciences, Mercer University School of Medicine, USA, for helping me to write the manuscript.

Conflict of Interest: No Conflict of interest applicable for this study.

Source of Funding: Not applicable

Ethical Clearance: Enclosed (Human ethical committee certificate -JIPMER).

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DOI Number: 10.5958/j.2320-608X.2.1.010

Contribution of Ergoreflex to Crrto Isometric Exercise in CP

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ABSTRACT

Background: Muscle hypothesis implicates abnormalities in peripheral muscle as a source of stimulus for symptoms and reflex abnormalities seen in chronic heart failure.

Aim: To evaluate ergoreflex contribution to CRRto isometric exercise in CP.

Material and Results: We studied 30 CP (age- 56.1±0.7) and 30 age matched normal subjects (age- 55.0±0.7). Post exercise regional circulatory occlusion method (PE-RCO) was used to assess ergoreflex. We compared cardiaorespiratory responses to sustained handgrip and during a 3-minute period of post exercise regional circulatory occlusion (PE-RCO). Contributions made specifically by ergoreflex to cardiorespiratory parameters in responses to exercise were derived by calculating absolute difference in these parameters during 10min recovery between with PE-RCO and without PE-RCO. CP showed significant ergoreflex activation compared with control subjects in term of Heart Rate and Respiratory Rate.

Conclusion: Ergoreflex is overactive in CP.

Keywords: *Cancer, Cachexia, Ergoreceptors, Ergoreflex, CCR:Cardiorespiratory Responses, CP: Cancer Patients*

INTRODUCTION

Cancer a progressive wasting syndrome characteristized by loss of adipose tissue and lean body mass (LBM), contrary to starvation where LBM is generally preserved until death[1]. Almost half of all CP show syndrome of cachexia. Cachexia also occurs in diseases like COPD, CHF, AIDS, and Anorexia Nervosa. Proinflammatory cytokines including TNF-α, IL-1, IL-6, Interferon-ã has been proposed as mediator of cachetic process[2]. Skeletal muscle wasting in CP reflects imbalance between protein synthesis and catabolism and is reflected in functional changes of various reflexes arising from them e.g. Ergoreflex.

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Ergoreflex is a peripheral reflex originating in skeletal muscles[3]. Ergoreceptors are intramuscular afferents functionally differentiated into Mechanoreceptors and Chemoreceptor's. Mechanoreceptors are finely myelinated group III afferents and respond mainly to mechanical stimuli. Chemoreceptors are group IV afferents sensitive to acid metabolites in muscles, also to prostaglandins and bradykinin. Once ergoreceptors are stimulated they cause sympathetic drive, increase in blood pressure and ventilation. This combined effect is beneficial in diverting more oxygenated blood to working skeletal muscles[4]. Ergoreceptors activation has been subject of recent studies in heart failure syndrome, where metabolic abnormalities in skeletal muscles, have been shown to be responsible for their enhanced activity[5]. Depletion of lean tissue in CP might contribute to functional changes in skeletal muscles and Ergoreflex. Study was undertaken to test hypothesis that Ergoreflex is hyperactive in CP.

MATERIALS AND METHOD

Present study was conducted on 30 CP and 30 normal subjects (45-60 years). Experimental protocol was explained to them and detailed informed written consent obtained from each subject.

Inclusion criteria for experimental (Cancer) group

(1) Newly Histologicaly diagnosed cancer

(2) Diagnosed CP before beginning of any Treatment.

Exclusion criteria for experimental (Cancer) group

Cachetic conditions like CHF, COPD, Anorexia nervosa, Tuberculosis, Liver Diseases, musculoskeletal disorders, Thyrotoxicosis.

Anthropometric indices: Height, Weight, BMI, Midarm circumference, Triceps skin fold thickness measured.

Formulas used

(1) % Body Fat= (1.2 x BMI) + (0.23 x Age in yrs)–10.8–5.4[6]

(2) Fat Mass (kg) = Body Weight (kg) / 100 × % Body Fat

(3) Fat Free Mass (FFM) (kg) = Body weight % Fat Mass

(4) Corrected Arm Muscle Area (CAMA)

$$CAMA = [MAC\ \% (\pi \times TSF)^2 / 4\pi]\ \%10$$

(5) Muscle Mass= [ht {0.0264+ (0.0029xCAMA)}][7]

Method of Testing Ergoreflex

Tests performed in morning from 8am-10am in thermo neutral zone. HR RR were recorded in computerized Physiograph(Medicaid). After instrumentation subjects gave 15min rest. To evaluate Ergoreflex in forearm, post exercise regional circulatory occlusion method (PE-RCO) was used[5]. Protocol included two exercise bouts performed in random order.

Protocol-1 (SHG without PE-RCO). Subject was instructed to sit on chair and maximum voluntary contraction of hand muscles of non dominant arm was determined using hand grip dynamometer. Subject was then asked to perform sustained hand grip (SHG) at 50% of MVC for 3 min.

Protocol-II (SHG with PE-RCO). Same protocol 1 followed, 10sec before end of exercise 3min of circulatory (venous) occlusion by inflation of riva rocci cuff tied on upper arm to 40mmHg was done (PE-RCO). After the arm was inflated subject was asked to relax. Thus contribution of the muscle ergoreceptors was evaluated by trapping of metabolites in the exercising muscles after exercise. This protocol has been shown to fix the metabolic state of muscles and to prolong the activation of ergoreceptors. There was a period of rest of atleast 30min between 2 protocols of excercise to minimise the effects of muscle fatigue. Recovery phase started with release of pressure at end of occlusion and lasted for 10min. There was continuous online recording of HRRR in computerised polygraph throughout the two protocols. Contributions made specifically by ergoreflex to cardio respiratory responses to isometric exercise were derived by calculating absolute difference between 10min recovery with PE-RCO and without PE-RCO.

Statistical Analysis

All the data were expressed as mean ± SEM. Unpaired t-test and ANOVA used for analysis. P value of < 0.05 was considered statistically significant.

RESULTS

CP showed statistically significant reduction in body weight, BMI, Fatfree Mass, Muscle Mass as compared with normal subjects ($p<0.001$)(Table-1).MVC was lower in CP compared with normal subjects($p<0.001$)(Table-1). On the other hand basal HRRR (HRRR) was significantly increased in CP ($p<0.001$)(Table-1).During Protocol-1, HRRR were significantly elevated during SHG exercise in both groups (Table-2&4). During Protocol-II (PE-RCO) it was observed that there was greater increase in HRRR than in protocol 1 in both the groups. (Table 3&5). During recovery phase there was delay in recovery of HRRR in CP. There was greater degree of ergoreflex activation in CP which was calculated by absolute difference between 10min recovery with PE-RCO and without PE-RCO. Differences (Δ^1- Δ^2) in the protocols were taken as index of ergoreflex activation. There was statistically significant difference in mean of recovery HR during the two protocols in CP ($p<0.001$) (Table-6).However, difference in mean of recovery respiratory rate during the two protocols amongst two group was observed but difference was not statistically significant (Table-7). It was observed that there was decrease in muscle mass and exaggerated ergoreflex in CP.

Table 1: Anthropometric indices of control and Cancer group (n=30)

Variable	Control group	Cancer group
Age(years)	55.0 ± 0.7s	56.1 ± 0.7
Height(cm)	161.9 ± 1.9	162.9 ± 1.1
Weight(kg)	67.5 ± 1.4	51.0± 1.7***
BMI(kg/m^2)	25.5 ± 0.6	19.3 ±0.5***
MVC(kg)	34.8 ± 1.2	23.3 ± 1.3***
Corrected Arm Muscle Area(CAMA)	37.4 ± 2.9	25.7± 1.4***
FFM(kg)	41.6 ±0.9	35.1 ±0.8***
Muscle Mass(kg)	20.9 ± 0.5	17.5 ±0.4***
Basal HR (beats/min)	78.5 ±1.0	97.2 ± 1.7***
Basal RR (breaths/min)	12.7 ±0.7	15.7 ±0.6***

Values in means±SEM

p value : *<0.05 (significant); **<0.01 (highly significant); ***<0.001 (very highly significant); >0.05 (not significant)

Table 2: Analysis of mean recovery heart rate during protocol I (non-occlusion)

S.No	Heart rate during recovery	Control group	Cancer group	
1	HR SHG	87.9± 1.4	110.5± 1.2	p=0.001F=107.2
2	HR Rec1	89.5± 1.6	106.6± 1.5	
3	HR Rec2	85.7± 1.6	104.5± 1.6	
4	HR Rec3	83.5± 1.4	100.5 ±1.7	
5	HR Rec4	82.6± 1.4	99.6 ±1.4	
6	HR Rec5	81.9 ±1.5	98.8± 1.3	
7	HR Rec6	81.7± 1.5	98.9± 1.4	

Values in means±SEM p value: *<0.05 (significant); **<0.01 (highly significant); ***<0.001 (very highly significant); >0.05 (not significant)

HR SHG - Heart rate during sustained hand grip

Rec1 - Ist minute of recovery phase

Rec2 - IInd minute of recovery phase

Rec3 - IIIrd minute of recovery phase

Rec4 - Mean of IV and Vth minute of recovery phase

Rec5 - Mean of VIth and VIIth minute of recovery phase

Rec6 - Mean of VIIIth and IXth minute of recovery phase

Table 3: Analysis of mean recovery heart rate during protocol II (occlusion)

S.No	Heart rate during recovery	Control group	Cancer group	
1	HR SHG	90±0.0	112±0.0	p=0.001F=160.4
2	HR SHG(occ)	95.1±1.6	122.0±1.4	
3	HR Rec1	89.2±1.5	116.0±1.7	
4	HR Rec2	87.6±1.6	111.0±1.8	
5	HR Rec3	85.2±1.5	107.3±2.0	
6	HR Rec4	84.1±1.5	106.6±1.6	
7	HR Rec5	83.3±1.2	104.7±1.5	
8	HR Rec6	82.3±1.2	102.8±1.3	

Values in means±SEM

p value : *<0.05 (significant); **<0.01 (highly significant); ***<0.001 (very highly significant); >0.05 (not significant)

Table 4: Analysis of mean recovery respiratory rate during protocol I (non-occlusion)

S.No	Respiratory rate during recovery	Controlgroup	Cancer group	
1	RR SHG	15.0± 0.9	19.7± 0.9	p=0.003F=9.6
2	RR Rec1	13.6± 0.9	18.4 ±0.9	
3	RR Rec2	13.4± 0.8	17.8± 0.9	
4	RR Rec3	12.9± 0.8	17.1± 0.9	
5	RR Rec4	12.4± 0.8	16.6 ±0.9	
6	RR Rec5	11.9± 0.7	15.0± 0.8	
7	RR Rec6	11.7 ±0.7	14.7 ±0.9	

Values in means±SEM

p value : *<0.05 (significant); **<0.01 (highly significant); ***<0.001 (very highly significant); >0.05 (not significant)

Table 5: Analysis of mean respiratory rate during recovery in protocol II (occlusion)

S.No	Respiratory rate during recovery	Control group	Cancergroup	
1	RR SHG	11±0.1	17±1.1	p=0.001F=16.6
2	RR SHG(occ)	16.6±0.9	20.9±1.0	
3	RR Rec1	14.5±0.8	17.7±0.9	
4	RR Rec2	13.3±0.8	17.3±0.9	
5	RR Rec3	12.4±0.6	16.1±1.0	
6	RR Rec4	12.2±0.7	14.9±0.9	
7	RR Rec5	11.9±0.6	14.6±0.8	
8	RR Rec6	11.8±0.6	14.2±0.8	

Values in means±SEM

p value : *<0.05 (significant); **<0.01 (highly significant); ***<0.001 (very highly significant); >0.05 (not significant)

Table 6: Recovery Heart rate (beats/min) in control and CP,

Recovery HR	Control group			Cancer group		
	Without occlusion (WO)	Occlusion (Occ)	Δ^1	Without occlusion (WO)	Occlusion (Occ)	Δ^2
HRSHG	87.9 ± 1.4	95.1 ± 1.6	9.2	110.5 ± 1.2	122.0 ± 1.4	12.4
HR Rec1	89.5 ± 1.6	89.2 ± 1.5	5.3	106.6 ± 1.5	116.0 ± 1.7	9.9
HR Rec2	85.7 ± 1.6	87.6 ± 1.6	6.2	104.5 ± 1.6	111.0 ± 1.8	9.5
HR Rec3	83.5 ± 1.4	85.2 ± 1.5	4.4	100.5 ± 1.7	107.3 ± 2.0	10.6
HR Rec4	82.6 ± 1.4	84.1 ± 1.5	4.7	99.6 ± 1.4	106.6 ± 1.6	9.1
HR Rec5	81.9 ± 1.5	83.3 ±1.2	5.2	98.8 ± 1.3	104.7 ± 1.5	7.2
HR Rec6	81.7 ±1.5	82.3 ± 1.2	5.1	98.9 ± 1.4	102.8 ±1.3	6.8
	P = 0.252F= 1.34			P = 0.001F= 15.26		

Values in means±SEM

p value : *<0.05 (significant); **<0.01 (highly significant); ***<0.001 (very highly significant); >0.05 (not significant)

D^1 -differences of mean in control group

D^2- differences of mean in Cancer group

Table 7. Recovery Respiratory rate in control and CP.

Recovery RR	Control group Mean ± SEM (n=30)			Cancer group Mean ± SEM (n=30)		
	Without occlusion (WO)	Occlusion (Occ)	Δ^1	Without occlusion (WO)	Occlusion (Occ)	Δ^2
RRSHG	15.0 ± 0.9	16.6 ± 0.9	5.3	19.7 ± 0.9	20.9 ± 1.0	3.7
RR Rec1	13.6 ± 0.9	14.5 ± 0.8	4.4	18.4 ± 0.9	17.7 ± 0.9	3.7
RR Rec2	13.4 ± 0.8	13.3 ± 0.8	4.3	17.8 ± 0.9	17.3 ± 0.9	4.4
RR Rec3	12.9 ± 0.8	12.4 ± 0.6	3.4	17.1 ± 0.9	16.1 ± 1.0	4.1
RR Rec4	12.4 ± 0.8	12.2 ± 0.7	3.0	16.6 ± 0.9	14.9 ± 0.9	3.6
RR Rec5	11.9 ± 0.7	11.9 ±0.6	2.9	15.0 ± 0.8	14.6 ± 0.8	3.7
RR Rec6	11.7 ±0.7	11.8 ± 0.6	2.7	14.7 ± 0.9	14.2 ± 0.8	3.8
	P = 0.792F= 0.071			P = 0.451F= 0.575		

Values in means±SEM

p value : *<0.05 (significant); **<0.01 (highly significant); ***<0.001 (very highly significant);

>0.05 (not significant)

Δ^1 -differences of mean in control group

Δ^2- differences of mean in Cancer group

DISCUSSION

In the present study it was observed that CP had significant decrease in body weight, BMI, fat free mass and muscle mass. Inspite of normal food intake patients have reported weight loss. Studies have shown that cancer cachexia is due to imbalance between catabolism and anabolism[1]. Cause of weight loss inspite of sufficient caloric intake may be due to imbalance between catabolic and anabolic factors[8]. Even at rest metabolic rate in CP is higher than normal which leads to patient weight loss inspite of sufficient daily caloric intake.

In our study it was observed that muscle mass was statistically lower in CP. There are some experimental evidences in which depletion of skeletal muscle mass in an experimental model of cachexia, occur by reduction in protein synthesis acccompained by a large increase in protein degradation[9]. Possible mechanism noted in experimental models is increased levels of proteolytic inducing factors which appear to initiate protein degradation in muscle by increasing PGE2 content[10]. We observed that maximum voluntary contraction (MVC) was lower in CP. CP were unable to perform SHG for 3 min .This may be due to loss in muscle mass and early fatigue. Exercise capacity is related to both muscle mass and strength[11, 12, 13]. Reduced muscle strength and endurance has been linked to changes in histology of muscles and metabolism in patients with cancer which are thought to be similar to cardiac cachexia[14].

We also found that in cancer patient's basal HRRR was higher compared to control subjects. Recent evidences have linked increased adrenergic transmission and activation of sympathetic nervous system in cancer which encourages an elevated BMR and weight loss[15]. Increased adrenergic stimulation may be responsible for increase in basal HRRR.

Alam and Smirk gave the concept of a chemical (metabolic) reflex arising from muscle, by showing that blood pressure and heart rate remained elevated when metabolites produced during exercise were trapped in muscle by occlusion of leg blood flow immediately following exercise[16]. These findings were later confirmed by Massie et al who found relation between degree of skeletal muscle alterations in the forearm during exercise and clinical severity of CHF[17]. In CHF patients with their damaged and wasted skeletal muscles, ergoreceptors are overactivated and contributes to exaggerated ventilatory and cardiovascular responses[18]. Signals for ergoreflex are metabolic stimulation of receptors. Possible stimuli for initiating the ergoreflex are local release of prostaglandins, Potassium, H+ion. Studies have documented that exaggerated metaboreceptor firing in human heart failure is dependent on systemic acidosis, prostaglandins, and bradykinin[18]. Studies

have shown local prostaglandin levels in exercising muscle correlate with ventilator response[19]. Strong relationship b/w more advanced cardiac cachexia and heightened muscle reflex overactivity supports the crucial role played by maladaptive changes in muscle[20].

Studies have reported that Cytokines play a major role in cancer related cachexia through complex and overlapping synergistic interactions and modify neuropeptides and signalling processes[1].

CONCLUSION

In patients with cancer, presumably due to skeletal muscle abnormalities, ergoreflex response generated by postexercise regional circulatory occlusion is much greater, both in terms of HRRR.

ACKNOWLEDGEMENT-

Authors are grateful to Himalayan Institute of Medical Sciences, Dehradun for providing facilities to conduct study.

Conflict of Interest: None

Source of Support: None

Ethical Clearance taken.

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DOI Number: 10.5958/j.2320-608X.2.1.011

Evaluation of Peripheral and Central Neuropathy in Type 2 Diabetes Mellitus Patients by using Somatosensory Evoked Potential

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ABSTRACT

Introduction: In recent days, central nervous system is most commonly affected by complication of diabetes mellitus and it could be determined by Somatosensory evoked potential (SSEP). This is a non invasive tool to diagnose the degree of peripheral and central nervous system involvement. So in view of this the present study is conducted to evaluate peripheral and central neuropathy in patients with type 2 Diabetes mellitus by using SSEP.

Method: Forty patients(40) with type 2 Diabetes mellitus(DM) of 8 to 12 years duration in 40 to 60 years age group including both gender were taken as a study group (Group 1).They were selected from diabetic out patient in Thanjavur medical college hospital, and compared with control group (Group 2) who were normal subjects and was age and sex matched. All groups were subjected to physical examination and laboratory investigations including Fasting blood glucose, renal functions in addition to SSEP. Cervical N13, cortical N20 latencies and central conduction time (N20- N13) was evaluated using median SSEP and compared between the study group and control group and statistically analyzed.

Result: Somatosensory evoked potential of (median) cervical N13, cortical N20 latencies and central conduction time (N20- N13) were prolonged in the study group compared to control group and the difference was statistically significant.

Conclusion: Our study shows that both Peripheral and cortical latencies of SSEP were evaluated and observed. Prolonged latencies suggest the existence of peripheral and central neuropathy in type 2 DM.

Keywords: *Somatosensory Evoked Potential (SSEP), Diabetes Mellitus (DM), Central Conduction Time (CCT).*

INTRODUCTION

Neuropathy is one of the important metabolic complications of Diabetes Mellitus. Electrophysiological investigations are sensitive in determining peripheral and central neuropathy in diabetic patients. Decrease of nerve conduction velocity was found in many patients with normal clinical examination[1] .Evoked potentials are useful as an investigation method in establishing neuropathy developing in the peripheral and central nervous system. Although the peripheral neuropathy in type 2 Diabetes has been investigated a lot, but less literature was found regarding diabetic complication related "central neuropathy". In view of this the present study was planned to evaluate peripheral and central neuropathy in Type 2 diabetic

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patients by using somatosensory evoked potential.

MATERIALS AND METHOD

This study was conducted in the Department Of Physiology, Thanjavur Medical College, Thanjavur. The study period extended between May 2010 to July 2011. The patients were selected from the diabetic outpatient department. 40 Patients, 22 males and 18 females with Type 2 Diabetes of mean age (40-60±5 yrs) were selected. Confirmation of Diabetes was based on fasting plasma glucose values exceeding 126mg/dl. The patient had no other obvious risk factors for neuropathy such as exposure to neurotoxic drugs, alcoholism, and renal failure with normal liver, renal function, no systemic diseases, malignancy & cerebrovascular diseases are included in the study. 40 controls, (age and sex matched subjects), 22 males and 18 females of mean age (40-60±5 yrs) were selected. All controls had a normal physical and neurological examination.

The work was done with 4 channel digital polygraph. Digital intex colour monitor, 17½ model no: IT-173SB.

Settings	SSEP
Sweep	5 msec
Sensitivity	10ìv
Low cut	30 Hz
High cut	3kHz
Pulse	2/sec
Pulse width	0.1 msec
Notch	Off
Decibels	-

Recordings 100 average was recorded using 5mAmp current.

Pre-test instructions

All groups were instructed[2]

1. About the procedure of the test and got informed consent.
2. To avoid applying hair spray or oil after the last hair wash.
3. To fully relax in supine position with head supported (to relax the neck muscles).
4. The room parameters should be maintained constant throughout the experiment.

Procedure

Electrodes were positioned using 10-20 electrode placement system[3]

1. The electrode was placed as.

Channel 1	C_c – Fz
Channel 2	C_c- EPc
Channel 3	C_5Sp – EPc
Channel 4	EPi – EPc

2. The recording was obtained from both groups in the lying posture with neck relaxed, by stimulating the median nerve at the wrist.
3. Number of trials 100, analysis time 40ms, keeping the low filter at 1-3 HZ [4]
4. From the waveform (figure1), the following were measured

N9 latency is measured in EPi- EPc channel from stimulus artifact to its peak.

N13 latency is measured in Ci – EPc or Cc- Fz channel.

N9 –Distal brachial plexus

N13- rostral cervical spinal cord

N20- thalamo cortical radiations

Bronchial plexus to the spinal cord (peripheral conduction time) = N9

Central sensory conduction time= N13 – N20

Cortical latency = N 20

Statistical analysis

The data were expressed as Mean ± SD. The analysis was done using statistical package Minitab version 15. An unpaired t test was done to compare parameters between study and control group. P value less than 0.05 was considered significant.

RESULTS

In study group the mean age group was 50.92 ±7.094 and the control group was 47.425 ± 7.798.

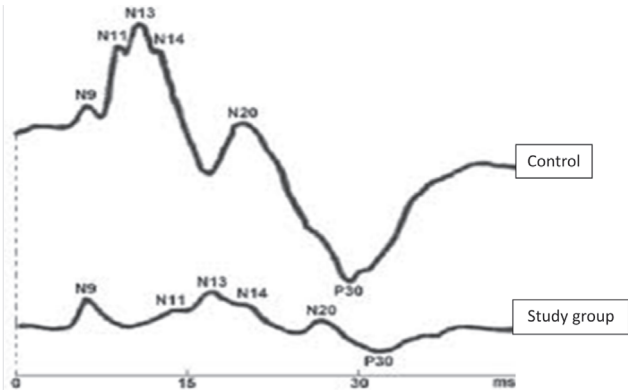

Fig. 1. Shows that comparison of different latency period of study group and control group.

Latency period

SSEP Waveform - Control & Study group

Table 1: Shows that comparison of latency period of both peripheral and central nervous system between study and control group.

Parameters	Mean±SD (Study group)	Mean±SD (control group)	P value
SSEP (median nerve)			
1. N20	20.54±1.13	27.09±3.08*	0.02
2. N13	13.53±1.89	17.70±2.80**	0.012
3. N9 (peripheral conduction time)	9.38±1.02	11.43±1.738**	0.012
4. CCT (N20 □ N13) (central conduction time)	7.08±1.55	9.38±2.16*	0.026

Values are expressed as Mean ± SD. An unpaired t test was done to compare parameters between study and control group. P value less than 0.05 was considered significant. *P d" 0.05 **P d" 0.01 ***P d" 0.001.

DISCUSSION

In median nerve SSEP, latency of N20, N13, N9 & CCT were prolonged in diabetic patients indicating delayed peripheral & central nerve conduction. Our findings are consistent with those by Ziegler, Comi, Fierro and Pozzessere [5]. Kondo et al have reported that positive correlations between the central conduction time from stimulation of the median nerve and the motor conduction velocity in the median nerve [6]. Celiker found that similar percentage of abnormal SEP in patients without clinical manifestations of polyneuropathy, which may suggest that the peripheral and the central nervous systems are affected independently in patients with diabetes [7]. Similar conclusions were drawn by Sartucci, Palma and Suzuki et al.[8,9,10]. M Imam and OH Shehata concluded in their study that central neuropathy in type 2 diabetics is not uncommon even in the absence of peripheral neuropathy and it is related to patient age, duration of disease, glycated haemoglobin value, dyslipidemia and diabetic nephropathy[11].

In patients suffering from diabetes for over 10 years, such changes were found to occur in more than two thirds of the diabetic [12]. Vascular pathologies concerning the cerebral microcirculation seem to have major significance in pathogenesis of DE (diabetic encephalopathy). At the same time, normal vascular reactivity has been known to be an essential compensatory mechanism, protecting the brain against the effects of hypoglycemia, hypoxia and hypercapnia, i.e. common diabetic conditions. In turn, deep hypoglycemia episodes cause "eruption" of excitatory amino acids, thus triggering the cascade of reactions that lead to neuronal death [13].

CONCLUSION

Peripheral neuropathy is the best-known diabetic - related nervous system complication. The articles related to central nervous system (CNS) complication of diabetic was less in number. However, clinical observations and a wide range of neuroimaging, electrophysiological and neuropathological investigations are conducted in recent decades. These investigations are useful to confirm the deleterious effect of diabetes on the morphology and physiology of the CNS. However, early involvement of the CNS, unlike the symptoms of peripheral neuropathy, is usually clinically silent and can be detected through neurophysiological investigations. Measurements of stimulus conduction within the CNS by means of evoked potentials allow sensitive and reliable detection of subclinical changes [14].

Recommendations

However further studies are required to evaluate the correlation between the electrophysiological parameters and the level of glycaemia i.e. the degree of metabolic control and duration of disease so that preventive measures can be suggested to prevent central neuropathy.

ACKNOWLEDGEMENT:

I would like to thank the Dean Dr T.B.Ravisankar, M.D.,D.H.A., Thanjavur medical college, Thanjavur. I sincerely thank Diabetology chief Dr Gurumoorthy

M.D , HOD of Biochemistry, Dr Sasivardhanam M.D., and I express my thanks & gratitude to all participants who cooperated to undergo the study.

Conflict of Interest: No conflict of interest applicable for this study.

Source of Funding: Not applicable

Ethical Clearance: Yes, Enclosed.

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DOI Number: 10.5958/j.2320-608X.2.1.012

Effect of Single Pranayam Technique on Cardio Vascular Parameters and Mental Chronometry among Medical Students

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ABSTRACT

Background: Different types of Pranayam are known to improve autonomic function by changing sympathetic or parasympathetic activity. Reaction time (RT) is an index of cortical arousal involving central neural mechanisms. It is an indirect index of processing ability of the CNS and a simple means of determining sensory motor associations and performance. In this study, we assessed the effect of slow pranayam on Auditory and Visual Reaction time.

Method: 60 volunteers were recruited and informed consent was obtained from them. They were divided into two groups: control (n=30), Savitri (n=30). At the beginning of the study period RT was recorded after 10 min rest. Savitri group were practiced slow yogic breathing for three months, after which RT was recorded again during the same experimental conditions. Paired' test was done to compare the values within group and unpaired' test was done to compare the values between male and female subjects.

Results: In the control group, all the parameters were not significant at the end of study period. In pranayam group, BMI was significantly lower in males and females respectively. VRT was significantly lower in males of pranayam group after the study period. Both ART and VRT were lower in males as compared to females after training of savitri pranayam.

Conclusion: Our study reported that slow pranayam are known to enhance parasympathetic tone, produce a highly significant decrease in oxygen consumption and psychosomatic relaxation. This is of applied value in situations requiring faster reactivity such as sports, machine operation, race driving and specialized surgery.

Keywords: *Savitri Pranayam, Auditory Reaction Time, Visual Reaction Time*

INTRODUCTION

The ancient science of yoga makes use of the voluntary regulation of breathing to make respiration rhythmic and to calm the mind. This practice is called '*Pranayama*'. It is an art of controlling the breath. It involves taking in breath, retaining it then exhaling it.[1] Reaction time (RT) is the time interval between the presentation of a sensory stimulus and the subsequent behavioural response.

Simple reaction time is usually defined as the time required for an observer to detect the presence of a stimulus. It is a physical skill closely related to human performance. Simple auditory reaction time has the fastest reaction time for any given stimulus. Thompson *et al* have documented that the mean reaction time to

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detect visual stimuli is approximately 180 to 200 milliseconds, whereas for sound it is around 140-160 milliseconds. [2]

Gallego et al (1991) found that during controlled breathing, reaction times were longer than during spontaneous breathing.[3] Beh et al (1974) studied the relationship between phase of normal respiration and reaction time. They found that mean RT for signals presented during the inhalation phase of respiration was significantly less than for signals presented during either the exhalation phase or the pause between exhalation and inhalation .[4] However, there is paucity of literature on single pranayam breathing on the gender differences in reaction time.

Therefore, in the present study is planned to assess

1. The effect of slow pranayam (Savitri) technique on BMI, Heart rate, Blood pressure, Auditory and Visual reaction time of an individual.
2. To find out if there is any gender difference?

MATERIALS AND METHOD

The present study was conducted on 60 young right handed healthy volunteers after obtaining ethical clearance from the institutional Human Ethics Committee. Their age ranged between 17- 20 years (17.65 ± 0.15), body weight between 46 - 65 kg (53.72 ± 2.28) and height between 146 – 173 cm (168.5 ± 1.12). All volunteers underwent ENT and other clinical examination at the beginning of the study to rule out any hearing, visual, and major illness. The subjects were randomly divided into control group and savitri pranayam group. Each group consisted of 30 volunteers and was further divided into two sub – groups based on gender. The participants were explained in detail about the study protocol and informed consent was obtained from them.

Equipment used:

Blood pressure and heart rate were recorded with the subject seated comfortably, using the noninvasive automated BP monitor (NIBP). Reaction time (RT) apparatus (Anand Agencies, Pune) was used for the study. The instrument has a built-in 4 digit chronoscope with a display accuracy of 1 ms. It features four stimuli, two response keys and a ready signal. Switch for selecting right or left response key for any stimulus is provided. Recordings were taken in an air-conditioned laboratory 2 h after a light breakfast. To avoid the effect of lateralized stimulus, visual and auditory signals were given from the front of the subject who was instructed to use his right hand first and then left hand while responding to the signal.

In the present study, auditory reaction time (ART) was recorded for auditory beep tone stimulus and visual reaction time (VRT) for red light stimulus. The subjects were instructed to release the response key as soon as they perceived the stimulus. The signals were given from the front of the subjects to avoid the effect of lateralized stimulus and they used their dominant hand while responding to the signal. [5,6] All subjects were given adequate exposure to the equipment on two different occasions to familiarize them with the procedure of RT measurement. This was done because RT is more consistent when subjects have had adequate practice. RT was obtained with an accuracy of 1 ms. More than ten trials were recorded and mean of three similar observations was taken as a single value for statistical analysis.

Specification of reaction timer

1. In built chronoscope – 4 digit chronoscope with least count of 1/1000 seconds.
2. It works on -230 volts AC.

Parameters recorded

The following parameters were recorded in all volunteers at the beginning and end of three months study period.

1. Anthropometry: BMI
2. Heart rate (HR)
3. Systolic blood pressure (SBP)
4. Diastolic blood pressure (DBP)
5. Auditory reaction time (ART)
6. Visual reaction time (VRT)

PROCEDURE

Subjects were asked to report to the recording laboratory between 4-6 pm. Basal parameters like HR

& BP were recorded by using NIBP after 15 min rest in sitting posture. VRT was measured by asking the subject to release the right index finger as quickly from the pressed button when a red light appears and withhold a response when a green light appears. Red light is selected for the study as it persists for a long time in retina. ART also measured in similar way to respond to high frequency sound and withhold a response for the click. The values were displayed in milliseconds. Ten values were recorded for each RT. Two lowest and two highest values were excluded and the six values were used to calculate the average for the respective reaction task, The participants basal values (pre-yoga) were recorded.

The pranayam group was taught savitri pranayam by trained yoga teacher and practices same under our direct supervision for 30 min per day, thrice per week for total duration of 12 weeks. They were performed pranayam for 5 minutes followed by 5 min rest. Three such cycles were practiced by subjects. Control group were not taught and did not practice Savitri pranayam.

Procedure for Savitri pranayam

Savitri pranayam is done with subject in sitting posture (with erect spine) in a well ventilated room. They were asked to breathe slowly, uniformly and deeply with a ratio of 2:1:2:1 between inspiration (purak) held in (kumbhak), expiration (rechak) and held out (shunyak) phases. Our volunteers performed the pranayam with a respiratory rate of three per minute. [7] The above mentioned parameters were recorded in all volunteers of both control and savitri pranayam groups at the end of three months study period.

DATA ANALYSIS

Data was analyzed using SPSS statistical program (version 13 for Windows. SPSS Inc Chicago IL, USA). An unpaired t test was done to compare parameters between male and female subjects and a paired t test to compare values at the beginning and end of the study period. P value less than 0.05 was considered significant.

Table I: Shows the basal parameters were measured in both groups at the beginning and at the end of study period.

Parameter	Group	Gender	Pre	Post	P value (95% CI)
1. BMI	Control (30)	M (15)	23.11 ± 0.508	23.18 ± 0.514	0.607 (-0.3675942 to 0.2226591)
		F (15)	21.74 ± 0.623	21.91± 0.667	0.330 (-0.5138648 to 0.1848277)
	Savitri (30)	M (15)	22.64 ± 0.356	22.17± 0.377***	0.001 (0.2482475 to 0.7078808
		F (15)	23.12 ± 0.516	22.82 ± 0.495**	0.019 (0.0569801 to 0.5492121
2. HR (beat/m)	Control (30)	M (15)	74.78 ± 2.28	71.14 ± 1.26	0.188 (-2.0013890 to 9.2845300)
		F (15)	80.01 ± 2.81	79.62 ± 2.70	0.912 (-7.1520363 to 7.9463159)
	Savitri (30)	M (15)	72.95± 2.95	68.97 ± 1.44	0.179 (-2.0585348 to 10.0246136)
		F (15)	79.90 ± 2.17	77.60 ± 1.82	0.370 (-3.013495 to 7.5986387)
3. SBP (mmof Hg)	Control (30)	M (15)	121.80 ± 2.13	121.60 ± 1.94	0.946 (-6.0485183 to 6.4485183)
		F (15)	122.33 ± 1.49	123.46 ± 1.25	0.453 (-4.2790205 to 2.0123538)
	Savitri (30)	M (15)	116.26 ± 2.62	111.80 ± 1.79	0.243 (-3.4008930 to 12.3342263)
		F (15)	114.80 ± 2.62	111.26 ± 2.93	0.426 (-5.6997338 to 12.7664005)
4. DBP (mmof Hg)	Control (30)	M (15)	74.26 ± 1.71	74.20 ± 1.39	0.974 (-4.2303899 to 4.3637232)
		F (15)	69.26 ± 1.64	69.66 ± 1.48	0.830 (-4.3314589 to 3.5314589)
	Savitri (30)	M (15)	63.86 ± 2.74	62.66 ± 1.53	0.689 (-5.1043596 to 7.5043596)
		F (15)	67.66 ± 2.83	63.40 ± 2.10	0.280 (-3.8842394 to 12.4175728)

An unpaired t test was done to compare parameters between male and female subject's values at the beginning and end of the study period. P value less than 0.05 was considered significant. Values are expressed as Mean ± SEM. *P< 0.05 ** P< 0.01 *** P< 0.001 Comparison between male and female volunteers at the end of the study.

Table II: Shows that ART & VRT were measured in both groups at the beginning and at the end of study period.

Parameters	Groups	Pre	Post	P value (95% CI)
1. ART (ms)	Control (N=30)	140.30 ± 2.192	137.27 ± 1.812	0.223 (-1.945 to 8.012
	Savitri (N=30)	136.40 ± 3.819	125.37 ± 3.521*	0.017 (2.312 to 19.935)
2. VRT (ms)	Control (N=30)	130.47 ± 2.362	128.20 ± 1.895	0.468 (-4.040 to 8.573)
	Savitri (N=30)	144.67 ± 5.583	126.77 ± 3.208**	0.006 (5.490 to 30.310)

Un paired t test was done to compare parameters at the beginning and end of the study period.

P value less than 0.05 was considered significant. Values are expressed as Mean ± SEM.

*P< 0.05 ** P< 0.01 *** P< 0.001 Comparison between parameters at the beginning and end of the study period.

Table III: Shows that gender difference in ART & VRT in both groups at the beginning and at the end of study period.

Parameter	Group	Gender	Pre	Post	P value (95% CI)
1. ART (ms)	Control (30)	M (15)	140.73 ± 3.540	137.13 ± 2.813	0.254 (-2.885 to 0.08)
		F (15)	139.87 ± 2.711	137.40 ± 2.384	0.539 (-5.939 to 10.873)
	Savitri (30)	M (15)	132.73 ± 5.870	121.40 ± 4.371	0.124(-3.501 to 26.167)
		F (15)	140.07 ± 4.904	129.33 ± 5.170	0.073 (-1.137 to 22.604
2. VRT(ms)	Control (30)	M (15)	132.33 ± 4.013	129.80 ± 3.008	0.602 (-7.645 to 12.712)
		F (15)	128.60 ± 2.552	126.60 ± 2.336	0.634 (-6.806 to 10.806)
	Savitri (30)	M (15)	145.27 ± 8.638	122.67 ± 3.460*	0.021 (4.008 to 41.192
		F (15)	144 .07± 7.379	130.87 ± 5.316	0.148 (-5.280 to 31.680)

An unpaired t test was done to compare parameters between male and female subjects and a paired t test to compare values at the beginning and end of the study period. P value less than 0.05 was considered significant. Values are expressed as Mean ± SEM. *P< 0.05 ** P< 0.01 *** P< 0.001 Comparison between male and female volunteers at the end of the study.

RESULTS

Table I: Shows those basal parameters were measured in both groups at the beginning and at the end of study period. In the control group, all the parameters were not significant at the end of study period. In savitri pranayam group, BMI were significantly lower (22.64 ± 0.356 to 22.17± 0.377) and (23.12 ± 0.516 to 22.82 ± 0.495) in males and females respectively.

Table II: shows ART in male and female volunteers of both groups were reduced but not statistically significant. VRT was significantly lower (145.27 ± 8.638 to 122.67 ± 3.460) in males of savitri group at the end of study period. Both ART and VRT were lower in males as compared to females after training of Savitri pranayam.

Table III: Shows the value of VRT and ART difference in males (Post-Pre) and females (Post-Pre) and basal pre value comparison between genders at the beginning of the study period.

Difference in male was more evident in VRT than ART in savitri group. But this difference was not statistically significant. Basal pre value differences in ART & VRT were not significant in both genders at the beginning of the study period.

DISCUSSION

In our study, there was a significant decrease in basal heart rate in slow breathing group after three months of practice of slow breathing exercise. This indicates that the practice of slow breathing exercise improves vagal activity. Slow breathing Pranayamic exercises show a strong tendency of improving or balancing the autonomic nervous system through enhanced activation of parasympathetic nervous system. In contrast to slow Pranayamic breathing, right nostrils breathing has been shown to increase baseline oxygen consumption indicative of sympathetic discharge of the adrenal medulla .[8]

Reaction time is dependent on several factors like arrival of the stimulus at the sensory organ, conversion of the stimulus by the sensory organ to a neural signal, neural transmissions and processing, muscular activation, soft tissue compliance, and the selection of an external measurement parameter.[9] It is also widely accepted that mean auditory reaction time is about >

120 -140 ms are faster than visual reaction time is about > 150 -180ms.

Kemp *et al* shows that an auditory stimulus takes only 8-10 milliseconds to reach the brain, but on the other hand, a visual stimulus takes 20-40 milliseconds. This implies that the faster the stimulus reaches the motor cortex; faster will be the reaction time to the stimulus. Therefore since the auditory stimulus reaches the cortex faster than the visual stimulus, the auditory reaction time is faster than the visual reaction time. A decrease in reaction time indicates an improved sensory motor performance and could be due to an enhanced processing ability of the central nervous system.

Pranayamic practitioners are known to have better attention and less distractibility. Thus determination of RT has important implications in sports physiology. [10] To assess the timing and speed of mental processes, reaction time on a given trail correlated with latency of the p300 wave which reflected the sequence of cognitive processes involved in perceptual processing. [11] At best, this form of yogic exercise may be useful to healthy individuals to improve their performance.

ACKNOWLEDGMENT

I express my heartfelt thanks to Dr. E.S.Prakash, Associate Professor of Physiology, Division of Basic Medical Sciences, Mercer University School of Medicine, USA, for helping to modify the manuscript.

Conflict of Interest: No Conflict of interest applicable for this study.

Source of Funding: Not applicable

Ethical Clearance: Yes. Enclosed (Human ethical committee certificate).

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DOI Number: 10.5958/j.2320-608X.2.1.013

Immediate effect of Chandra and Suryanadi Pranayamas on Cardiovascular Parameters and Reaction Time in a Geriatric Population

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ABSTRACT

Previous studies have reported differential physiological and psychological effects of exclusive right and left nostril breathing. Though potential health benefits have been postulated, further clinical research is required to prove immediate and sustained efficacy of these techniques. This study evaluated immediate effects of exclusive right (SNP) and left (CNP) nostril breathing on cardiovascular (CV) parameters and reaction time (RT) in a geriatric population. 26 subjects attending regular yoga sessions at a senior citizen hospice, were recruited for this self-controlled study. They were instructed to sit in any comfortable posture and relax for 5 min before taking the pre-intervention recordings of Heart rate (HR), blood pressure (BP), auditory and visual RT (ART and VRT respectively). They then performed the selected technique and parameters were recorded immediately after performance of 9 rounds of either SNP or CNP. The entire sequence of recordings was randomised to avoid any bias. Intra and inter group statistical analysis was carried out using Student's paired t test for data that passed normality testing and Wilcoxon matched-pairs signed-ranks test applied for the others. Overall intra-group comparison of pre-post data and inter-group Δ % comparisons showed statistically significant ($p < 0.05$) differences for all parameters. There was an overall reduction in HR and BP-based parameters following both SNP and CNP. However, inter-group Δ % comparisons revealed a significantly greater reduction after CNP for all parameters. Inter-group comparisons revealed highly significant decreases ($p < 0.001$) in VRT and ART after SNP. In conclusion, our study sheds new light on the physiological changes occurring after SNP and CNP in a geriatric population. While both techniques reduce HR and BP, CNP does it more significantly. There is shortening of RT following SNP and this may be attributed to enhance sensory motor function that is of great significance in the elderly. We suggest that Yoga should be part of the heath care facilities for the elderly as it can enhance their quality of life and improve their overall health status.

Keywords: *Cardiovascular, Geriatrics, Pranayama, Reaction Time, Yoga*

INTRODUCTION

Ageing is a progressive, generalised impairment of function, resulting in a loss of adaptive response to stress and in a growing risk of age-related disease. (1) It is a natural process characterised by declining physical performance, slower speed of reaction, inadequate working of various systems with poor motor and sensory conduction. The process of aging is characterised by progressive and generalised impairment of homeostasis resulting in declining ability to respond to external or internal stresses and increased risk of diseases. (2)

Yoga is a conventional long-established and time-tested art and therapeutic science that has positive contribution to make in maintenance of general wellbeing and happiness. According to the Hathapradipika, one of the traditional Yoga texts, it is a safe and reliable practice that can be done at any age *(Yuva vrddho'thivrddho va vyadhito durbalo'pi va abhyasat siddimapnoti sarvayogeshvatandritah.* Whether young,

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old or very old, sick or debilitated, one who is vigilant attains success in all yoga, by means of practice, provided they abide to the rules and regulations properly- Hathapradipika I:64). [3] Yoga has preventive, curative as well as rehabilitative potential and this may be explained on the basis of its ability to modulate autonomic functions, relieve stress, improve physiological functions including cardio-respiratory fitness and improve quality of life. [4,5,6]

Swarodaya vigyan, the science of understanding the ultradian nasal cycle has been traditionally codified in Shiva Swarodaya wherein differential effects of different phases of the nasal cycle are given in great detail [7] It is traditionally taught that breathing exclusively through the left nostril or chandra nadi pranayama (CNP) potentiates ida nadi, the "lunar channel" while breathing exclusively through the right in surya nadi pranayama (SNP), activates the pingala nadi, the "solar channel".

There is some evidence that the practice of Pranayama (the fourth limb of Ashtanga Yoga) can significantly lower dangerous free radicals while increasing the body's intrinsic potential to produce protective antioxidants. [8] This may be one of the intrinsic mechanisms by which it helps improve psycho-physiological wellbeing in patients suffering from chronic degenerative diseases that are more common in the elderly.

Previous studies have reported differential physiological and psychological effects of exclusive right and left nostril breathing. [9,10,11] Though potential health benefits have been postulated, further clinical research is required to prove immediate and sustained efficacy of these techniques especially in a geriatric population.

With the above in mind, this study planned to evaluate immediate effects of SNP and CNP on cardiovascular (CV) parameters and reaction time (RT) in a geriatric population. We selected heart rate (HR) and blood pressure (BP) as these indicate changes in cardiac autonomic regulation while RT is an index of processing ability of central nervous system and a simple, non invasive means of determining sensorimotor co-ordination and performance. [12, 13]

MATERIALS AND METHOD

Twenty six subjects (21 females, 5 males) attending regular yoga sessions at a senior citizen hospice, twice weekly for more than 3 months were recruited for this self-controlled study by convenience sampling. Their mean age and body mass index (BMI) were 61.38 ± 3.61 (SD) years and 25.26 ± 6.33 units respectively. All of them were right handed. Three of them reported normal health status, whereas others reported that they were on regular treatment for one or more medical conditions like hypertension (14), hypothyroidism (3), type 2 diabetes mellitus (15), knee pain (4), low back pain (3), arthritis (1), asthma (2), dyslipidemia (4) and insomnia (2). None were receiving autonomic modifying agents like α- or β-blocking drugs.

The study was conducted on four different days between 4pm and 5.30 pm. To avoid any confounding effects of recording on different days, subjects were randomly assigned to do one of the techniques on two days of their recording. One half of the subjects performed CNP, while the others performed SNP and this was reversed on the next day. The subjects were instructed to sit in any comfortable posture and relax for 5 min before taking the pre-intervention recordings of HR, systolic pressure (SP), diastolic pressure (DP), auditory and visual RT (ART and VRT respectively). They then performed the selected technique and the parameters were recorded immediately after the performance of 9 rounds of either the SNP or CNP. The entire sequence of recordings was randomised to avoid any bias.

SNP was performed using nasika mudra wherein the ring finger of the right hand was used to occlude the left nostril by pressing on the outside of the nostril. CNP was performed using nasika mudra wherein the thumb was used to occlude right nostril by pressing on the outside of the nostril. The left hand was held in Jnana Mudra on both the occasions. Participants were instructed to focus their mind on their breath and ensure it was slow, deep, and regular while attempting to utilize all sections of their lungs. Respiratory rate for all techniques was maintained at 5-6 breaths per min (BPM) and this was regulated by providing an audible count of six for both inspiration and expiration. As they were all attending regular Yoga sessions, none reported any difficulty in doing the techniques.

HR, SP and DP were recorded using non-invasive semi-automatic BP apparatus (CH – 432, Citizen Systems, Tokyo, Japan) having range from 40 to 180 beats/min and accuracy ± 5%. Mean pressure (MP), pulse pressure (PP), rate-pressure product (RPP) and double product (Do P) were calculated by respective formulae.

RT apparatus (Anand Agencies, Pune) with a built in 4 digit chronoscope and display accuracy of 1 ms was used for the study. Simple ART was recorded for auditory beep sound stimulus and simple VRT for red

light stimulus. The subjects were instructed to release response key as soon as they perceived stimulus. Signals were given from the front to avoid effect of lateralized stimulus and they used dominant hand while responding to signals.[10,11] All subjects were given adequate exposure to the equipment on two different occasions to familiarize them with the procedure as RT is more consistent when subjects have had adequate practice. [14] More than ten trials were recorded and the mean of three similar observations was taken as a single value for purpose of statistical analysis. [15, 16]

Data were assessed for normality using GraphPad InStat version 3.06 for Windows 95, (GraphPad Software, San Diego California USA). Intra and inter group statistical analysis was carried out using Student's paired t test for data that passed normality testing by Kolmogorov-Smirnov Test. Wilcoxon matched-pairs signed-ranks test was applied for other data. P values less than 0.05 were accepted as indicating significant differences for pre-post and intergroup comparisons.

RESULTS

The results are given in Table 1. Overall intra-group comparison of pre-post data and inter-group Δ % comparisons showed statistically significant ($p < 0.05$) differences for all parameters. There was an overall reduction in HR and BP-based parameters following both SNP and CNP. However, inter-group Δ % comparisons revealed a significantly greater reduction after CNP for all parameters except DP and HR (that just missed statistical significance). Inter-group comparisons revealed highly significant decreases ($p < 0.001$) in VRT and ART after SNP.

Table 1: Immediate effect of chandra nadi pranayama (CNP) and surya nadi pranayama (SNP) on heart rate (HR), systolic pressure (SP), diastolic pressure (DP), mean arterial pressure (MAP), pulse pressure (PP), rate pressure product (RPP), double product (DoP), auditory reaction time (ART) and visual reaction time (VRT) in a geriatric population before (B) and immediately after (A) nine rounds of the technique.

Parameters	CNP			SNP			Comparison		
	(n = 26)			(n = 26)			(p value)		
	B	A	Δ %	B	A	Δ%	B	A	Δ%
HR	79.19	74.46	-4.64	79.81	77.65	-1.69	0.408	0.047	0.0889
(beats/min)	± 12.52	± 7.54**	± 11.13	± 12.75	± 8.59	± 9.26			
SP	142.42	132.85	-6.31	142.12	138.65	-2.17	0.7593	0.0097	0.0032
(mmHg)	± 18.61	± 13.7***	± 6.05	± 18.51	± 15.28*	± 4.27			
DP	83.46	79.73	-3.77	83.85	80.35	-3.56	0.4836	0.5779	0.7222
(mmHg)	± 11.09	± 7.25**	± 7.58	± 11.19	± 8.24**	± 7.21			
MP	103.12	97.44	-5.05	103.27	99.78	-3.05	0.7531	0.0313	0.0182
(mmHg)	± 11.81	± 7.77***	± 5.78	± 11.89	± 9.21**	± 4.63			
PP	58.96	53.12	-7.91	58.27	58.31	2.03	0.5113	0.0248	0.0254
(mmHg)	± 16.13	± 12.94**	± 17.71	± 15.91	± 13.13	± 14.66			
RPP	112.99	99	-10.44	113.79	107.83	-3.76	0.6476	0.0057	0.0101
(units)	± 23.86	± 5.34**	± 13.78	± 25.12	± 17.64*	± 10.62			
DoP	81.81	72.58	-9.24	82.66	77.48	-4.63	0.2999	0.007	0.029
(Units)	±16.28	± 9.70**	±13.90	± 17.17	± 11.01**	± 10.63			
ART	297.83	292.03	-1.12	293.28	279.73	-4.59	0.0215	0.0003	0.0038
(ms)	± 56.21	± 37.48	±5.67	± 52.9	± 50.18***	± 2.81			
VRT	315.05	316.89	0.82	307.65	296.21	-3.68	0.0132	<0.0001	<0.0001
(ms)	± 68.7	± 64.82	±2.7	± 54.06	± 51.38***	± 2.12			

Values are given as mean ± SD for 26 subjects. * $p < 0.05$, ** $p < 0.01$ and *** $p < 0.001$ by paired t test for intra group comparisons of HR, SP (SNP), DP, MP, PP, RPP and DoP and Wilcoxon matched-pairs signed-ranks test for SP (CNP), ART and VRT. Actual p values are given for paired t test (HR, DP, MP, PP, RPP and DoP) and Wilcoxon matched-pairs signed-ranks test (SP, ART and VRT.) are given for the intergroup comparisons. Δ % comparisons were done by paired t test for PP and RPP and by Wilcoxon matched-pairs signed-ranks test for the rest.

DISCUSSION

In the present study we have found a reduction in all CV parameters following 9 rounds of both CNP and SNP, but these changes were more significant following CNP. This may be due to the fact that slow and deep breathing at the rate of 5-6 BPM has been reported to enhance cardiac autonomic regulation. [17] A normalization of autonomic CV rhythms as a result of increased vagal modulation and/ or decreased sympathetic activity and improved baroreflex sensitivity have been suggested in an earlier report on CNP in hypertensive patients [18] It has been however reported that yogic breathing through right, left, or through both nostrils in normal subjects produces distinct autonomic changes and that SNP increased SP and DP, whereas CNP resulted in significant reduction in SP and MP. [11] Jain et al suggested that sympathetic activation produced by right nostril breathing may be masked by vagally mediated lung baroreceptor activity enhanced by voluntary breathing efforts. [19] Hence changes following CNP may be attributed to a parasympatho-mimetic effect as the nasal cycle is dependent upon tonic activity of limbic autonomic nervous system with hypothalamus as control centre, as well as levels of circulating catecholamines and other neuro-hormones. [20, 21]

Interestingly in our geriatric population, even right nostril breathing decreased CV parameters. This seems to be a contradiction to concepts of swara yoga but a recent report has found that SNP is safe in hypertensives and attributed this to in-built safety mechanisms of yoga that enhances homeostatic normalcy. [22] The goal of Yoga is to restore homeostasis, hence, if sympathetic reactivity of a subject is already higher than normal, it is suggested that yogic techniques will not further increase such a hyper reactivity but rather bring it back to normal. Hence, we suggest that SNP may be practiced safely by the geriatric population though CNP has greater benefits. Changes in the RPP and DoP signify a reduced work load on the heart with reduced O_2 consumption, and this is indeed a positive finding in the geriatric population.

The RT changes following CNP and SNP were however very divergent with significant reduction being seen in SNP and no such changes in CNP. The activation following SNP may be attributed to an improved central neuronal processing ability due to greater arousal and faster rate of information processing. [15] This is usually attributed to an alert state produced by sympathetic activation, but in the present study, as CV parameters haven't shown such a change, it must be due to other mechanisms. Earlier studies by the authors have reported shortened RT following mukha bhastrika in both normal and mentally challenged children and also after surya namaskar. [16, 23] It has been previously suggested that right nostril dominance in the nasal cycle as well as right uninostril forced breathing, may be correlated with the "activity phase" of the basic rest-activity cycle, the time during which sympathetic activity in general exceeds parasympathetic activity throughout the body.[24] Werntz et al have also reported relatively greater integrated electro encephalogram (EEG) value in one hemisphere correlating with predominant airflow in contralateral nostril, defining the inter-relationship between cerebral dominance and peripheral autonomic nervous function.[25] In this study, the wider variation in RT values may be attributed to reduced sensory awareness and attention span in the elderly. This may also be why there were significant differences in pre-test values too.

In conclusion, our study sheds new light on physiological changes occurring after SNP and CNP in a geriatric population. While both techniques reduce HR and BP, CNP does it more significantly. There is shortening of RT following SNP and this may be attributed to enhanced sensory motor function of great significance in the elderly. We suggest that Yoga should be part of heath care facilities for elderly as it can enhance quality of life and improve overall health status.

Conflict of Interest: None

Source of Funding: Mahatma Gandhi Medical College and Research Institute (MGMCRI), Sri Balaji Vidyapeeth Deemed University, Pondicherry.

Ethical clearance: IHEC of MGMCRI approved the research study at the meeting held on 13th December 2011. (FAC/2011/05)

ACKNOWLEDGMENTS

The authors thank Mrs D Pushpa, Miss G Sarulatha, Miss Imma Sivaraj and Miss Visalakshi for their valuable assistance during recording sessions and data entry. We thank the inmates and authorities of the Hospice of Saint Cluny for their wholehearted cooperation during the training and recording sessions.

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DOI Number: 10.5958/j.2320-608X.2.1.014

Change in Erythrocyte Sedimentation Rate (ESR) in Pregnancy and Puerperium in the Same Woman

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ABSTRACT

Aims and Objective: Normal pregnancy involves many changes including alterations in hematologic parameters. Hematologic changes also involve change in Erythrocyte Sedimentation Rate (ESR) during pregnancy. Therefore in the present study, the change in erythrocyte sedimentation rate is studied in pregnancy and puerperium in the same woman.

Method: 30 pregnant women in the age group of 20 to 30 who are registered in KIMS, Hubli were enrolled for the study. Erythrocyte sedimentation rate (ESR) is measured in pregnancy and puerperium in the same women.

Results: Values were analyzed statistically using paired "t" test. Erythrocyte sedimentation rate is increased in pregnancy compared to puerperium ($p < 0.0001$) which is statistically highly significant.

Conclusion: The increased erythrocyte sedimentation rate in pregnancy is due to increased plasma fibrinogen level and hemodilution during pregnancy.

Keywords: *Erythrocyte Sedimentation Rate, Pregnancy And Puerperium*

INTRODUCTION

Pregnancy is a process whereby the life of a baby begins in the mother's womb and progresses up to the stage when it is safe to expose the baby to the outside world. During pregnancy there is progressive anatomical, physiological and biochemical changes not only confined to the genital organs but also to all systems of the body.[1]

Normal pregnancy involves many changes in maternal physiology including alterations in hematologic parameters. These changes include expansion in maternal blood and plasma volumes and a decrease in hematocrit, as well as an increase in the levels of some plasma proteins that alters the balance of coagulation and fibrinolysis[2]

Puerperium is the period following childbirth during which the body tissues, specially the pelvic organs revert back approximately to the pre- pregnant state both anatomically and physiologically.[3]

The puerperium is a time of equal physiological interest because many of the changes effected over the nine months of pregnancy are reversed in a matter of hours or days. These changes may be complex, as appears to be the case with regard to the haematological indices commonly determined in obstetric practice[4].

Pregnancy and puerperium also involves changes in erythrocyte sedimentation rate (ESR). Therefore the present study is undertaken to assess the changes in erythrocyte sedimentation rate in pregnancy and puerperium in the same women.

AIMS AND OBJECTIVES

- To estimate erythrocyte sedimentation rate (ESR) in pregnancy and puerperium in the same woman.
- To compare the variations observed in erythrocyte sedimentation rate (ESR) in pregnancy and puerperium in the same woman.

MATERIALS AND METHOD

This study was conducted on 30 normal healthy pregnant women with age group of 20 to 30 years.

Ethical committee KIMS, HUBLI, has approved this study to conduct in the department of physiology, KIMS, Hubli.

Source of Data

SUBJECT: Study group consists of 30 pregnant females aged between 20-30years and later followed during puerperium in and around HUBLI

Inclusion Criteria

1. Healthy women in reproductive age groups.
2. They should not have anemia, blood disorders.

Exclusion Criteria

H/o gynaecological disorders

H/o bleeding disorders

H/o diabetes mellitus, gestational diabetes

H/o hypertension, PIH (pregnancy induced hypertension)

OBSERVATIONS AND RESULTS

Erythrocyte sedimentation rate of 30 normal healthy pregnant women (aged between 20-30 years) were studied in pregnancy and puerperium, results were analyzed by applying paired "t" test.

Table: I ESR (mm/at the end of 1st hr) in pregnancy and puerperium

Pregnancy	Puerperium	t-value	P value	Significance
24.50±4.25	8.75±1.77	36.36	<0.0001	Highly Significant

Values are expressed as Mean±SD;Data was analysed using Paired "t" test.*(P<0.0001) statistically highly significant.SD-Standard deviation.

DISCUSSION

In our study we found Erythrocyte sedimentation rate values as follows, Pregnancy 24.50±.25 and puerperium 8.75±1.77.

We found increased ESR in pregnancy compared to puerperium and it is statistically significant.

The erythrocyte sedimentation rate rises early in pregnancy due to increase in fibrinogen and other physiological changes: 100mm in an hour is not uncommon in normal pregnancy.

During normal pregnancy, fibrinogen concentration increases approximately 50 percent. It averages 450mg/dL late in pregnancy, with a range from 300 to 600mg/dL. The percentage of high-molecular weight fibrinogen is unchanged [5]

Hytten et al in 1971 studies show that another marker of inflammation, the erythrocyte sedimentation rate (ESR), is increase in normal pregnancy because of elevated plasma globulins and fibrinogen[6]

Johnson et al in 1997 studied that the majority of the procoagulant factors from the coagulation cascade are markedly increased, including factors I, VII, VIII, IX and X. Factors II, V and XII are unchanged or mildly increased and levels of factors XI and XIII decline[7].

Ozanne et al in 1983 studied that plasma fibrinogen (factor I) levels begin to increase in the first trimester and peak in the third trimester at levels 50 percent higher than before pregnancy. The rise in fibrinogen is associated with an increase in the erythrocyte sedimentation rate[8].

CONCLUSION

Erythrocyte sedimentation rate (ESR) is increased in pregnancy because of elevated plasma globulins and fibrinogen. Hemodilution during pregnancy may be another cause of increased erythrocyte sedimentation rate.

ACKNOWLEDGEMENTS

Authors are grateful to Karnataka institute of medical sciences, Hubli, for providing facilities to conduct the work. The authors are grateful to Dr.K.F.Kammar Professor& Head of Department of physiology for his constant support and valuable guidance.

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

Source of Fund: The project was funded by an institutional research grant from Karnataka institute of medical sciences, Hubli, Karnataka, India.

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DOI Number: 10.5958/j.2320-608X.2.1.015

A Study to Determine the Immediate effect of Forced Nostril Breathing in Memory Performance

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ABSTRACT

Study was done to determine the immediate effect of forced nostril breathing in memory performance. Fifty normal subjects of both genders, age 25±5 years were enrolled. The subjects were trained for forced nostril breathing; i.e. right nostril breathing, left nostril breathing, alternate nostril breathing and breath awareness for duration of 30 minutes daily for two week. The subjects were examined before and after two week yoga training for immediate effect of nostril breathing in memory performance using WECHSLER memory scale. This was self-control study to determine the immediate effect of forced nostril breathing in memory performance. Measure ANOVA analysis revealed a significant increase in Digit Span Forward , Digit Span Backward and associate learning recall performance due to forced nostril breathing at P<0.001 level.

Keywords: *Digit Span Forward, Digit Span Backward, Associate Learning, Wechsler Memory Scale*

INTRODUCTION

Breathing is the most important function in the body but it is the most neglected one. Learning to control the breath allows to control body functions.

Nasal cycle is characterized by alternating patency of the nostrils every two to eight hours [1]. A rhythmic and alternating shift of activity in the autonomic nervous system and cerebral activity has been reported [2]. Brain areas involved in the neuroanatomy of memory such as the hippocampus, the amygdala, the striatum, or the mammillary bodies are thought to be involved in specific types of memory[3]. The hippocampus is involved in spatial learning and declarative learning, while the amygdala is involved in emotional memory [3]. A study showed that the average increase in spatial memory scores for the yoga groups was 84%. It appears yoga breathing increases spatial rather than verbal scores, without a lateralized effect [4].

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MATERIALS & METHOD

The present study comprises 50 healthy, physically active, young normal subjects having 30 male and 20 female. The study was started as two weeks Yoga training i.e. forced nostril breathing (right nostril breathing (surya anuloma viloma) left nostril breathing (Chandra anuloma viloma), alternate nostril breathing (anuloma viloma) and breath awareness) for duration of 30 minutes daily, for two week. The subjects were tested before and after two weeks of forced nostril breathing training. Memory level was assessed by using Wechsler Memory Scale (DSF, DSB, AL) after four types of Yogic breathing training. The present study was conducted in the Yoga center, Ghaziabad in collaboration with department of Psychiatry in Santosh medical college and Hospital, Ghaziabad. The project was approved by the Institutional Ethics Committee. A code was provided to the subjects at the time of pretest to keep their personal identity closed. Their achievement scores were exclusively used for the research purpose and were not disclosed.

Inclusion Criteria

1. Young healthy subject of either sex having good general physical condition.

2. Subjects of age group 20-30 years.
3. Subjects of average height and built matched with respect to body mass index.

Exclusion Criteria

Subjects with the history of any of the following were excluded the study

4. Hypertension, Tuberculosis and major psychiatric illness.
5. Smoking and alcohol intake.
6. Long term drug therapy for any disease.
7. Psychological stress related conditions like

a. Recent death of family member

b. Illness of family member.

c. Any family discordance.

8. Subject with moderate to very severe either depression, anxiety or stress, calculated through DASS-42 questionnaire.

Forced nostril breathing

There were four aspects of forced nostril breathing.

1. Right forced nostril breathing (surya anuloma viloma) which involved alternate cycle of inhalation and exhalation exclusively through the right nostril while the left nostril was gently occluded.
2. Left forced nostril breathing (Chandra anuloma viloma) involved similar breath cycle through the left nostril breathing while the right nostril was gently occluded.
3. Alternate forced nostril breathing (anuloma viloma) involved inhalation through one nostril while other is occluded and vice-a versa for next breath cycle and
4. Breath awareness, for which the subjects were instructed to keep a watch on the breath pattern while remained in normal state of breathing.

Testing of memory task performance

The memory of the subjects were examined for the effects of forced nostril breathing by using Wechsler memory scale which was standardized for Indian population. Wechsler Adult Intelligence Scale—Fourth Edition (WAIS–IV) [5] were various components. Present study included three types of tests:

1. Digit span forward,
2. Digit span backward,
3. Paired associate learning (easy and hard), with 10 items each.

The digit span forward included six pairs for the numerical items of easy task and four pairs for the numerical items of hard task. Each correct answer was scored as '1'. The sequence of recall of numerical items in digit span backward was in the reverse order unlike in digit span forward. The last test included paired associate learning verbal task which comprised the presentation of ten pairs of unrelated words in three trials.

List of Verbal paired associate's tests

LIST A		
Truck	–	Arrow
Insect	-	Corn
Reptile	-	Clown
Bank	-	Cartoon
Star	-	Ladder
Badger	-	Paper
Rose	-	Bag
Elephant	-	Glass

After the completion of the three trials the subjects were provided with the first word in each pair and subsequently the subject had to complete the appropriate associating second word. Out of the ten pairs of associate learning items, the six pairs were semantically easier to remember (eg. paper-pen). It was scored as '1' and if no relevant association existed, it was considered as hard task and was scored as '2'. Scoring was based on the conventional scoring for Wechsler memory scale [6, 7.]

The data was analyzed applying repeated measured ANOVA test using statistical software package.

FINDINGS

The effect of Yoga on principal outcome measures was analyzed by two types of digit span test and associate learning. Any change in the values of the principal outcome variables was considered significant if $p < .001$.

Table No. 1: Values of the digit span forward test before and after forced nostril breathing. Values are ± SEM.

Parameters	Values of digit span forward before forced nostril breathing	Values of digit span forward after forced nostril breathing	p-Value
Digit Span Forward	6.34±0.03	6.93±0.03*	p<0.001

*p = < 0.001 versus values of digit span forward before forced nostril breathing

Table No. 2 Values of the digit span backward test before and after forced nostril breathing. Values are ± SEM.

Parameters	Values of Digit Span Backward before forced nostril breathing	Values of Digit Span Backward after forced nostril breathing	p-Value
Digit span backward	5.38±0.04	5.88±0.03*	p<0.001

*p = < 0.001 versus values of digit span backward before forced nostril breathing

Table No. 3: Values of the associate learning test before and after forced nostril breathing. Values are ± SEM.

Parameters	Values of associate learning before forced nostril breathing	Values of associate learning after forced nostril breathing	p-Value
Associate Learning	12.45±0.04	13.11±0.05*	p<0.001

*p = < 0.001 versus values of associate learning before forced nostril breathing

DISCUSSION & CONCLUSION

The present study was designed to evaluate the memory performance after forced nostril breathing. Findings of this study indicate a significant increase in all three components of Wechsler Memory Scale (WMS), such as recall of Digit Span Forward Memory , Digit Span Backward Memory and associate memory performance after forced nostril breathing at p=0.001 level and it also shows relatively lesser in digit backward memory p=0.001 level as compared to Digit Span Forward memory. There may be so many reasons in increase of the memory performance after forced nostril breathing training. Forced nostril breathing can enhance refresh rate of cerebral cortex which consist of two halves, the left and right hemispheres. Although simplistic, activities such as speech, logical thinking, analysis, sense of time are thought to function of the left hemisphere, while the ability to recognize faces and comprehend maps is thought to function of the right hemisphere. On the physiological level, left cortical hemisphere operates primarily in a verbal, intellectual, sequential mode, while the right hemisphere operates in spatial oriented mode. The left hemisphere lobe of cerebral cortex is the seat for recall of numerical, descriptive and analytical data[8]. This involves temporal lobe to register and encode the incoming stimulus information in the parietal lobe for information storage. The display of recall would be a motor output such as the verbal recall involving speech motor pathways. This cortical aspect of retrieval function is also co-related with the regional cerebral circulation [8].A studies reveal the relation between the breathing techniques such as uni-nostril (right and left nostril) and alternate nostril breathing which enhanced spatial memory performance[9]. However in the underlying mechanism of effectiveness of nostril breathing on recall function in Backward Digit Memory (BDM) test is still unclear. In the present study, the results showed that forced nostril breathing significantly increases both digit span forward, digit span backward. Similar results had shown that memory performance increases after three interventions types of nostril breathings' and breath awareness. The right nostril breathing (surya anuloma viloma), increases Digit span forward and digit span backward (p<0.001) and alternate nostril breathing also showed significant increase in digit span backward task (p<0.014). Other practices did not show any significant change [10].The possible mechanism which underlies the effect of uni-nostril breathing on the central nervous system has not been clearly understood. The mechanical receptors in the nasal mucosa are activated with the airflow into the nostril, and this signal is unilaterally transmitted to the hypothalamus [1.] The hypothalamus is considered the highest centre for autonomic regulation. The yoga breathing practices studied here have been shown to influence autonomic functions. The way in which unilateral breathing influences central nervous system functions remains to be worked out.[1]It has been reported that a 4-week program of yogasanas and meditation lowers the aggressive behavior of students [11]An earlier study which supported the findings of the present study assessed the effects of three nostril manipulated breathing techniques on performance in a letter cancellation, verbal task [12]After the practice of right and

alternate nostril yoga breathing there was an increase in letter cancellation task scores, which is a letter detection task and hence is left hemisphere specific. Hence the increased performance after right nostril yoga breathing also suggestes a contra-lateral affects though the effect of alternate nostril yoga breathing. These results were in accordance with the earlier reported studies, which found that meditation, practiced over long periods, produces definite changes in perception, attention, and cognition [13]. Other study showed that yoga techniques are helpful in management of anxiety and improvement in concentration[16]. Another researcher found that Transcendental Meditation (TM) improves academic performance and enhances problem-solving ability[15,14]. Finding of the a study suggests that yoga practice, including physical postures, yoga breathing, meditation and guided relaxation improves delayed recall of spatial information as reported earlier [15]. The present study concludes that the forced nostril breathing facilitates better inherent digit backward, digit forward span memory and associate learning performance and warrants further investigations in this area.

ACKNOWLEDGEMENT

Authors are thankful to the management RMCH & RC Ghaziabad. I have the proud privilege and honour of having worked under excellence supervision of Dr. Yogesh Tripathi professor Physiology SMC. I am also thankful to Dr. Prakash Chandra Asso.Prof. Psychiatry SIMS for great cooperation.

Conflict of Interest: Nil

Source of Funding: Self

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DOI Number: 10.5958/j.2320-608X.2.1.016

A Study of Influence of Menstrual Cycle on Cardiac Autonomic Function

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ABSTRACT

Objective: To study the effect of different phases of menstrual cycle on cardiac autonomic functions.

Method: The study was conducted in department of Physiology SSIMS & RC on 30 apparently healthy regularly menstruating female subjects in the age group of 18- 25 years based on predetermined inclusion -exclusion criteria. Effect of different phases of menstrual cycle (menstrual, proliferative and secretory) on autonomic functions was assessed using autonomic function tests like heart rate variability (HRV), isometric hand grip test, cold pressor test (CPT), heart rate (HR) response to Valsalva maneuver, blood pressure (BP) response to change in posture.

Result: There is variation in autonomic function tests in different phases of menstrual cycle with predominant sympathetic activity in luteal phase than the follicular phase.

Conclusion: Alteration in autonomic functions in different phases of menstrual cycle could be under the influence of fluctuating levels of female sex hormones that lead to salt and water retention.

Keywords: *Menstrual Cycle, Luteal Phase, Follicular Phase, Heart Rate Variability, Estrogen, Progesterone*

INTRODUCTION

Menstrual cycle refers to the cyclic changes occurring in the endometrium during active reproductive years in females leading to recurrent monthly bleeding per vaginum. Menstrual cycle of 28 days can be divided into 3 phases, menstrual, proliferative (follicular), and luteal (secretory). About 24 hours before the end of menstrual cycle, estrogen and progesterone levels decline resulting in menstrual bleeding. This is followed by proliferative phase which is under the influence of estrogen and then the secretory phase which is under the influence of estrogen and progesterone.[1]

Gonadal hormones not only influence the reproductive functions but both oestrogen and progesterone have marked effects on the cardiovascular system.[2,3] Some behavioral and neurological symptoms like headache, painful enlargement of breasts, weight gain, increased BP, decreased concentration, nervous irritability, emotional instability, poor judgment, depression, tension are seen in women during the premenstrual phase.[4]

Heart is under the influence of autonomic nervous system (ANS) and most of the behavioral and emotional patterns are exhibited through ANS.[5,6] Heart Rate Variability (HRV) reflects the ability of the heart to respond to various stimuli. It is a very sensitive index of autonomic nervous activities. HRV analysis assesses the overall cardiac health and its regulation by ANS.[7,8] Studies have shown significant physiological differences between follicular and luteal phases by using different parameters like baroreflex sensitivity, reaction time and HRV.[2,9,10] HRV in women is related independently to endogenous sex hormones, hormone replacement therapy, menopause, menstrual cycle.[11] Though there are studies suggestive of changes in autonomic functions during different phases of menstrual cycle, but they are lagging as the parameters used in them are very less and hence to overcome these shortcomings we have combined the conventional cardiac autonomic function tests with HRV . The changes in autonomic activity during different phases

of menstrual cycle might be due to direct or indirect effect of one or more variables like hormonal levels, physical and mental stress, personality characteristics, genetic determinants and social factors.[5]

MATERIALS AND METHOD

The study was conducted in department of Physiology SSIMS & RC after the approval of the institutional human ethical committee. Thirty apparently normal eumenorrhic females in the age group of 18- 25 years who did not have any history of menstrual irregularity, pregnancy, lactation or use of contraceptives in last one year were included in the study. Subjects with history of smoking or alcohol intake were excluded from the study. The study protocol was explained and informed written consent was taken from all the volunteers. Detailed personal, medical and menstrual history was taken. Recording was done on day 3 of each phase. The following tests were done to assess the cardiac autonomic functions.[12,13]

1. Resting 5 minutes lead II ECG and heart rate was recorded by AD Instruments - Power lab 26T, Australia (Serial number T26-2756, Model number ML856). Offline assessment of time and frequency domain heart rate variability was done with Lab Chart 7 software supplied by AD Instruments, Australia.

2. Heart rate response to deep breathing: Subject was asked to lie supine with sphygmomanometer and ECG leads (lead 2) attached. Resting ECG and baseline HR was recorded. Subject was asked to breathe deeply at the rate of 6 breaths per minute, allowing 5 seconds each of inspiration and expiration. The maximum and minimum heart rates during each breathing cycle were measured and the mean of the differences during three successive breathing cycles were taken to give the maximum-minimum heart rate.

3. Heart rate response to Valsalva maneuver: Subjects was made to sit comfortably with sphygmomanometer and ECG leads attached, nose clipped by nose clip, mouth piece between teeth and lips and the other end attached to a manometer. Baseline HR and blood pressure (BP) was recorded. The subject was asked to blow into the mouth piece maintaining a pressure of 40 mm of Hg for 15 seconds. The HR normally increases during maneuver, followed by rebound bradycardia after the release. Valsalva ratio is defined as the ratio of the longest R-R interval shortly after the maneuver to the shortest R-R interval during the maneuver. Procedure was repeated thrice. Valsalva ratio is taken as the mean of three successive readings.

4. Diastolic blood pressure response to isometric hand grip test: After recording the base line BP subject was asked to hold the hand dynamometer in the dominant hand and compress the hand with maximum efforts. Procedure was repeated thrice and mean of the three readings which is called maximum isometric tension (T_{max}) was taken. Subject was asked to maintain a pressure of 30% of T_{max} for 5 minutes. BP was recorded from the non exercising hand just before the release. The difference between the diastolic BP just before the release of handgrip and the baseline diastolic BP was taken as the measure of the response. Handgrip dynamometer used was supplied by INCO, Ambala.

5. Blood pressure and heart rate response to change in posture: Subject was asked to lie supine on the couch for 5 minutes with sphygmomanometer and ECG leads attached. Resting ECG (lead 2), baseline HR, resting BP was recorded. Subject was asked to stand and continuous ECG was recorded for 3 minutes. BP was recorded at 1 and 3 minutes after standing. HR at 15^{th} and 30^{th} beat after standing was noted to calculate 30:15 ratio. 30:15 ratio the longest R-R interval occurring about 30 beats after standing divided by shortest R-R interval which occurs about 15 beats after standing.

6. Blood pressure response to cold pressor test: After recording the baseline BP subject was asked to immerse his hand in ice cold water (4^0C) for 2 minutes. BP was recorded in the other arm at the end of two minutes. Change in BP were recorded and compared with the baseline BP. The change in BP was taken as the measure of the response.

Statistical Analysis

Data was analysed using ANOVA (one tailed test) and students't 'test.

RESULTS

Table 1 shows the demographic data of the volunteers. The time and frequency domains of HRV are shown in figure 1 and 2 respectively. Our study

shows statistically significant changes in the Low frequency component (LF) of HRV. Although the conventional tests like deep breathing, Valsalva, isometric hand grip test, cold pressor test and effect of change of posture on HR and BP showed variation in different phases of menstrual cycle but these changes were not found to be statistically significant.

Table 1: Demographic data

	Mean(n=30)	SD
Age (years) (Range 19-25 years)	21.33	2.34
Height (cm)	160.70	4.55
Weight (kg)	60.00	5.97
Age at menarche (year)	13.80	0.75
Average duration of menstrual cycle (days)	28	1.41
Average duration of menstrual phase (days)	5	1.54

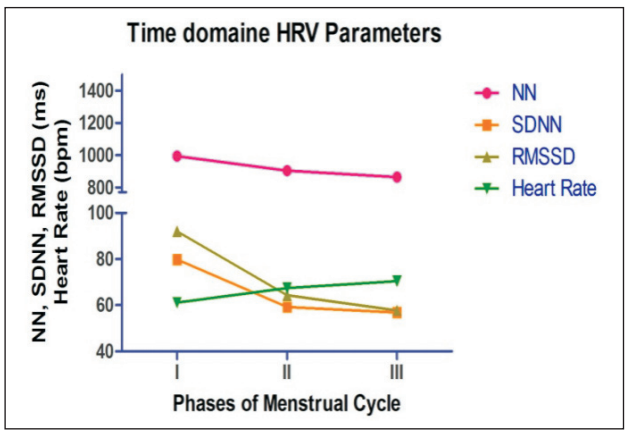

Fig. 1. Variation of time domain HRV parameters with different phases of menstrual cycle

Variation of SDNN in different phases of menstrual cycle is statistically significant , P = 0.027*

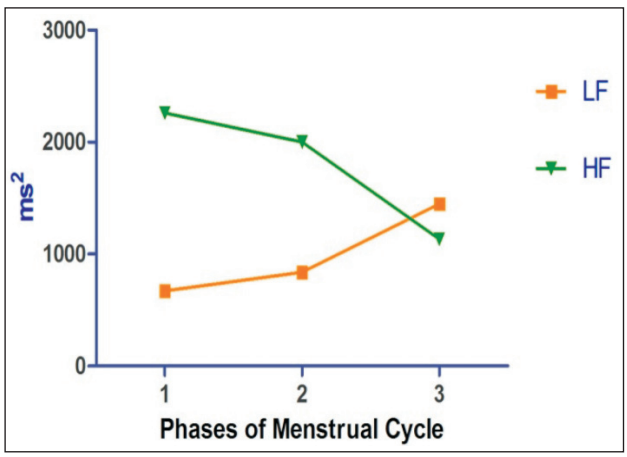

Fig. 2. Variation of frequency domain HRV parameters with different phases of menstrual cycle

Although both LF and HF show variation across different phases of menstrual cycle but the difference in LF is statistically significant , P < 0.002**.

DISCUSSION AND CONCLUSION

In our study, LF was increased in the luteal phase as compared to that in the follicular and menstrual phase. LF component of HRV is indicative of increased sympathetic activity. Studies have shown increased systolic, diastolic BP and pulse rate in luteal phase which is reflective of higher sympathetic activity. Increased sympathetic activity during luteal phase can be attributed salt and water retention caused due to ovarian steroids.[3,4] Other studies have also shown increased sympathetic activity towards the luteal phase and have attributed these changes due to effects of estrogen.[5,13,14,15]

Hormonal fluctuations occurring in a normal menstrual cycle can alter the baroreflex regulation of sympathetic outflow.[2] Studies also show that baroreflex control of heart is altered during regular menstrual cycle and estradiol exerts cardiovagal modulation in healthy women.[16]

In the twenty first century females are exposed to variety of stress as they are at par with males and are equally involved in the delivery of essential services like medical, police, military, transport etc. In our study women showed increased sympathetic response in luteal phase indicating augmented stress response.

Limitations

The study can be further more authenticated by correlating our results with hormonal assay which however remains the limitation of this study.

ACKNOWLEDGMENTS

We are highly indebted to all the volunteers who cooperated with us.

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.2.1.017

Peak Expiratory Flow Rates in Normal Healthy School Children of Central Karnataka, India

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ABSTRACT

Background: PEFR is the easiest and most cost effective method to evaluate respiratory functions. PEFR can be measured by a simple instrument Peak expiratory flow meter. Measuring PEFR has been suggested as an important tool in asthma management by all International guidelines. The aim of this study was to determine the PEFR values in healthy school children of central Karnataka, India.

Method: PEFR was measured in Two thousand and two hundred school children using mini Wright's Peak flow meter. All PEFR measurements were obtained in standing position and the best out of three trials were recorded. Height and weight were recorded. Regression analysis was used to calculate the predicted normal values of PEFR and also to assess its relation to weight and height.

Results: Positive correlation was seen between age, height, weight and PEFR. The boys had higher values of PEFR than girls at all heights. The prediction equation based on height was PEFR = 5.63 (Ht) - 474.43, r = + 0.902 for boys and PEFR = 5.30 (Ht) - 451, r = + 0.876 for girls.

Conclusion: PEFR values in this study were comparatively low to those of North Indian and western school children, High to those of other children of south India. The prediction equation obtained from the study can be used to detect PEFR values in central part of Karnataka.

Keywords: *PEFR, Children, Peak flow meter, Regression equation, Height*

INTRODUCTION

PEFR recording is one among the many lung function tests helpful in evaluation, monitoring, management and follow-up of patients with bronchial asthma. PEFR is easily measured using peak expiratory flow meter and can be recorded by the patients at home by themselves and at the clinic to reflect the severity of outflow obstruction and was shown to anticipate early deterioration of patients conditions before it actually happens.[1] Bronchial asthma is a common respiratory disease of childhood which is associated with fluctuation in airway caliber and one of the earliest sign of impending attack is fall in PEFR.[2]

PEFR is an accepted index of pulmonary function. Personal best PEFR is a useful concept for asthma self management plan. Serial PEFR monitoring is a convenient method for investigation and diagnosis of asthma. A variation of greater than 20 percent of baseline may indicate airway reactivity. Predictive normal values are essential for clinical interpretation of lung function tests. Normograms predicting PEFR from anthropometric measurements are available for various population groups. While using lung function tests in epidemiology, it is important to ensure that the population from which the regression equation is derived is an appropriate one as predicted normal values are affected by many factors including ethnic, regional and environmental influences.[3,4]

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The present study was designed to establish normograms of PEFR in healthy school children from8-18 yrs age in central part of Karnataka and to derive prediction formula for this population.

MATERIALS AND METHOD

Two thousand and two hundred children of age group 8-18 years of both sexes (1100 boys and 1100 girls) were selected from various schools and colleges. These children constitute a representative cross section of normal children of Davangere. Schools and colleges were selected by Systemic random sampling technique.

Proper consent was taken from the parents, school and college authorities before starting the study. These children were interviewed to rule out acute and chronic respiratory tract infection, skeletal deformities of thorax, cardiac and neurological disease and smoking in adolescents

Age was taken as completed years as on the school/college records. The children were subjected to full clinical assessment. The anthropometric measurements taken were height and weight. Weight was measured in kilograms (kgs) using standard weighing machine. Weight was taken without footwear and with light clothes. Weighing machine was kept on absolutely flat surface and was calibrated before taking measurements. Accuracy of the weighing machine was ± 50 grams. Any fraction of weight thus measured was corrected to the nearest kilogram. Standing height was measured by making the child to stand against a fixed calibrated rod with adjustable headrest. Height was measured without foot wear and children standing erect, looking forward with feet closed, back of head, head and body touching the rod. The measured height was then corrected to nearest centimeter. Children who were found as malnourished as per IAP criteria were excluded from the study.

PEFR was measured by mini Wright's peak flow meter (60-800 L/min). Instrument is a plastic cylindrical tube with a graduated scale on the surface and a mouth piece. Graduation starts with 50 L/min to 800 L/min with accuracy of 10 L/min. All the measurements of PEFR were taken in standing position. The purpose of the test and procedure was explained and was demonstrated in detail so as to familiarize them with the procedure and to get their fullest cooperation. The procedure was repeated thrice, highest value of these 3 readings was taken as observed PEFR. Disposable mouth piece were used for recording of PEFR.[5]

Regression analysis was used to calculate the predicted normal values of PEFR and also to assess its relation to weight and height.

RESULTS

A total of Two thousand and two hundred Children of age group 8-18 Yrs comprising 1100 boys and 1100 girls were recruited for determination of PEFR. The PEFR in relation to age are represented in Table 1. PEFR values increases as age increases. Boys had higher levels of mean PEFR than girls, and this was more significant during puberty except at the age of 8 where both have a same mean PEFR. The difference in PEFR increases between the two sexes after the age of 14 yrs due to a faster increase of PEFR in boys.

Table 2 shows PEFR values in relation to sex and height. PEFR was observed to increase linearly with height in both sexes. Boys had a higher value of mean PEFR than girls at a given height. Significant correlation ($p < 0.001$) was seen between PEFR and height in boys ($r = 0.902$) and girls ($r = 0.876$) Table 3.PEFR prediction equations based on height were calculated as for boys, PEFR = 5.63 (Height) – 474.43 and for girls,PEFR = 5.30 (Height) – 451. As age, Height and Weight has significant correlation with PEFR, it is possible to derive predictive equation using multiple regression analysis.

For boys, PEFR = 20.7 (Age) + 1.43 (Height) + 0.95 (Weight) – 158

For girls, PEFR = 11.6 (Age) + 2.34 (Height) + 0.31 (Weight) – 189

Normograms for boys and girls were plotted from linear regression equation using PEFR as dependent variable and height as independent variable are shown in figure 1 & 2 respectively. The upper and lower line denote the +2 SE (+95%) and -2 SE (- 95%) around the middle line denoting mean PEFR respectively.

Table 1: PEFR (L/min) values for boys & girls in relation to age

Age (yrs)	No	PEFR for boys (l/min)	PEFR for girls (l/min)
8	100	208.5	208.5
9	100	231.5	218.4
10	100	244.3	236.4
11	100	286.0	239.2
12	100	319.1	308.8
13	100	359.6	324.2
14	100	427.2	347.6
15	100	434.9	357.5
16	100	460.3	374.9
17	100	472.4	377.8
18	100	477.2	386.3

Table-2 PEFR (L/min) values for boys & girls in relation to height

Height (cms)	No	PEFR for boys (l/min)	PEFR for girls (l/min)
110	100	145.3	132.0
120	100	201.6	185.0
130	100	257.9	238.0
140	100	314.2	291.0
150	100	370.5	344.0
160	100	426.8	397.0
170	100	483.1	450.0
180	100	539.4	503.0

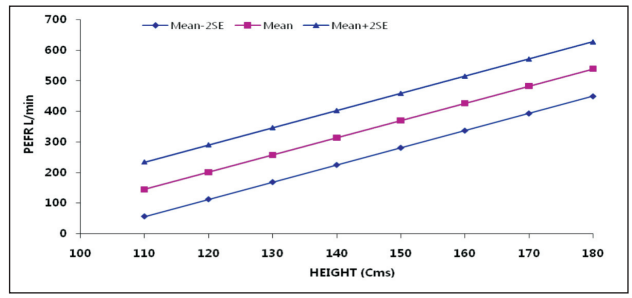

Fig. 1. PEFR Normogram from various heights for boys (8-18 yrs)

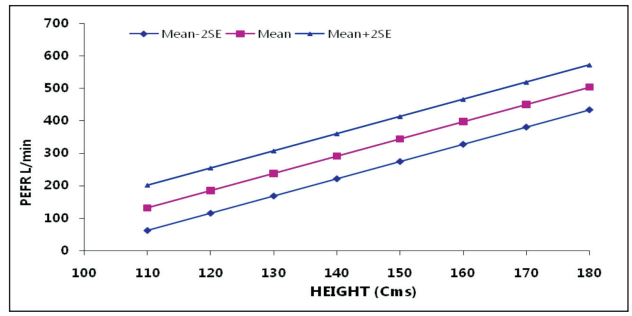

Fig. 2. PEFR Normogram from various heights for girls (8-18 yrs)

Table 3: coefficient of correlation between PEFR vs height

Sex		Height	P value
Boys (n=1100)		r = + 0.902	< 0.001
Girls(n =1100)		r = +0.876	< 0.001

r = coefficient of correlation

Table 4: comparison of PEFR (L/min) from present study with those of previous studies with respect to height.

Source of data	Height					
	120 cm		140 cm		160 cm	
	Boys	Girls	Boys	Girls	Boys	Girls
Swaminathan[2](tamilnadu)	205	193	286	272	368	350
Amar taksande[8](maharashtra)	217.4	178.9	311.4	251.7	405.4	324.5
Malik[9](punjab)	222	216	320	314	418	412
Carson[10](dublin)	250	244	344	332	469	457
Present study	202	185	314	291	427	397

DISCUSSION

The peak flow meter is a simple, easy, cheap and inexpensive device and PEFR is a reliable and acceptable index in the evaluation and management of asthmatic patients.[6] In the present study we have selected children from 8-18 years of age who are considered as healthy by ruling out the systemic disease.[7]

Comparative observations of previous studies by different authors are summarized in the table 4. North Indian children and western children have higher values of PEFR where as other south Indian state children have lower values of PEFR when compared to present study. Comparative analysis revealed that the present study results were correlate with the studies conducted at different places. Though there is a slight variation in the PEFR levels at different heights still they are within the reference range of normal limits predicted in the present study. PEFR increases with increase in height and boys had higher PEFR levels than girls at a given height.

Variations in the PEFR values at different height can be explained by the fact that the intra individual

variation may be attributed to body position, head position, effort dependency of maximum flow and circadian rhythm. Inter individual variability may be due to variety of host factors, including size (weight, height), age, race, past and present health, geographical pollution and socioeconomic status also may influence the inter individual variation. Therefore it would be more appropriate for each region to have its own value.[11]

ACKNOWLEDGEMENTS

The authors would like to thank the children and their parents, teachers and principals of the different schools for their participation and cooperation in this study.

Conflict of Interest: None

Source of Funding: Self

Ethical Clearance: Institutional ethical clearance obtained

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DOI Number: 10.5958/j.2320-608X.2.1.018

A Study on Short Duration of Physical Exercise, Short-Term Endurance Training and its Correlation to CVS Performance in Healthy Male Subjects

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ABSTRACT

Background: The autonomic nervous system establishes and maintains a dynamic adaptive state, allowing an organism to respond to internal and external demands. It mediates changes in HR, BP and peripheral vascular tone in responses to daily changes, including change of posture and physical exercise.

Aims: To evaluate the ability of HRV by using short term physical exercise of endurance in nature and study the transient changes in HRV in response to a bout of endurance exercise.

Method and Material: 50 male healthy, non-athletic, young individuals from various socioeconomic groups. In the supine position systolic blood pressure, diastolic blood pressure and pulse rate were recorded and continuous standard lead II ECG was recorded for five minutes in eyes closed relaxed state.

Results: The mean age of male is 19.12±1.33. Heart rate response to graded exercise on bicycle ergometer showed a significant decrease at 3rd , 4th , 5th & 6th minute after physical training[$p<0.05$]. There was no significant change in post training values of time and frequency domain measures of HRV the trend.

Conclusions: Endurance exercise training sessions performed over 4 weeks significantly alters cardiac autonomic modulation.

Keywords: *HRV, Autonomic Modulation, ECG, SBP*

INTRODUCTION

The cardiovascular activity is controlled by the autonomic nervous system through the complex interplay between the vagal and sympathetic divisions of it[1]. The autonomic nervous system establishes and maintains a dynamic adaptive state, allowing an organism to respond to internal and external demands. It mediates changes in heart rate, BP and peripheral vascular tone in responses to daily changes, including change of posture and physical exercise. A large body of evidence has shown that the functioning of the autonomic nervous system plays a substantial role in cardiovascular health and disease[2,3 and 4].

Recently attention has focused on the HR response to endurance exercise and on the pattern of HR recovery after exercise[5]. When compared with resting measurements, the measurement of autonomic HR control during and after endurance exercise may provide additional information on the functioning of the autonomic nervous system. Endurance training improves autonomic HR control at rest and autonomic HR response to endurance exercise[6, 7]. The improved autonomic HR response to endurance exercise may be one of the most important benefits of endurance training since sudden cardiac death is often associated with an acute bout of endurance exercise[8,9].

The measurement of HRV provides a noninvasive tool for assessing autonomic HR control[10, 11]. From the clinical point of view, the measurement of HRV has received a great deal of attention because abnormalities

in HRV after myocardial infarction are strongly associated with an increased risk for death[12, 13 and 14]. HRV has classically been used to assess autonomic HR control at rest[15]. A conventional frequency domain analysis of HRV has been developed essentially for conditions in which the level of HR is unchanged. However, during recent decades, many studies have also reported changes in HRV in response to endurance exercise [16 and 17].

During exercise, there are technical problems related to non-stationary signals. To avoid these problems, researchers have voluntarily excluded approximately the first five minutes after endurance exercise from HRV analysis[18, 19, 20, 21 and 22]. Quiet recently, studies have been targeted at developing novel methods of HRV analysis that allow the assessment of HRV also in conditions when HR changes rapidly[23].

By using time-frequency approaches it is possible to obtain information on autonomic control when HR changes rapidly, also immediately after the cessation of endurance exercise[24-26]. The principle aim of this study was to evaluate the ability of HRV to quantify within-subject changes in autonomic HR control by using short term physical exercise of endurance in nature and study the transient changes in HRV in response to a bout of endurance exercise and to endurance training.

MATERIAL AND METHOD

50 male healthy, non-athletic, young individuals from various socioeconomic groups residing nearby residential layouts of college belonging to age group of 18-25yrs included by using simple random sampling from the list of male subject population.

The study was approved by the Ethical clearance committee. The volunteers selected for study who fulfilled the criteria, on detailed history and systemic examination of the subjects to rule out any known chronic illness of respiratory, cardiovascular and musculoskeletal impairment or any disorder. This would be interfering the autonomic responses or is a contraindication for exercise as per the guidelines given by American College of Sports Medicine and excluded from study.

Recording were standardized and instructions followed as per the guidelines of Task Force of the European Society of Cardiology as HRV, Standards of measurement, Physiological interpretation and Clinical Use.

PROCEDURE:

The procedure was explained in detail before starting the recording, to the best of their understanding. Subjects were made to relax in supine position for 15min before the start of procedure. In the supine position systolic blood pressure, diastolic blood pressure and pulse rate were recorded and continuous standard lead II ECG was recorded for five minutes in eyes closed relaxed state.

After five minutes of rest the subject on the same day were tested for graded exercise response on bicycle ergometer, the subject were asked to pedal the bicycle against no resistance for first two minutes than increment in load of the magnitude of 20 watt after every 2min for a total duration of 6min was performed.

Physical Training:

The physical training includes five minutes of warm up exercise followed by jogging; the duration of exercise was personally supervised by instructor.

After completion of four weeks of physical training the individuals were again subjected for autonomic activity and graded physical exercise test and the above mentioned all procedures were repeated to study any changes in the autonomic activity.

Statistical Analysis

Data were expressed in terms of mean ± SD. Paired student's t-test was applied to analyze the changes in the cardiovascular parameters during exercise and recovery. Non-parametric Wilcoxon signed rank test was applied to analyze the changes in the heart rate variability parameters because of non-normal distribution of the data. P-value < 0.05 was considered statistically significant. Data analyses were conducted using SPSS v16.0.

RESULTS

The measured values of baseline characteristics of subjects are as presented in Table-1. Healthy male subjects are in the age group of 17-22yrs. The mean age of male is 19.12±1.33. The mean BMI in male is 21.16 ± 2.70, mean HR is 72.38±3.66 and the mean SBP is 112.72 ± 5.54.

Effect of physical training on heart rate to graded exercise load in Males

Heart rate response to graded exercise on bicycle ergometer showed a significant decrease at 3rd minute,

4th minute, 5th minute and 6th minute after physical training [p<0.05] (Table-2)

Systolic blood pressure response to graded exercise performance in Males

The systolic blood pressure response to graded exercise on bicycle ergometer showed a significant decrease at 4th minute, 5th minute and 6th minute after physical training [p<0.05] (Table-3)

Effect of physical training on parameters of Heart Rate Variability in males

There was no significant change in post training values of time and frequency domain measures of HRV the trend, Total Power and high frequency power normalized from pre training values. Similarly time domain measures of HRV, mean RR interval, SDNN, RMSSD, NN50 and pNN50, there was no significant change after physical training in male.(Table-4 & 5)

Table 1: Baseline Characteristics of the subjects

Characteristics	Males (n=50)
Age (years)	19.12 ± 1.33 [17-22]
BMI (Kg/m^2)	21.16 ± 2.70 [16.73-27.2]
HR(bpm)	72.38 ± 3.66 [64-79]
SBP (mmHg)	112.72 ± 5.54 [100-126]

Table 2 : Effect of physical training on heart rate to graded exercise load

Characteristics	Resting HR	1st min	2nd min	3rd min	4th min	5th min	6th min	Recovery HR
Pre training	72.38±3.67	91.44±3.56	99.68±4.16	108.46±4.68	114.88±5.12	122.86±5.42	129.40±6.39	87.18±4.69
Post training	72.16±3.45	91.10±3.67	99.40±3.91	107.74±4.35	114.20±5.13	121.94±5.30	128.0±5.81	86.98±5.00
t-test	t=1.85	t=1.58	t=1.70	t=3.10	t=3.61	t=4.03	t=6.27	t=1.32
p-value	p>0.05	p>0.05	p>0.05	p<0.05	p<0.05	p<0.05	p<0.05	p>0.05

Table 3: Effect of physical training on systolic blood pressure to graded exercise load

Characteristics	Resting Supine SBP	1st min	2nd min	3rd min	4th min	5th min	6th min	Recovery Supine SBP
Pre training	112.72±5.54	122.18±4.83	127.26±4.67	132.46±4.55	137.12±4.17	140.24±4.3	147.82±4.34	125.46±3.92
Post training	112.38±5.55	121.94±4.79	127.06±4.51	132.14±4.70	136.18±4.45	139.12±4.63	145.98±4.57	125.82±3.87
t-test	t=1.67	t=1.45	t=1.65	t=1.63	t=3.25	t=3.79	t=6.73	t=1.36
p-value	p>0.05	p>0.05	p>0.05	p>0.05	p<0.05	p<0.05	p<0.05	p>0.05

Table 4 : Time domain measures of Heart Rate Variability

Parameter	Pre-training Mean ± SD	Post-training Mean ± SD	p-value
Mean R-R	877.34 ± 107.24	892.06 ± 96.04	P>0.05
SDNN	43.95 ± 5.37	43.36 ± 4.67	P>0.05
RMSSD	30.20 ± 3.69	30.72 ± 3.67	P>0.05
NN50	7.22 ± 0.91	7.40 ± 0.85	P>0.05
PNN50	3.32 ± 0.41	3.42 ± 0.58	P>0.05

Table 5 : Frequency domain measures of Heart Rate Variability (Mean ± SD)

Parameter	Pre-training	Post-training	p-value
TP	1016.09 ± 124.29	990.86 ± 95.80	P>0.05
LF	429.36 ± 52.48	417.79 ± 42.95	P>0.05
HF	138.72 ± 16.96	135.49 ± 12.64	P>0.05
LFnu	91.08 ± 11.13	89.00 ± 8.42	P>0.05
HFnu	16.61 ± 2.03	16.26 ± 1.60	P>0.05

DISCUSSION

Effect of physical training on heart rate to graded exercise load

The work was found consistent to prove that physical fit individuals for exercise have lower resting heart rate and also expected to be in a better physical condition and they also showed that which was similar

in our study that individuals with high level of physical fitness are known to have quicker drops in the recovery rate than the sedentary individuals[27].

Systolic blood pressure response to graded exercise performance

Several researchers have demonstrated that a reduction in blood pressure occurs in individuals who engage in moderate intensity exercise[28,29]. In the majority of studies that examine the effect of exercise on blood pressure, both measurement levels were found to be significantly different when examining pre vs. post intervention values. The concern with this study and others whose findings are similar in nature, showing reductions in both SBP and DBP may not be clinically relevant because the reductions often seen in one or both of the variables are so minute.

Using a bicycle ergometer, subjects exercised 20-30 minutes, three times per week, for 16-week program duration. Statistical analysis revealed a 10 mm Hg decrease in SBP and a 6 mm Hg decrease in DBP; both statistically significant at $p < 0.01$. Although the present study display a significant reduction in blood pressure in the exercise-trained group from pre to post intervention, a reductive trend in the systolic component of blood pressure was observed**.** Moreover, a significant difference was demonstrated in the absolute change of SBP from pre to post-intervention periods ($p < 0.05$). Also finding a statistically significant basis studies revealed that exercise training elicited only a significant reduction in SBP[29,30] in 23 mildly hypertensive Taiwanese patients.

Effect of physical training on parameters of Heart Rate Variability

Similar results that correlated to study[31]; the average volume of aerobic training was 5.6±0.4 and 5.7±0.3 sessions a week at an intensity of 76±2 and 75±1 % of maximal HR in the moderate and high-volume groups, respectively. The duration of training was 32±3 and 61±4 min/session in the moderate and high-volume groups, respectively. Eight weeks of both moderate and high-volume training caused an increase in VO2peak as well as a reduction in maximal HR. SBP decreased ($P<0.05$) in the high-volume training group. HRV was following one week, 4 weeks, and 6 weeks of exercise training. They subsequently reported a significant increase in HF power after one-week of training, followed by no further increases over the rest of the training period.

CONCLUSION

The results of this investigation suggest that endurance exercise training sessions performed over 4 weeks significantly alters cardiac autonomic modulation. We reported a shift in sympathovagal balance favouring a vagal modulation of the heart following training. These changes were reflected by alterations in the HR that is significant decrease in HR and SBP after physical training in the same subjects and we also found the HRV power spectrum such that there were increases in HFnu and increase in time domain analysis but not in significant manner.

The changes in autonomic modulation further suggest that 4 weeks of exercise training may attenuate the sympathetic outflow and/or the vagal withdrawal associated with an orthostatic challenge. HRV indices and risk of unfavourable cardiac events, these findings may have implications regarding exercise programming in both healthy and at-risk populations.

We conclude that, even a short duration of physical training results in favourable cardiovascular performance and it may be ascribed to autonomic modulation.

ACKNOWLEDGEMENTS

Authors are thankful to the institution, all the subjects and staff of the department of Physiology for their contribution and support in the completion of this work

Conflict of Interest: None

Source of Funding: Self

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

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DOI Number: 10.5958/j.2320-608X.2.1.019

Blood Pressure Profiles of Apparently Healthy Children of Urban Private School of Central Karnataka, India

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ABSTRACT

Background: Hypertension is one of the most common disease prevailing in the developed and developing world and has its roots in childhood and adolescence. Blood pressure levels vary with age, sex, height, weight, BMI, family history of hypertension, socio-economic status and ethnic groups.The aim of this study was to determine the blood pressure values in healthy school children of central Karnataka, India.

Method: Blood pressure data of 1651 urban school children (829 boys and 822 girls) in the age group of 6-16 years were analyzed to study the distribution pattern of systolic blood pressure(SBP) and diastolic blood pressure(DBP) at different age, sex, weight,height and BMI. The correlation coefficient and regression coefficient was calculated and prediction equation for systolic and diastolic blood pressure for that particular age, height,weight and BMI were obtained. Normograms according to age were established.

Results: The SBP and DBP tends to increase with age, weight, height and BMI. The blood pressure values (SBP and DBP) increased grossly after 11 years of age. In the normograms obtained in the study, 95% of the study population falls between mean+2SD and mean-2SD.

Conclusion: The blood pressure of children and adolescents can be evaluated using the reference table according to age. The table provided helps to classify as 'normal' or 'hypertension' (>+2SD).

Keywords: *Blood Pressure, Normograms, Children,Hypertension*

INTRODUCTION

The measurement of blood pressure is firmly established as an important component of routine pediatric physical examination[1]. Norms for blood pressure and definition of hypertension were revised and strengthened by "the fourth report on the diagnosis, evaluation and treatment of high blood pressure in children and adolescents; April 29, 2004."[2]

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The American Heart Association recommends that all children aged 3 years and above should have yearly blood pressure measurements[3]. Accurate measurement of blood pressure may be difficult in children because the readings vary significantly with cuff size, patient positioning, clinical setting, equipment used (mercury sphygmomanometer versus oscillometric methods) and training of the observer[4]. Blood pressure is considerably lower in children than adults but almost always increases steadily throughout the first 2 decades of life.[2,5]

The prevalence of hypertensive in children is reported to be 1-3%[6]. Elevated blood pressure in children and adolescents may be an early expression of essential hypertension in adulthood [2,7,9].Juvenile blood pressure was found to be one of the several predictors of adult blood pressure[8].

The blood pressure profiles in childhood vary with age, sex, weight,height, body mass index (obesity), family history of hypertension, socioeconomic status and dietary habits[2,10]. Studies have concluded that both systolic and diastolic blood pressurehave an direct correlation with age, weight and with height (independent of age)[10,11,12,13,14].Height is an easily measured indicator of physiologic maturity in a clinical setting and is better correlated with skeletal age than the chronological age. Height is related to blood pressure independent of age.[2,12] Thus the most powerful determinant of normal blood pressure change in an individual is maturation, not chronological age[12].

The association between hypertension and obesity in adults is well established.[2,15,17] But relationship between hypertension and obesity in childhood has been noted, but less extensively evaluated. Few studies have also shown that obese children (high BMI) have increased systolic and diastolic blood pressure levels[2.15,16]

Reference norms developed for one particular population may not be applicable to other because of racial, ethnical and cultural difference across the world [7,8,11,12,13,14].There are number of studies conducted in different parts of the world regarding pediatric blood pressure profiles and its correlation with weight,height and body mass index, but there is paucity of studies in Indian context.The present study was designed to establish reference blood pressure values in healthy school children from 6-16 yrs age in central part of Karnataka,India.

METHODOLOGY

One thousand six hundred fifty one healthy school children of age group of 6-16 years of both sexes (829 boys and 822 girls) were selected from urban private school of central Karnataka(Davangere city),India. A written proforma and consent form was sent home with the child to collect information about family history of hypertension (father/mother). Dietic history (Veg/Non veg) and socio-economic status (per capita income) and the same was collected after 2 days.An short history about febrile illnesses, burning micturition, cough,dyspnoea/breathlessness was taken. A complete general physical examination and systemic examination was done to exclude the systemic disorders like congenital heart disease, renal disorders and liver diseases.

The following parameters were studied. Age, Sex, Weight, Height, Body Mass Index (Kg/m2), Systolic and Diastolic blood pressure. Age in completed years was recorded as per school admission registers. Weight was measured in kgs using a dial type of weighing machine & height was measured to nearest 1cm. BMI was calculated using the formula.BMI=Weight (kg) / Height(m^2)

Before recording blood pressure, the procedure was explained to children and sufficient time was given to allay anxiety and fears. Blood pressure was measured in supine position using. Diamond mercury manometer was used with a set of different sized cuffs as per the recommendation given by the fourth report on the diagnosis, evaluation and treatment of high blood pressure in children and adolescents (2004).[2]

The cuff bladder was wide enough to cover atleast 2/3 of arm and long enough to encircle arm completely. Auscultatory method was used and the 1st and 5th Korotkoff's sounds were taken as indicative of the systolic and diastolic blood pressure respectively.Measurements were made by a single person and same equipment was used to obtain accurate measurement and to increase the sensitivity of the results. Blood pressure was recorded 3 times with 2 min interval between each measurement. In children where a higher range of blood pressure was observed, the factors like anxiety and fear were removed and re-recorded after one hour. Average of 3 BP readings was taken.The data is analyzed by Karl-Pearson's coefficient of correlation and regression.

RESULTS

A total of One thousand six hundred fifty one children of age group 6-16 years comprising 829 boys and 822 girls were recruited for determination of blood pressure. The BP in relation to age is represented in table 1. From these readings it was observed that SBP& DBP did not vary much between 6-10 years and the same increased significantly from 11-16 years of age in both male and females. Male children had 1-2 mm of Hg of higher blood pressure when compared with their female counterparts at all ages.

The BP in relation to height is represented in table 2. Based on height of the individual, eight groups were made, independent of age and weight with a difference of 10 cms between the groups. It was observed that there is not much increase in mean SBP and DBP upto 130 cms (both in males and females) and SBP increased significantly and gradually in children above 130 cms of height.

Based on the mean systolic and diastolic blood pressure readings obtained in our study, the correlation coefficient and regression coefficient was calculated and prediction equation for systolic and diastolic blood pressure for that particular age, height, weight and BMI are displayed in table 3 & 4.

Formulae used for statistical analysis

a) Correlation co-efficient- $R = 1/n \Sigma xy - x\,y / SxSy$

Σx is the sum of the values obtained

b) Prediction equation $Y = a+bx$

a= constant (value of Y where the regression line cuts y axis),

b= regression coefficient

e) Regression coefficient $byx = r\,(Sy/Sx)$,

(y-dependent variable, x– predictor variable)

Table 1. Relationship of mean SBP & DBP to Age

	Males					Females				
	SBP			DBP		SBP			DBP	
Age (Yrs)	Cases	Mean	SD	Mean	SD	Cases	Mean	SD	Mean	SD
6	78	99.69	3.62	60.11	3.64	73	96.55	2.86	57.97	2.62
7	76	99.46	3.07	62.13	1.61	76	98.53	2.17	59.46	1.39
8	75	100.41	2.56	62.37	1.45	75	99.08	2.38	61.18	1.69
9	75	102.31	1.84	63.30	1.11	75	100.86	2.16	61.59	1.08
10	75	102.20	2.16	64.59	1.00	75	101.16	2.12	62.56	1.13
11	75	104.20	1.93	65.03	0.86	75	104.04	2.38	63.34	1.55
12	75	105.84	1.88	66.18	0.87	75	105.07	1.93	64.01	1.64
13	75	107.75	1.33	68.12	0.86	75	108.32	1.32	65.24	1.63
14	75	109.90	1.92	69.27	0.86	75	107.87	‘1.33	66.07	1.35
15	75	112.47	2.09	71.86	1.09	75	110.47	2.32	68.45	1.20
16	75	115.33	1.26	74.00	1.08	73	112.41	1.06	70.11	1.54

Table 2 Relationship of mean SBP & DBP to Height

	Males					Females				
	SBP			DBP		SBP			DBP	
Height	Cases	Mean	SD	Mean	SD	Cases	Mean	SD	Mean	SD
100-110	02	96.33	1.41	56.67	1.89	03	95.33	1.76	57.78	2.69
110-120	97	99.57	3.43	60.39	3.28	121	97.10	2.60	58.41	2.19
120-130	175	100.54	2.61	62.64	1.45	172	99.71	2.11	61.21	1.47
130-140	129	102.34	2.00	64.27	1.08	112	101.74	1.97	62.84	1.34
140-150	125	105.46	1.63	65.91	0.98	139	105.67	1.83	63.88	1.62
150-160	138	108.63	1.69	68.57	1.20	252	109.69	2.20	67.47	2.19
160-170	154	113.61	2.13	72.56	1.76	23	112.87	2.18	70.29	1.69
170-180	09	116.37	1.16	73.85	1.19	—	—	—	—	—

Table 3. Prediction equation of SBP and DBP for Age, Height, Weight and BMI for Male

	Systolic Blood Pressure			Diastolic Blood Pressure		
Variable	Correlation coefficient	P value	Prediction Equation	Correlation coefficient	P value	Prediction Equation
Age	0.89	< 0.001	SBP=88.14+1.57 (Age)	0.92	< 0.001	DBP=52.07+1.28 (Age)
Height	0.91	< 0.001	SBP=63.42+0.29(Height)	0.92	< 0.001	DBP=32.6+0.24(Height)
Weight	0.92	< 0.001	SBP=90.02+0.46 (Weight)	0.94	< 0.001	DBP=53.68+0.36 (Weight)
BMI	0.83	< 0.001	SBP=61.37+2.7 (BMI)	0.89	< 0.001	DBP=29 .37+2.25 (BMI)

Table 4. Prediction equation of SBP and DBP for Age, Height, Weight and BMI for Female

	Systolic Blood Pressure			Diastolic Blood Pressure		
Variable	**Correlation coefficient**	**P value**	**Prediction Equation**	**Correlation coefficient**	**P value**	**Prediction Equation**
Age	0.91	< 0.001	SBP=86.8+1.56 (Age)	0.92	< 0.001	DBP=51.64+1.1(Age)
Height	0.93	< 0.001	SBP=63.42+0.29(Height)	0.92	< 0.001	DBP=31.9+0.23(Height)
Weight	0.92	< 0.001	SBP=88.21+0.49 (Weight)	0.94	< 0.001	DBP=52.5+0.35(Weight)
BMI	0.82	< 0.001	SBP=66.5+2.31 (BMI)	0.89	< 0.001	DBP=35.74+1.72 (BMI)

DISCUSSION

Blood pressure is considerably lower in children than adults but almost always increases steadily throughout the first two decades of life and the predictive value of childhood blood pressure for the development of hypertension, coronary heart disease, stroke or renal disease in adults is well known.

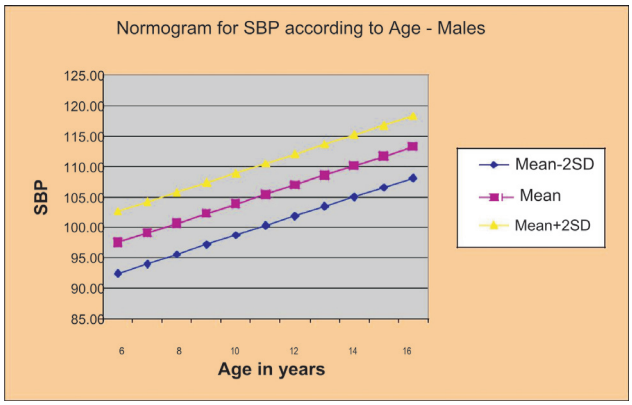
The SBP & DBP in our study according to age & sex (table 1) has been compared with those studies done by Krishna et al[7], Rosner B et al[12], Raj M et al[13], Mohammed et al[14] & Gupta AK et al[18]. SBP & DBP showed a positive correlation with age. Males had slightly higher values of BP (1-2 mm of Hg) when compared to the female counterparts at all ages . This could be explained by the fact that boys are heavier and taller when compared to females for that age. It was also observed that there is not much increase (1-2 mm of Hg/year) in the SBP& DBP between age groups 6-10 years, But the rise was steeper (2-3 mm of Hg/year) during adolescence (>11 years) .Similar results were obtained by Sharma BK et al[19] and Krishna et al[7]. The spurt in systolic and Diastolic blood pressure may be possibly due to age related hormonal, physical and psychological changes occurring in the body during puberty (> 11 years).

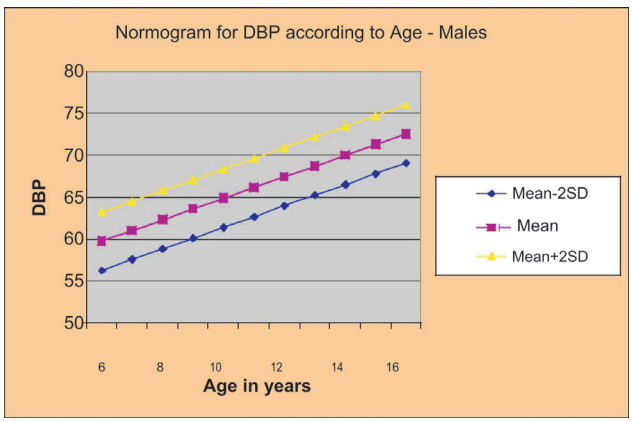
SBP & DBP showed a positive correlation with height independent of age and weight (table 2). It was also observed that SBP & DBP showed an increase of 3-4 mm of Hg upto an height of 130 cms in both sexes..Interestingly the BP increment was more pronounced (4-5 mm of Hg) in children with more than 130 cms tall (both sexes). This probably means that blood pressure does not have a simple linear correlation with height as it is thought.Similar results were shown by other studies[3,5,7,12,]18. Hence height has to be considered independent of age before classifying the child as prehypertensive / hypertensive. That means taller children are allowed higher normal blood pressure when their height is taken into consideration than when age is used alone. On the other hand, more short children and adolescents are identified as having high normal or mildly elevated blood pressure when only age and sex derived data is used. This is important in pediatric practice when dealing with chronic conditions resulting in short stature such as thalassemias, hypothyroidism. Cushing syndrome, Sickle cell disease, chronic renal and hepatic insufficiency and Turner syndrome.Thus the blood pressure normograms obtained according to height should always recommended to be used in pediatric practice.

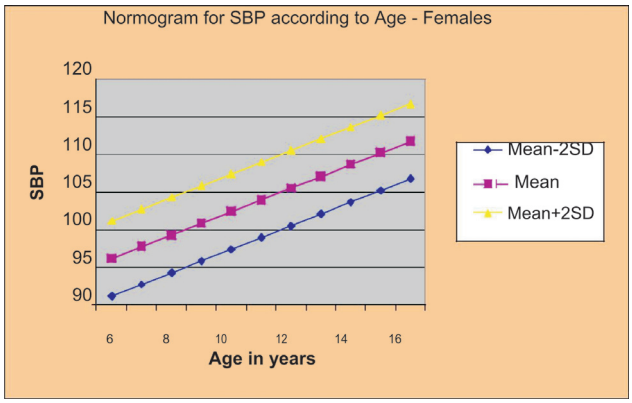
In our study, SBP & DBP showed a positive correlation with weight. The study done by Agarwal et al[11] also showed a similar trend. Our study showed a positive corelation of BMI with SBP & DBP in both sexes . Similar results were obtained by other studies[5,7,16,18].

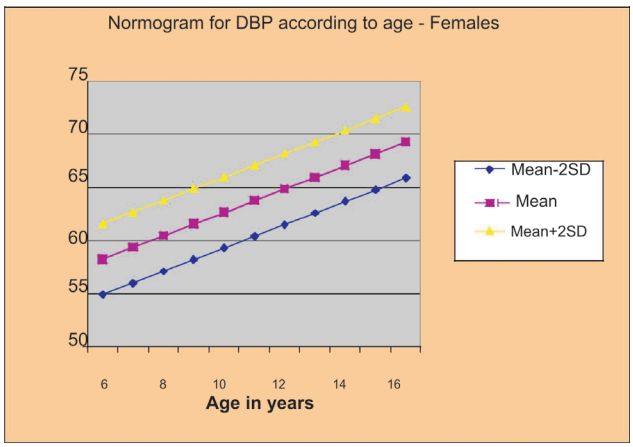
The correlation coefficient for relationship between height and SBP in males and females is 0.91 and 0.93 respectively with significant P-value (P<0.001).The correlation coefficient for relationship between height and DBP in males and females is 0.92 and 0.88 respectively with significant P-value (P<0.001). Similarly the correlation coefficient for relationship between age, weight, BMI and blood pressure values (both SBP & DBP) demonstrated significant P-value (P<0.001)(table 3,4).

Based on the predictive equations, norms were obtained for both systolic and diastolic blood pressure based on the observed readings and the upper and lower limits of systolic and diastolic blood pressure for that age was obtained for the local population from 6-16 years age group. The normograms from our study is obtained by calculating mean – 2 SD of regression to mean + 2SD of regression. The 95% of the study population falls between these 2 limits. Normograms are shown in Graphs 1,2,3& 4.









ACKNOWLEDGEMENTS

The authors would like to thank the children and their parents, teachers and principal of the school for their participation and cooperation in this study.

Conflict of Interest: None

Ethical Clearance: The study was started after obtaining written consent from the parents of each child. Ethical clearance was obtained from the ethical clearance committee of the institute.

Source of Funding: Self

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DOI Number: 10.5958/j.2320-608X.2.1.020

Efficacy of Relaxation Technique in Normalizing Altered Sleep Architecture in Stressed Information Technology Professionals of Bangalore City

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ABSTRACT

Study objective: The urban life style with rat racing, and high work pressure at working place are stressors for IT individuals, taking toll on sleep. They can counteract negative effect of stress by evoking relaxation response which is the state of deep rest.

Hence, the study is undertaken to investigate efficacy of relaxation technique in normalizing altered sleep architecture in stressed IT individuals

Study design , Participants & Intervention: The study involved 44 IT Professionals of Bangalore city in the age group of 25-40 years and having stress scores more than 40 and considered stressful as per State trait anxiety inventory.They were subjected to Polysomonography recording in the sleep lab at Victoria Hospital, Bangalore. The subjects underwent training & Practice of relaxation technique for 48 days & subjected to final recording of Polysomonography. Manual scoring of PSG recordings were done as per Kale' Manual, were compiled & statistically analyzed.

Results and Conclusion: Sleep latency, wake after sleep onset, stage 1% were prolonged and sleep efficiency reduced when compared with normative data of American Society of Sleep Medicine for that Age group in recordings obtained before training. Significant improvement was seen in the above said parameters after training and practice of Relaxation technique for 48 days, Stress by increasing activity in locus ceruleus, norepinephrine projections and also by increasing levels of epinephrine and cortisol alter parameters on PSG.

Relaxation technique by calming stress response systems improves quality of sleep.

Keywords: *Polysomnographic Recordings, Relaxation Technique, 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 accompanied with 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. 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 DM & HTN.[2]

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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] They cannot avoid stress but they can counter act its negative effect by learning how to evoke relaxation response which is the state of deep rest.

Hence, the study is undertaken with a view to investigate efficacy of relaxation technique in normalizing altered sleep architecture in stressed Information Technology Professionals.

OBJECTIVES

1. To evaluate sleep architecture by using Polysomnography (PSG) in stressed IT individuals before induction of relaxation technique.
2. To evaluate sleep architecture by using PSG in stressed IT individuals after induction of relaxation technique for 48 days.
3. To compare the results before & after relaxation technique for statistically significant results.

MATERIALS & METHOD

IT Professionals residing in and around Bangalore city were given STAI (State Trait Anxiety Inventory) questionnaire[4] 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.

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 Ethical committee of Bangalore Medical College and Research Institute. Subjects were instructed to visit sleep lab at centenary building of Victoria Hospital for two consecutive nights. The first night was meant for habituation and the next night 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.

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

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 Electroencehalogram electrodes

EOG – Electrooculogram

EMG – Electromyogram

A1 and A2 – Auditory electrodes

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 subjects normal habitual sleeping hours, under video monitored supervision.

Thereafter, the subjects underwent training of Indian Slow and Deep breathing technique (Pranayama) for 10 days and practiced the same for 48 days followed by repeat recording of PSG.

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

Results of both recordings were compiled and statistically analyzed. Student't' test applied to find't' values & 'p' values.

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 American Association of Sleep Medicine (AASM)[6]. 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.

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

Table 2: Comparison of PSG parameters before and after relaxation training.

PSG variables	Before training	After training	t value	p Value
Sleep Latency (min)	48.27 + 14.22	26.05 + 7.47	10.00	<0.001**
Total sleep time (min)	367.18 + 34.07	422 + 19.13	-11.19	<0.001**
Wake after sleep onset (min)	33.32 + 17.8	11.38 + 9.38	8.46	<0.001**
Stage 1%	20.72 + 6.16	6.53 + 1.14	21.45	<0.001**
Stage 2%	39.5 + 4.96	45.94 + 6.80	-5.44	<0.001**
Stage 3%	4.78 + 0.72	6.97 + 0.65	-15.01	<0.001**
Stage 4%	13.38 + 1.89	15.41 + 0.86	-7.33	<0.001**
Sleep Efficiency %	81.97 + 5.11	92.06 + 2.45	-12.92	<0.001**

Table – 2 shows the comparison of PSG parameters before and after relaxation training. Statistically significant improvement is seen after training in Sleep latency, Total sleep time, Wake after sleep onset, stage 2 %, stage 3%, stage 4% and Sleep efficiency with 'P' values < 0.001

This study is in agreement with Sulekha S, Thennarasu [9] and Telles S, Patra[10] who have found decreased Wake after sleep onset after relaxation technique

Table – 3 shows REM sleep % and Slow wave sleep % before and after training with significant increase after training with 'P' values <0.001

Table 3: Mean and standard deviation of SWS & REM sleep before and after relaxation training.

PSG variables	Before training	After training	t value	p Value
SWS	18.05 + 2.22	22.35 + 1.23	-12.71	<0.001**
REM %	20.21 + 4.26	23.91 + 2.47	-6.49	<0.001**

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.[11]

GABA projections from Ventro lateral preoptic nucleus of anterior hypothalamus are sleep inducing.[12] There are also endogenous sleep promoting factors PGD2, adenosine accumulating in the brain during wakefullness and produces sleep by activating sleep neurons in Tuberomamillary nucleus[13]. Neurotransmitters employed by neurons of sleep regulating centres forming neural substrate of sleep include Serotonin, Acetylcholine, Noradrenaline, GABA and Galantine[14]. 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[15]. In addition Histamine from Tuberomamillary nucleus of Posterior hypothalamus and Orexin promote wakefulness.

Stress by increasing activity in locus ceruleus, nor-epinephrine projections and also increasing levels of epinephrine and cortisol during stress are responsible for altered parameters in PSG obtained before relaxation induction.

Yoga practice or relaxation technique enhances the quality of sleep. They help in achieving highest possible functional harmony between body and mind. Deep breathing technique practiced for a period of 30 minutes is a unique method of balancing autonomic nervous system and influencing psychological and stress related disorders. Mechanism contributing to a state of calm alertness includes increased parasympathetic drive, calming of stress response system, neuroendocrine release of hormones and thalamic generators.[9, 16]

The decreased sympathoadrenal drive and release of de-stressing neuro-endocrinal hormones as an effect of calming of stress response system results in normalizing the altered polysomnography parameters.

Improvement in REM sleep % & SWS sleep % after training can be attributed to calming of stress response system including locus cereleus, norepinephrine and CRH.

However batteries of Autonomic function tests to show increased parasympathetic drive in subjects after practice of relaxation technique could not be conducted in our study and also a follow up study is required to find long term effects of relaxation training.

CONCLUSION

An evaluative study was conducted on 44 stressed IT professionals to know effect of Relaxation technique in normalizing altered sleep architecture.Initial sleep recording was done using PSG . Individuals underwent Deep breathing technique training and practice for 48 days. Sleep recording was repeated; data analyzed and found that PSG parameters like sleep latency, wake after sleep onset, Sleep 1% were prolonged and sleep efficiency reduced before training. Significant improvement was seen in sleep architecture after practice of Deep breathing. There was also improvement in slow wave sleep & REM sleep. Hence it was concluded that relaxation technique will normalize altered sleep structure in stressed individuals.

Conflicts of Interest: none

Financial Assistance: Not taken from anybody

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DOI Number: 10.5958/j.2320-608X.2.1.021

Effects of Pranayama on Bronchial Asthma

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ABSTRACT

Background: The purpose of the present study is to examine the effects of PRANAYAMA on bronchial asthma

Method: A group of thirty patients (eleven male and nineteen female) were treated with pranayama and pre- and post investigation was done with pulmonary function test.

Results: Results showed significant improvement in FEV1 ($t= 4.38$ so $p < 0.05$); PEFR ($t=4.03$ so $p < 0.05$) in pulmonary function test. All patients showed improvement in quality of life which was analyzed by Wilcoxon signed rank test. There is no significant improvement between male and female in FEV1 and PEFR. There is also not significant difference in improvement in age more than 50 and age less than 50 in FEV1 and in PEFR.

Conclusion: Bronchial asthmatic patients demonstrate significant improvement in FEV1, PEFR, and Quality of life after pranayama.

Keywords: *Pranayama, Bronchial Asthma, PFT*

INTRODUCTION

Asthma is a clinical syndrome characterized by attacks of wheezing and breathlessness due to narrowing of the intrapulmonary airways. The severity of narrowing varies over short periods and is reversible either spontaneously or as a result of treatment.[1] Asthma is now only treatable life threatening condition in western world with rising death rate. Unlike in case of most other diseases, the prevalence of asthma is highest in urban area than in rural areas.[2]

Over 300 million people around the world suffer from this non-communicable respiratory disease. Asthma affects 3.5% to over 20% of population in any country. While the course of asthma is still unclear, its pathogenic mechanism appears to be same for those suffering from it.[1] Annually there are more than 180,000 deaths worldwide from this condition, and asthma seems to have become a more serious disease in recent years.[3] An increasing number of patients with asthma are attracted by complementary and alternative medicine (CAM) and therapy like acupuncture, homeopathy, yoga, pranayama, reiki, herbal and nutritional therapy.[4]

Pranayama means Prana + Ayama. Prana stands for respiration, breath, life, vitality, wind, energy and strength. Ayama means length, expansion, stretching and restraint of breath, with reference to yoga.

Pranayama is a term with a wide range of meaning. Patanjali defines pranayama as regulation of incoming and outgoing flow of breath with retention. Pranayama also denotes cosmic power or the power of the entire universe which manifests itself as conscious living being in us through the phenomenon of breathing. Andrew Weil directs the program on integrative medicine at the university of Arizona Tucsan and has become nationally known for his bestselling books including "Spontaneous healing and natural health, natural medicine" which promotes health and wellness. He reminds us that breathing is the only autonomic function that can be consciously controlled and suggests that it is the key to bringing the

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sympathetic and parasympathetic system into harmony. Breath is the only function that can influence the involuntary nervous system. That is, one can establish the rhythm of breathing with ones voluntary nerves and muscles that will affects the involuntary nervous system. With increasing demand and usage of complementary / alternative medicine by general public, it can be concluded that yoga therapy may be effective in asthma.[5]

Pulmonary function testing provides the basis for classifying the disease into three categories and they are obstructive, restrictive and combined lung diseases. Obstructive lung diseases are characterized by decreased flows, especially on forced expiration. The primary factor in obstructive airway diseases is an increased in airway resistance. This may be caused by broncho spasm, increased pulmonary secretion, and/ or a breakdown of structural support system of small airways. As a result the airflow is decreased. Pulmonary function parameters that signify obstructive disease includes increased airway resistance, decreased forced expiratory flows and air trapping.[6]

Asthma is divided into two major types according to the precipitating factors: Extrinsic asthma and intrinsic asthma.

Extrinsic Asthma

When an asthmatic episode can be clearly associated with exposure of specific antigenic agent. It is an immediate anaphylactic reaction.

Intrinsic Asthma

When an asthmatic episode cannot be directly linked to specific antigen. The etiologic factors responsible for intrinsic asthma are elusive and onset usually occurs after the age of 40.

Pathomechnics

When susceptible individual is exposed to a certain antigen, lymphoid tissue cells from specific IgE antibodies which attach themselves to the surface of mast cells in bronchial walls. Re- exposure or continued to same antigen creates antigen-antibody reaction on surface of mast cells which in turn causes the mast cells to degranulate and release chemical mediators, which stimulates the parasympathetic nerve endings in bronchial airways, leading to reflex bronchoconstriction, and an increase in permeability of capillaries which result in the increase of dilatation of blood vessels and cause tissue edema. For bronchial asthma drugs used are: Broncho dilators, anti inflammatory.[7]

Pranayama is a scientific method, being a part of "yoga" systematized by Maharshi Patanjali. "Asana" (postures) only doesn't help to improve chronic diseases, along with the prescribed asana pranayama which is system of breath control is also practiced. Practice of pranayama is so simple, innocent and harmless that even children, sick people and aged also can practice it without any harm. The different derivatives / categories of PRANA have been given five names: Prana, Apana, Vyana, Udana and Samana. These all are spread in some part / over the entire body and gives vitality or energizes the specific organs of the particular region.

There are Four stages of Pranayama

To take the air, i.e. to inspirate

To retain the air so taken in the body for sometime

To expire the air

To keep the air out , i.e. not to inspirate

Benefits

Clears the body and mid

Destroys bodily and metal abnormalities

Freeing the mind from painful and unpleasant experiences

Make lungs stronger

Improves blood circulation

Make the man healthier

Bestows upon him the boon of long life

Mental aberrations calmed down

Improve concentration and meditation

Cleansing all your Nadis (channels through which the prana flows in the entire body) which makes the body healthy lustrous and strong.[8, 9]

AIM and Objectives

AIM: To show effects of pranayama on bronchial asthma.

OBJETCIVES

To check effectiveness of pranayama on attacks of asthma by [a] objective studies and [b] subjective experiences

To study the relative merits of pranayama

To co-relates any positive findings in modern study.

METHODOLOGY

Study Design: The sample size consisted of 30 patients who were diagnosed with bronchial asthma, their age between 15 to 80 years (36 ± 19.82)

Selection Criteria

Inclusion criteria

Patients diagnosed with bronchial asthma

Age more than 10 years

Exclusion criteria

Pregnant patient

Severely breathless patient

Patient with acute exacerbation of asthma attacks

Patients having other associated respiratory disease with asthma

MATERIAL USED

Weighing scale, measurement tape, pulmonary function test machine, mini AQLQ scale

PFT provides valuable information concerning respiratory disease; thereby assisting in diagnosis and assessment of pulmonary disorders, as well as used for therapeutic information.

ASSESSMENT

Assessment form, mini AQLQ and pulmonary function test.

Pre participation evaluation form consisted of mini AQLQ and respiratory assessment which included – chief complains, precipitating factors, history, clubbing, cyanosis, and grades of dyspnoea, number of attacks of asthma, chest auscultation and general information.

P.F.T.: FEV1, PEFR, FVC, VC, MVV was measured.

Teaching Pranayama

UJJAYI: Take slow steady breath out through both nostrils, fill the lungs up to brim with production of sibilant sound due to closure of glottis.

KAPALBHATI: Meaning is – kapal= skull and Bhati= that which brings lightness; breathing techniques used specifically for cleansing and deliberately breathe faster and at the same time use only abdomen (i.e. diaphragmatic breathing) ad not the chest breathing. There will be short rapid and strong breathing. Subject use lungs as pump, creating so much pressure as he expels the air passage from the lungs up through the nostril.

BHASTRIKA: Forced rapid deep breathing. The air is forced both in and out but patient should not excessively restless.

NADISHODHNA: Alternate nostril breathing. Yogic believes that this exercise will clean and rejuvenate the vial channels. Inhalation counts 4 seconds and exhalation counts 8 seconds.

ANULOMA-VILOMA: Inhalation and exhalation both controlled. First right nostril is closed with thumb and air taken through left nostril. Care is taken that there is no stress and no pauses should taken. A short break is taken before shifting over to the left nostril. The same technique is repeated for right nostril. [10]

Each pranayama was initially started with 15 repetitions once a day and it was progressed to about 70-80 repetition per day. The patients were asked to stop pranayama in case of dyspnoea or giddiness. After doing the 5 types of pranayama, the patients were asked to relax for 5 minutes, which is called SAVASANA, which is the relaxation therapy. This whole procedure took 20-30 minutes. The patients were asked to perform pranayama early in the morning in sitting position with trunk in erect position. The follow-up of patient was done alternate day for first month and then twice a week.

OUTCOME MEASUEMENT

Pulmonary function test, number of asthma attack in two month, and mini AQLQ scale was taken before the practice of pranayama and after two months of practice of pranayama.

Data Analysis

Mean difference between pre and post treatment

score were calculated. Wilcoxon's sign rank test calculated mini AQLQ.

RESULTS

In this study total 30 asthmatic patients were taken and out of 30 patients 11 were male and 19 patients were female. Results showed significant improvement in FEV1(t=4.38,so p<0.05)PEFR(t=4.03 so p<0.05),in pulmonary function test. All the patients showed improvement in quality of life which was analyzed by wilcoxon signed rank test.

Table 1: Pre and post PFT values

Variable	Pre (Mean±Sd)	Post (Mean±Sd)	t Value
FEV1	1.61±0.55	176±0.54	4.38005
PEFR	4.21±1.46	4.57±1.46	4.037
VC	2.53±0.82	2.63±0.88	1.9979
MVV	56.2±17.75	57.9±17.42	1.406
No. of Attacks	3.33±2.45	3.0±1.61	1.3055

DISCUSSION

Yoga is an ancient Hindu discipline increasing the mental and physical control of the body. Yoga is taught in eight steps one of which, pranayama is widely believed to be helpful in asthma because it deals with control of breathing: stepwise reduction in the breathing frequency, attainment of a 1:2 ratio for the duration of inspiration and expiration.[11]

In the present study, statistically significant improvement was seen in PEFR, FEV1. This could be due to pranayamic breathing responsible for strengthening of the respiratory muscles as well as a major physiological stimulus for the release of lung surfactant and thereby increasing the lung compliance.[12] Also the release of prostaglandin may contribute to the decrease in smooth muscle tone. Functional breathing disorders have been described in people with asthma and asthma like symptoms. Recently reported that one third of women and one fifth of men treated for asthma in a single general practice , and symptoms suggestive of dysfunctional breathing , hypothesized that pranayama corrects the breathing pattern and hence, improves the quality of life. [13]

In this study 4 patients showed increase in their number of attacks after the practice of pranayama, this might be because of frictional stress in airway during the forceful pranayamic technique. As high level of frictional stress perpetuate airway inflammation in the airways which are already inflamed and vulnerable to frictional stress- induced trauma in asthmatic patients. [14]

The correct amount of CO2 is critical for healthy breathing. If CO2 levels get too low the hemoglobin that carries oxygen through the blood becomes too "sticky" and doesn't release sufficient oxygen , the body takes drastic measures to decease the respiratory rate, and thus CO2 can build back up to safe levels. These measures produce the classic symptoms of an asthma attack: Smooth muscles constrict around the airways, the terminal bronchioles further constrict them by producing mucus and histamine (which causes swelling) and person gasp for breath. [15]

Study by M Thomas suggests that breathe retaining results in an improvement in health related quality of patients treated with asthma. Breath retaining did indeed have a specific effect on the well being and quality of the subject, independent of non-specific effects on anxiety and depression indices, although further studies are needed to confirm this observation.[13]

Freeman quoted that stress causes a tendency for enhanced ventilation with upper chest breathing patterns which can become habitual in some people. This conclusion is supported by Lump, and Magarin.[16]

Nasal congestion increases (vasodilatation) with hyperventilation or breathing cold air Cole, 1983: nasal resistance can increase very greatly among subjects and over time (Holmes, 1950) results in rapid breathing and hyper ventilation. However, the yogic rapid breathing techniques cause only slight or no excess ventilation. Several lines of evidence support this conclusion.[17]

The small volume of each breath makes respiration very inefficient that prevents excess ventilation. Yogic rapid breathing provides significant exercise for the respiratory muscles with only a mild to moderate overall bodywork output.[18]

Asthma is a complex disease and the relationship between objective physiological measures and the patient's subjective experience of their condition is far from simple. It has, for instance, been shown that psychological and emotional factors influence asthma symptoms and asthma health status independent of its severity, and that the relationship between airflow obstruction and symptoms is very weak.

Ujjai is a natural pranayama undertaken in a very simple manner. Hence practice of ujjai has been found,to be helpful in asthma. [19]

Benefits of ujjai pranayama which helps in bronchial asthma

1. Improvement in the quality of the blood due to its increased oxygenation in the lungs. This aids in the elimination of toxins from the system

2. The movements of the diaphragm during the deep breathing exercise ,massages the abdominal organs-the stomach, small intestine,liver and pancreas.

Kapalbhati are covered as logic cleaning processes of the body. kapalbhati cleans the bronchial airways.It has been proved to be of immense help to the asthmatic patients.[19]

Bhastrika pranayama creates very high heat as a lot of strength is applied. This increases the working capacity of lungs and energy to a great extent. Complete system, starting from the nose, trachea and deep up to the end of lungs right up to the diaphragm becomes disease less, strong and gets endowed with greater working capacity. [19]

We will consider yoga asana (stretches) and pranayama (breathing technique) that may be of therapeutic benefit specifically for patients with asthma and chronic lung diseases. According to the american yoga association, yoga breathing exercise can strengthen and relax the muscle of ventilation. Yoga breathing is used to increase respiratory stamina, relax the chest muscles, expand the lungs, raise energy levels, and calm the body. Thus it helps in improving the quality of life in asthmatic patients.

CONCLUSION

Pranayama improved the quality of life and it was seen that PFT readings of FEV1 and PEFR showed significant improvement. Pranayama is cost effective and very easy to perform. So pranayama is safe and effective if carried out in right manner and on regular basis. Thus it can be concluded that pranayama is a useful adjunct therapy in treating bronchial asthma.

Further, in future studies I wish to suggest that the present study is to be carried out with controlled group to compare and differentiate the effectiveness of pranayama on bronchial asthma between the experimental and controlled group.

I also suggest to take large sample size in both the groups to find out the effectiveness of pranayama.

Lastly, I would like to recommend that the future study to conduct and find out how long does the pranayama effect last for and whether is maintaining or reducing its effects.

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DOI Number: 10.5958/j.2320-608X.2.1.022

Translation to Kannada and Validation of the Kannada Version of the Global Physical Activity Questionnaire

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ABSTRACT

Background: Physical activity needs to be assessed and quantified and this is possible with the Global Physical Activity Questionnaire(GPAQ).For use in Kannada speaking population, GPAQ needs to be in Kannada.

Objectives: To translate the GPAQ to Kannada and verify the translated instrument for psychometric properties such as Convergent validity and test retest reliability.

Methods: Following translation to Kannada and back translation, validation process was conducted. 51 bilingual subjects of varying educational capacities answered Kannada versionon day1, English version on day2 and the Kannada version was re-administered again on day 7-9.

Results: Results showed high correlation coefficient of >0.8 for convergent validity and test retest reliability.

Conclusion: The robust correlation values for convergent validity and test retest reliability indicates that the Kannada version is validated and can be used to assess and quantify the physical activity level in Kannada speakers by research groups and clinicians.

Keywords: *Translation, Kannada, Global Physical Activity Questionnaire, Validation*

INTRODUCTION

Physical activity has emerged as an important modifiable risk factor that needs to be aptly modified, and in most instances increased, and forms an important aspect in the management of patients of non communicable disease like cardiovascular diseases, obesity and diabetes mellitus. During patient management, physical activity needs to be assessed and then quantified. This will enable better understanding of the physical activity level of the patient. Furthermore, during research surveys in patients with non communicable diseases, there is a great need to quantify physical activity levels of participants. [1]

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The global physical activity questionnaire (GPAQ), which is available at the World Health Organization-physical activity surveillance website and which enables assessment and quantification of the physical activity level of individuals is a partial solution to this problem. This questionnaire is available in German, Russian, Spanish, Arabic and English. However, it is not available in any of the Indian languages. If the physical activity of a Kannada speaking individual needs to be assessed, it is a requisite that there should be a validated Kannada translation of the GPAQ. As the English non-fluent, Kannada speaking population that attends the outpatient at government hospital is high, the author sensed the need to have Kannada translation of the global physical activity level questionnaire. Any translated questionnaires needs to undergo the process of linguistic validation before it can be used as a tool for research purpose. [2]

The aim of this research project was to translate the English version of the Global Physical Activity Questionnaire to Kannada and to check for the validation of the Kannada version of GPAQ.

OBJECTIVES

1. To translate the questionnaire to Kannada
2. To verify the psychometric properties of the instrument

a) Testing for cross validity or convergent validity of the Kannada translation and English version of the GPAQ.

b) Testing for test retest reliability of Kannada translation of GPAQ

METHOD

Instrument

The Global physical activity questionnaire (GPAQ) which is freely available at the World Health Organization-physical activity surveillance website was selected as the instrument to be translated. The GPAQ was a questionnaire with sixteen questions and covered the whole range of occupation-related, leisure-related, travel-related and sedentary behaviour-related activities of the individual during the past week

Conversion to metabolic equivalents of energy expended during activity

The physical activity level of individual was quantified manually by converting the total hours of physical activity at work into minutes and multiplying the minutes spent in vigorous activity-both at work and during recreation by 8 and the minutes spent in moderate activity -both at work and during recreation by 4 and the minutes spent in travel to and from work to home by 4 and the value thus derived represented the value of physical activity in terms of energy spent during physical activity in metabolic equivalent. The minutes spent in sedentary behaviour when awake was multiplied by 1 to quantify the metabolic equivalents of energy spent during sedentary hours. The sum total of all these values gave us the total physical activity level of individual.

The process of translation

Two teams of medical students, fluent in spoken and well versed in grammatical written English and, fluent in colloquial Kannada and willing to devote time to translate the questionnaire were selected by the author from MBBS students of Bangalore Medical College and Research Institute. The first team consisted of three students, each of whom independently translated the questionnaire. In the second stage, they discussed their translated versions and together, wrote down the final version in Kannada. This hand written version in Kannada was typed out in Kannada by the author using "Google transliterate" and was checked for typographical error and grammatical errors.

A second team of 2 medical students, who were unaware of the physical activity questionnaire in English, back translated the Kannada draft, back to English. This back translated English version was then compared with original English version and differences in semantic and conceptual meaning were then identified and a second attempt at translating certain lines was made and completed. The handwritten product was then retyped in Kannada using "Google Transliterate" and was checked for typographical and grammatical errors.

The show cards available on the WHO-physical activity surveillance website were also translated to Kannada in the above manner.

Pilot survey

The so prepared Kannada version of the questionnaire was then administered to 12 bilingual Kannada and English speaking teaching and clerical staff of Bangalore Medical College and their responses were tabulated. The English version was administered a day later to note the differences .When difficulties were encountered during interview when certain questions were asked, more specifically with respect to whether their physical activity was of moderate or vigorous intensity, these issues were solved when show-cards of corresponding language versions were used.

The process of validation

The process of validation consisted of testing the features of convergent validity, and test- retest reliability in the Kannada translation following interview of bilingual (Kannada and English) participants. 53 participant, other than the pilot survey participants aged between 18-70 years, took part in the validation process. The bilingual individuals were randomly selected from employees of Bangalore Medical College and Research Sciences and BMCRI alumni association run digital library and their spouses. The participants were employed in various capacities, as clerks, office assistants, undergraduate and post graduate students, tutors (both medical graduates and MSc), assistant and associate professors, professors, engineers and general practitioners. Thus, we observe that the participants were of varying levels

of education. The two criteria required of each participant were that they should be bilingual (Kannada and English) and should be willing to participate in the project. Their willingness to participate was confirmed by an informed consent. Almost all of them had no prior exposure to physical activity questionnaire. The interviews using the questionnaire were conducted by the author. Most part of the questionnaire interview involved reading out the questionnaire and encouraging the participants to use showcards.

2 participants in the project (validation process) dropped out. The first drop out was a MBBS student whom I lost for follow up as she went on leave due to medical reasons. The second was a clerical staff who could not complete the questionnaire due to burden of her clerical work. The incomplete data of these individuals were not included for statistical analysis. Hence, we finally included data of only 51 participants in the data analysis.

Protocol

The participants were administered questionnaires in Kannada on day 1 and in English on the 2nd day. The Kannada questionnaire was again administered after a gap of 7-9 days after the first Kannada questionnaire. The data was entered in Microsoft excel and analysed using SPSS 16.

Validation Protocol: Statistics: The data was analysed using SPSS16. Correlation was assessed using Pearson's correlation coefficient.

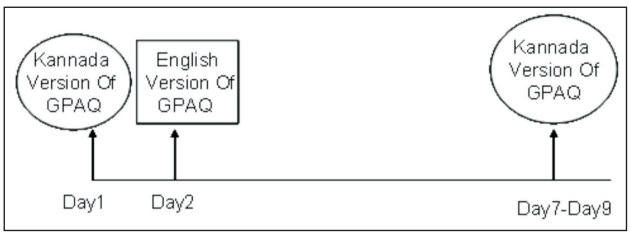

Table-1 Shows Convergent validity depicted by correlation coefficients obtained by correlating the English and Kannada version of the Global Physical activity Questionnaire with respect to physical activity related to following areas

Table 1. Convergent validity depicted by correlation coefficients

	N	Correlation Co-efficient	P
Occupation-related vigorous intensity physical activity	51	0.8**	0.008
Occupation-related moderate intensity physical activity	51	0.9**	0.009
Travel related physical activity	51	1.0**	0.007
Recreation-related vigorous intensity physical activity	51	0.8**	0.003
Recreation-related moderate intensity physical activity	51	0.9**	0.001
Sedentary behavior	51	0.9**	0.009

*Correlation is significant at P< 0.05.

**Correlation is significant at P<0.01

Table-2 shows test-retest reliability depicted by correlation coefficients obtained by correlating the 1st and 2nd version administrations of the Kannada version of Global Physical Activity Questionnaire with respect to physical activity related to following areas

TABLE 2 Test-retest reliability depicted by correlation coefficients

	N	Correlation Co-efficient	P
Occupation-related vigorous intensity physical activity	51	0.30*	0.029
Occupation-related moderate intensity physical activity	51	0.73**	0.007
Travel related physical activity	51	0.86**	0.008
Recreation-related vigorous intensity physical activity	51	0.67**	0.005
Recreation-related moderate intensity physical activity	51	0.82**	0.006
Sedentary behavior	51	0.81**	0.001

*Correlation is significant at P< 0.05.

**Correlation is significant at P<0.01

RESULTS

The table 1, shows the convergent validity or correlation in physical activity in mets between the English and the Kannada version administered within a gap of 1 day.While the answers to the "travel to and fro" shows high correlation coefficients of r=1, the mets expended in sedentary hours also shows high correlation coefficients of correlation coefficient 0.9.

The table 2 shows test retest reliability or in other words correlation between the first and repeat administration on the 7-9th day of the Kannada version. The table shows robust correlation with significant values.

DISCUSSION

During translation, the process of the back translation was a very important step in verifying whether the translation was up to the mark. It enabled identification of those areas which were not aptly translated and hence immediate action could be taken to translate those sentences again.

During validation, we have stressed on two psychometric properties of convergent validity and test retest reliability. The word "Psychometrics" used above can be defined as the field of study concerned with the theory and technique of psychological measurement, which includes the measurement of knowledge, Intelligence, attitudes, personality traits, and educational measurement. This field is primarily concerned with the construction and validation of measurement instruments such as questionnaires, tests, and personality assessments. WE come across two words essential in understanding the subject of psychometrics. They are validity and reliability of measurement.. A reliable measure is one that measures a construct consistently across time, individuals, and situations. A valid measure is one that measures what it is intended to measure

Both reliability and validity can be assessed statistically. Consistency over repeated measures of the same test can be assessed with the correlation coefficient, and is often called test-retest reliability[3]. Similarly, the equivalence of different versions of the same measure can be indexed by a correlation.

The parameters discussed here are the convergent validity and the test-retest reliability of the Kannada version of the Global physical activity questionnaire.

The first psychometric property that needs to be assessed for any instrument to be validated is "Convergent validity". It refers to the degree to which a measure is correlated with other measures that it is theoretically predicted to correlate with.

Convergent validity is assessed by comparing the instrument that needs to be validated with second instrument that measures the same feature .The second instrument should be already validated. Here, in our project, we have looked for correlation between each set of question in Kannada translation of the questionnaire and its corresponding set in the English version of the instrument for convergent validity. For example, observe that the correlation value of the questions, travel to and fro and the sedentary behaviour question has a correlation value of 1 and 0.9 respectively indicating robust convergent validity.[4]

Test-retest reliability is the other psychometric properties which we have tested for the translated Kannada version Global physical activity questionnaire to validate the instrument. Test –retest reliability is a measure of how consistently the instrument measures on repeated occasions what it is supposed to measure. In this project, we checked how consistently the instrument will measure the same behaviour on 2 different occasions usually 7-9 days apart. The interval should not be too close so as to remember and repeat the same answer and should not be so far apart so as to reflect a drastic change in behaviour. The correlation value between the first and second administration of the Kannada translated version of the instrument as seen in results, table 2 indicates good test-retest reliability. [5]

CONCLUSION

High correlation coefficients obtained while testing the translated Kannada version for psychometric properties of convergent validity and test -retest reliability indicates that it has necessary properties so as to term the instrument as validated. Hence, the Global physical activity questionnaire in Kannada is a validated version and can be used by research groups and clinicians to assess and quantify the physical activity level in Kannada speaking population.

ACKNOWLEDGEMENT

I acknowledge the work done by the two teams constituted by the following members who are MBBS students of Bangalore Medical College And Research Institute

Translation team

- Sharada Aithal-7th term,
- Kishore.H 9th term
- Manjunath Yadav-7th term

Back translation team

- Tushar. K -7th term
- Dilip-9th term

Source of funding: self

Ethical Clearance: Has been obtained from ethical clearance committee of Bangalore Medical College and Research Institute

Conflict of Interest: None by the author

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DOI Number: 10.5958/j.2320-608X.2.1.023

Effect of Cigarette Smoking on Leukocytes Count in Human Adult Males

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ABSTRACT

This study was done to compare total and differential leucocyte count in smokers and non smokers. It was conducted on 70 healthy male volunteers (35 each), 18-25 years of age. The study population consisted of 35 healthy adult smokers. The number of cigarettes smoked by them was upto 9 cigarettes per day for last 2-5 years. Control group consisted of 35 healthy adult Non- smokers of the same age group. The term "non smoker" was applied to one who had never smoked any type of cigarette. The results for both the groups were compared by using unpaired T-test.

Total WBC count was significantly higher in smokers as compared to non smokers. There was significant increase in the number of lymphocytes in smokers as compared to non smokers.

Keywords: *TLC, DLC, Male Cigarette Smokers*

INTRODUCTION

It is a well-known fact that cigarette smoking affects the health. Cigarette smoking is a risk factor for many of cardiovascular diseases, respiratory diseases, many forms of cancer, and various hematological abnormalities such as leucocytosis.

Due to the presence of many stressful conditions in the society, there is increased incidence of cigarette smoking, tobacco chewing, alcoholism and addiction among young population, which is further influenced by many factors such as socioeconomic position, life style and educational status. There is increase in number of smoking induced diseases in this age group. As cigarette smoking alters the immune system and total leucocyte count, our study was designed to investigate the effect of cigarette smoking on leucocyte count in human adult males.

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Leucocytes are considered the units of body's immune defense system. They protect body against the invasion of pathogens by destroying the foreign bodies. They also locate and destroy cancer cells.

Polymorphonuclear leucocytes (P.M.N.Ls.) have segmented nuclei with several lobes. Their cytoplasm contains numerous membrane enclosed granules.[1] Chronic cigarette smoke exposure causes leucocytosis, which is associated with an increase in circulation of P.M.N.Ls. and band cells, confirming that a release of both mature and immature P.M.N.Ls. from the bone marrow contributes to the rise in leucocyte count. This is associated with an increase in bone marrow turnover of P.M.N.Ls. with a shortening of the mean transit time of P.M.N.Ls. through the postmitotic pool of the marrow. [2]

This study was designed to observe the effect of cigarette smoking on total white blood cell count and differential white blood cell count in the young male population.

MATERIAL AND METHOD

Research Design

Comparative study of total and differential leucocyte count in smokers and non smokers was

conducted on 70 healthy male volunteers (35 each), 18-25 years of age.

The study population consisted of 35 healthy adult smokers. The number of cigarettes smoked by them was up to 9 cigarettes per day for last 2-5 years. Control group consisted of 35 healthy adult non smokers of the same age group. The term "non smokers" was applied to one who had never smoked any type of cigarette.

All participants gave their informed consent to participate in the study. The volunteers were asked to participate in a health interview prior to collection of blood sample. The subjects who had history or clinical evidence of respiratory disease like asthma, chronic bronchitis, or any recent infectious illness were excluded from the study. Smoking history was noted with respect to duration of smoking (years), number of cigarettes smoked per day, and name of the brand of cigarette smoked. 'Pack years' of consumption of cigarette was defined for all smokers as duration of smoking (years converted into days) multiplied by the number of cigarettes smoked per day and divided by 20.

Pack years =

$$\frac{\text{Duration of smoking (days) x number of cigarette smoked per day}}{20}$$

Blood samples were collected in the morning hours between 11.30 and 1.00 p.m. from all subjects. The blood was collected by finger prick method since small amount of blood is required for this investigation. The left ring finger was selected for collection of blood.

T.L.C. was done on Neubauer's chamber using compound light microscope under low power. W. B. C. diluting fluid was used for dilution and all precautions were taken to avoid errors in the method.

D.L.C. was performed on blood smear stained by Leishman's stain containing methylene blue, eosin and acetone free methyl alcohol.

The total leucocyte count and differential leucocyte count were statistically analyzed by applying unpaired't' test. The p value < 0.01 was taken as statistically significant.

FINDINGS

Table No.1 shows total W.B.C. count in smokers and non smokers. Total WBC count is significantly higher in smokers as compared to non smokers.

Table No.2 shows differential W.B.C. count in smokers and non smokers. There is significant increase in the number of lymphocytes in smokers as compared to non smokers.

Table No.1. Total W.B.C. Count

Group	Total count / cummMean ± 2SD
Control Group (n = 35)	7787.14 ± 1063.10
Smoker Group (n = 35)	11128.57 ± 1109 *

** Statistically significant p < 0.01 (t - Test)*

Table No.2. Differential W.B.C. Count

Group	D.L.C. %		Mean ± 2 SD		
	N	E	B	L	M
Control Group (n = 35)	62.17 ± 2.10	3.20 ± 0.89	0.29 ± 0.45	28.69 ± 1.90	5.69 ± 1.15
Smoker Group (n = 35)	57.77 ± 3.10	3.31 ± 1.15	0.11 ± 0.32	36.60 ± 2.87 *	2.31 ± 1.15

** Statistically significant p < 0.01 (t - Test)*

CONCLUSION

The present study was designed to observe the effect of cigarette smoking on total leucocyte count and differential leucocyte count in human adult males. The changes in leucocyte count were studied in smokers and non smokers of the same age group, socio – economic conditions, and occupation. History of respiratory disease and allergic status was ruled out.

Table No. 1 shows T.L.C. in smokers and non smokers. The results in our study indicate a significant increase in total leucocyte count in smokers as compared to non smokers. Total leucocyte count for smokers (11128.57 ± 1109.006 cell/mm^3) was significantly higher (p<0.01) compared with total leucocyte count for non smokers (7787.143 ± 1063.107 cell/mm^3).

Leucocytosis in smokers corroborates with the findings of D.B.Petitti et al.[3]

who reported that in current, regular cigarette smokers, leucocyte count was higher in those who

were smoking large number of cigarettes and was associated with smoking cigarette with a high tar and nicotine yield, deep inhalation of cigarette smoke, and a longer duration of smoking.

Tomoyuki Kawada [4] reported that smokers had higher total white blood cell count as compared to non smokers. He observed the dose dependent increase in leucocyte count. He reported that when number of cigarettes smoked per day was categorized into three groups (<10, 11-20, and >20), mean white blood cell count in the group smoking > 20 cigarettes per day was significantly higher than those of the other groups. They attributed this rise in count as follows: Smoking causes inflammatory stimulation to bronchial tract and could lead to chronic bronchitis, which may increase inflammatory indicators in blood. Markers of inflammation such as C-reactive protein and W.B.Cs. count were consistently associated to free radicals generated by smoking.

This result agrees with findings of Rebecca King et al. [1] who showed a high leucocyte count when person was actually smoking. Cigarette smoking seems to cause a rapid effect on the leucocyte count. She suggested two theories to explain an increase in leucocyte count. One theory suggested was that nicotine induces the release of catecholamines that could raise leucocyte count. The other theory explained leucocytosis due to an irritant effect of smoke on the respiratory tree with resultant inflammation.

Metin Kilinc et al.[5] reported that increase in the total leucocyte count in smokers was due to chronic bronchitis or release of leucocytes from lymphoid organs to periphery.

In another study done by Masuhiro Takahashi et al. [6] it was reported that nicotine was not the only component of smoke that caused leucocytosis, but various other factors such as occult chronic bronchitis or catecholamine associated change in distribution of leucocyte from a marginal pool to a circulating pool could be the cause of leucocytosis. As smoke contains innumerable components having biological activity, there may be several components in smoke which may increase leucocyte counts.

Thus leucocytosis observed in our study could be multifactorial. It could be due to inflammatory stimulation to bronchial tract which leads to chronic bronchitis and increased inflammatory indicators in blood or release of leucocytes from lymphoid organs to periphery. Stimulation of lung macrophages to produce neutrophil chemotactic factors and enhancement of neutrophil chemotactic responsiveness may be another factor for leucocytosis. Another mechanism for increase in leucocyte count could be the effect of nicotine which evokes discharge of catecholamines from adrenal medulla that can raise leucocyte count by changing distribution of leucocyte from marginal pool into circulating pool.

Effect of cigarette smoking on differential leucocyte count is controversial. In our study we observed a significant increase in the lymphocyte count in smokers as compared to non smokers. The mean ± SD of total lymphocyte count for smokers (36.60 ± 2.871) was significantly higher ($p< 0.01$) as compared with that of non smokers (28.69 ± 1.90). There was no significant difference between other types of white blood cells in smokers and non smokers.

Robert C. Noble et al. [7] quoted Corre F. J. Lellouch who reported an increase in the percentage of neutrophils and decrease in the percentage of lymphocytes in smokers. Our findings do not correlate with the findings reported by Corre F. J. Lellouch.

Taylor R.G. et al. [8] observed that absolute eosinophil count was increased in smokers disproportionate to the increase in total white blood cell count. They reported that smoking was associated with increase in some markers of allergy. In our study eosinophilia is not observed in smoker group.

In another study, Erik Juel Jensen et al. [9] reported increased number of neutrophils, lymphocytes, and basophils in the blood of smokers compared with non smokers. They reported that chronic bronchitis and episodes of acute airway inflammation, stimulation of lung macrophages to produce neutrophil chemotactic factors, and enhancement of neutrophil chemotatic responsiveness and plasma nicotine level could be responsible factors for the increased leucocyte counts. They attributed increase in the number of lymphocytes in smokers to the stimulating effect of nicotine on lymphocytes. The mechanism by which nicotine influences lymphocyte count was not known. Results of our study correlate with the above study.

In our study the results agree with those observed by N.R. Nancy et al. [10] who reported a significant lymphocytosis but neutropenia in smokers as compared to non smokers. In our study neutrophil count is found less in smokers even though this reduction is not statistically significant.

Our result is in accordance with the findings noted by David J. Tollerud [11],who investigated the effect of cigarette smoking on T cell subsets. He reported that current smokers had a significantly higher absolute lymphocyte count than non smokers. The proportion of CD4 cells (which are one type of lymphocytes) were significantly increased in smokers as compared to non smokers. They also found that the percentage of CD4 cells tend to increase with the number of cigarettes smoked per day. They reported that the mechanisms responsible for this effect, were obscure.

David J. Tollerud et al. [11] quoted Vanuxen D. who reported that cigarette smoking was associated with a variety of alterations in the cellular immune system, including an elevated white blood cell count and increased number of circulating lymphocytes.

Nancy N.R. et al. [10] quoted Schlumm who observed lymphocytosis in chronic abusers of nicotine. The mechanism by which smoking causes lymphocytosis, has not been fully explored.

Disturbance in the function of adrenal gland under the influence of a stress factor like smoke may have a significant role in elevating lymphocyte percentage as evidenced by the experiments of Venulet and Majchersk who studied the effect of chronic tobacco smoke exposure on the functional state of adrenal cortex in mice as quoted by Nancy N. R. et. al. [10].

Increase in lymphocyte count obtained in our study can be attributed to the stimulating effect of nicotine on lymphocytes. It can be explained in the following way. Disturbance in the function of adrenal gland under influence of a stress factor like smoke might be having a significant role in elevating lymphocyte count. The irritant effect of cigarette smoke on respiratory tree, resulting in chronic inflammation (chronic bronchitis) must be another reason for increased release of lymphocytes from lymphoid organs. However the limitation in our study is that in our study we have not done CD4 count and animal experiments.

ACKNOWLEDGEMENTS

We are grateful to our Institution, Bharati Vidyapeeth Medical College, Pune, for permitting us to conduct our study successfully and for providing us the infrastructure to carry out our study. We gratefully acknowledge the teaching and non-teaching faculty members of the Department of Physiology, who spared their valuable time in assisting us to carry out this study. Last but not the least; we would like to acknowledge the subjects who participated in our study.

Conflict of Interest: None

Source of Funding: Self

Ethical Clearance: Taken from College ethical Committee.

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DOI Number: 10.5958/j.2320-608X.2.1.024

Neuroprotection of the Striatal Dopaminergic Neurons by Tempol in Aged Rat Model of Parkinson's Disease

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ABSTRACT

In the present study, the potential of tempol has been examined as a neuroprotective agent against the toxicity of the 6-hydroxydopamine (6-OHDA) in aged rat. Literature is silent about it. Sprague-Dawley rats were pretreated with tempol and subsequently administered the neurotoxin 6-OHDA into the aged rat striatum. Various behavior and immunohistochemical tests were used to evaluate the neuroprotective effect of tempol. Significant difference in various groups was found (ANOVA, $p<0.001$) in apomorphine-induced rotational behavior, staircase test success rate & disengage time and (ANOVA, $p<0.05$) in stepping test, initiation time & postural balance test. On the basis of immunohistochemical changes, the present study concludes that tempol is an effective neuroprotective agent for dopaminergic neurons in 6-OHDA induced aged rat model of Parkinson's disease (PD). Aged rats showed less neuroprotection in dopaminergic neurons loss than young rats

Keywords: *Tempol, 6-Hydroxydopamine and Aged Rat*

INTRODUCTION

Tempol (4-hydroxy-2,2,6,6-tetramethyl-piperidine-1-oxyl) is promising free radical spin trap which may be particularly effective in scavenging peroxynitrite. It protects brain injury by inhibiting lipid per-oxidation in a rat model of transient focal cerebral ischemia[1]. It increases intracellular adenosine triphosphate which led to an additive increase in cortical neuronal survival[2]. It reduces brain damage after acute subdural hematoma in the rat by attenuation of super oxide radical production[3]. In cell culture, it protects dopaminergic mesenchephalic cells from apoptosis. It also protects mice from cell loss in striatum and mortality[4]. In case of murine neuroblastoma, it has been seen to decrease the mortality rate, sympathetic nervous system impairment, activity impairment and tumor weight compared with those seen with 6-OHDA alone[5]. It also causes significant neuroprotection against MPTP neurotoxicity[6]. It has been reported recently that the 6-OHDA-induced activation of autophagy was suppressed by addition of the free radical scavengers tempol and manganese [III] tetrakis (4-benzoic acid) porphyrin[7].

The above mentioned studies focused on the use of young animals to examine the in vivo effects of tempol. However, since the degeneration of substantia nigra dopaminergic neurons that occurs in Parkinson's disease is more often than not confined to elderly individuals, it is of interest to determine whether the protective effects of tempol against 6-OHDA in young adult rats can be extended to aged animals. Therefore in the present study, tempol is investigated to determine its ability to protect the striatal dopaminergic loss induced by 6-OHDA in aged rat model of PD.

MATERIAL AND METHOD

Animals groups: The animals were randomly allocated to four groups of 10 rats each. Group A is the aged sham control group. Aged animals of group B received 8 µg 6-OHDA (Sigma) into the striatum. Animals of group C received first tempol (Sigma) dissolved in 1ml saline at a dose of 10 mg / kg body weight i.p. for 7 days and then 8µg 6-OHDA was administered into the striatum of young rat. Group D received first tempol dissolved in 1ml saline at a dose

of 10 mg / kg body weight i.p. for 7 days. After 7 days, 8 µg 6-OHDA was injected into striatum of aged rat.

Lesions surgery by 6-hydroxydopamine: Rats were anesthetized with ketamine (50-100 mg / kg i.p.) and Xylazine (5-10 mg / kg, i.p.). Animals were placed in stereotaxic apparatus (INCO). 8µg 6-hydroxydopamine in 8 µl of 0.9% saline was injected into the striatum with reference to bregma is 0.0 mm anterior to bregma, 3.5 mm lateral to it and 5.5mm ventral to it. The position of rat tooth on the tooth bar of stereotaxic apparatus was fixed 3.3 mm[8].

Quantitation of rotational behavior: Rats were tested for apomorphine induced rotations in response to apomorphine (Sigma, 0.05mg / kg s.c.) at the base line (prelesion) and after 5 weeks of 6-OHDA induced lesion (postlesion) in all groups for 30 minutes duration by the help of Rota count 8 (Columbus Instruments,USA) [9].

Skilled forelimb test: For each test, the animals were placed into Plexiglas box holding a removable double staircase on which six steps were baited with 30 food pellets on each side, and the testing period was 15 min[10].

Stepping tests: The number of adjusting steps were counted while the rat was moved sideways along the table with a constant speed (60 cm in 6 sec), first in the forehand direction and then in the backhand direction[11].

Initiation time: The experimenter held the rat with one hand fixing the hind limbs and slightly raising the hind part above the surface. The other hand fixed the forelimb not to be monitored. Initiation time was measured until the rat initiated movement with the forelimb not fixed by the experimenter[12].

Postural balance test: The postural balancing reaction of that forelimb was scored from 0 to 3. Briefly, scores were: 0, representing no detectable muscle reaction in the forelimb; 1, clear forelimb reaction with muscle contraction, but lack of success in recovering balance; 2, clear forelimb movement with incomplete recovery of balance and impaired placement of the paw, i.e., the digits were partly crossed over one another; and 3, normal forelimb balancing movement with total recovery of balance[13].

Disengage time: The perioral region beneath the vibrissae on each side of the head was touched repeatedly by a wooden stick at 1-2 sec intervals while the rats were eating a piece of chocolate. The response latency was measured as the time interval by which perioral stimulation resulted in an orienting response toward the stimulus[14].

Brain Histology: After the completion of behavior test, all animals were anaesthetized with lethal dose of ketamine (200-400 mg / kg i.p.). The rats were perfused with 4% paraformaldehyde in 0.1 M, ph 7.4 phosphate buffer solution (PBS). The brains were removed and placed in the same fixative for 24 h. Then they were transferred to 15% sucrose in 0.l M PBS until they sank. Brains sections (5 µm cryostat coronal sections) were cut using a microtome. Sections were stained according the procedure of Tyrosine hydroxylase immunohisochemistry and were observed for dopaminergic neurons under microscope[15].

Statistical analysis: All values were presented as mean ± S.E.M. The significance of difference between prelesion and postlesion within the group was determined by paired student's t test. ANOVA was used to find the significance of difference between the values of all the groups for pre lesion and post lesion separately. A p value of less then 0.05 was regarded as being statistically significant[16].

FINDINGS

Rats subjected to tempol and receiving stereotaxic injection of 6-OHDA had significant effect in various behavior tests (Figure 1-9). There were no statistical significant differences between prelesion values of group A (student's t test, $p > 0.1$). Comparative analysis between prelesion value and postlesion value of group B was found highly significant (student's t test, $p<0.001$) in apomorphine-induced rotational behavior, stepping test, initiation time, staircase test, disengage time and postural balance test. Statistical significant difference in various behavior tests was observed between prelesion and postlesion values of group C (student's t test, $p<0.001$ in apomorphine-induced rotational behavior, stepping test, initiation time, disengage time and $p<0.05$ in staircase test, postural balance test). Significant difference (student's t test, $p<0.001$) between prelesion and postlesion value of group D was found in apomorphine-induced rotational behavior, staircase test success rate, stepping test, initiation time & disengage time and $p<0.05$ in postural balance test. Statistical evaluation revealed significant difference between all the groups (ANOVA, $p<0.001$) in apomorphine-induced rotational behavior, staircase test success rate & disengage time and (ANOVA, $p<0.05$) in stepping test, initiation time & postural balance test.

Tyrosine hydroxylase immunohisochemistry were also investigated in all groups of the rats. Microscopic examination of slides showed abundant dark brown stained dopaminergic neurons in the brain section of group A. Very less dark brown stained TH-immunoreactive neurons were demonstrated in brain section of group B. It is due to loss of normal dopaminergic neurons. The animals of group C & D exhibited abundant dark brown stained neurons in rat brain sections. The dark brown color neurons were found significantly more in group C & D than that of animals of group B. The aged rats showed less protection in neurons loss (49 %) than that of young (61 %) rats (Figure 10).

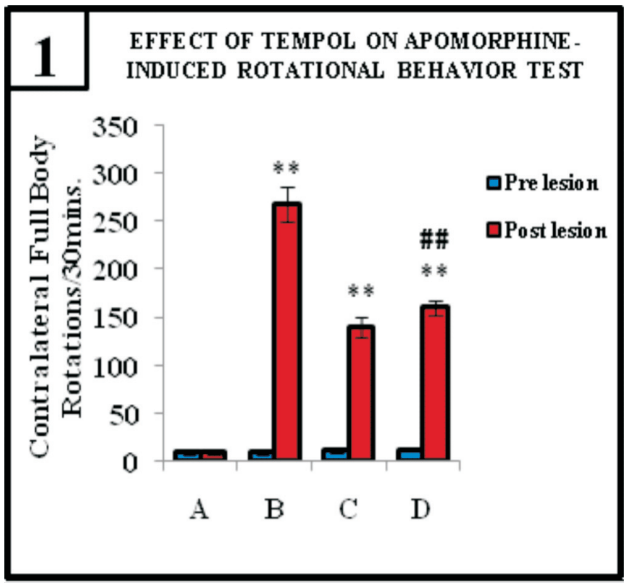

Fig. 1. Intraperitoneal administration of Tempol rectifies the rotational behavior test in aged rat. The values are expressed as Mean ± S.E.M in all the figures from 1 to10

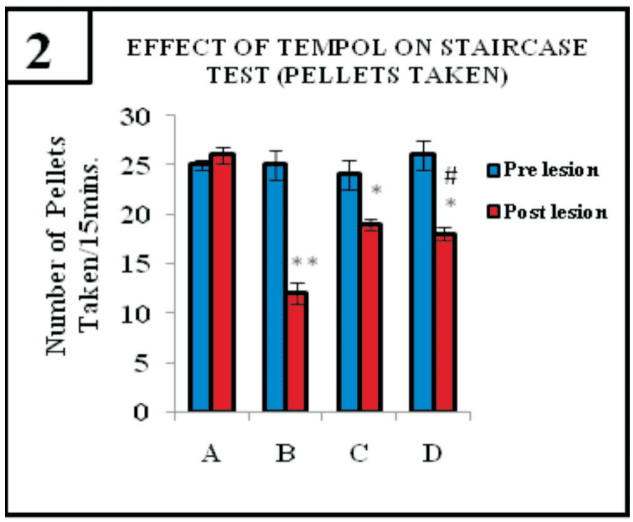

Fig. 2. Intraperitoneal administration of tempol rectifies the performance in pellets taken in aged rats

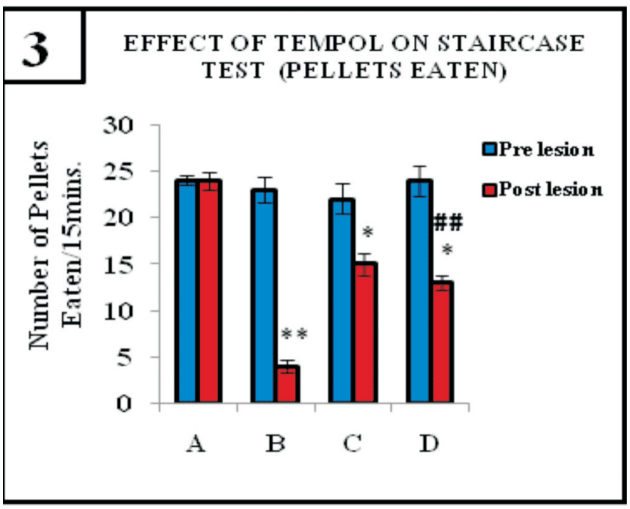

Fig. 3. Intraperitoneal administration of tempol improves the performance in pellets eaten in aged rats.

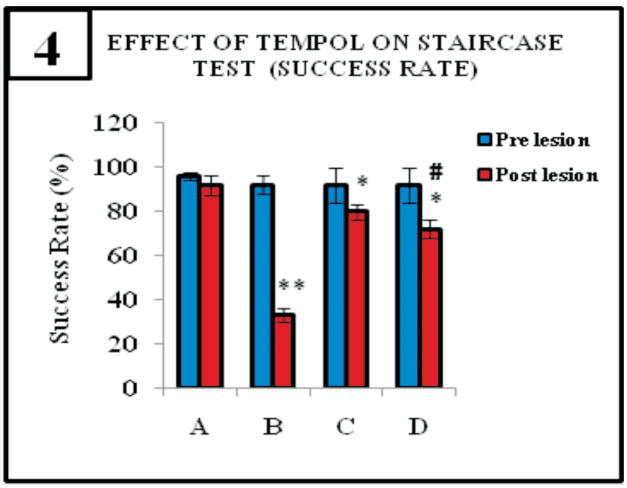

Fig. 4. Intraperitoneal administration of tempol improves the success rate in aged rats.

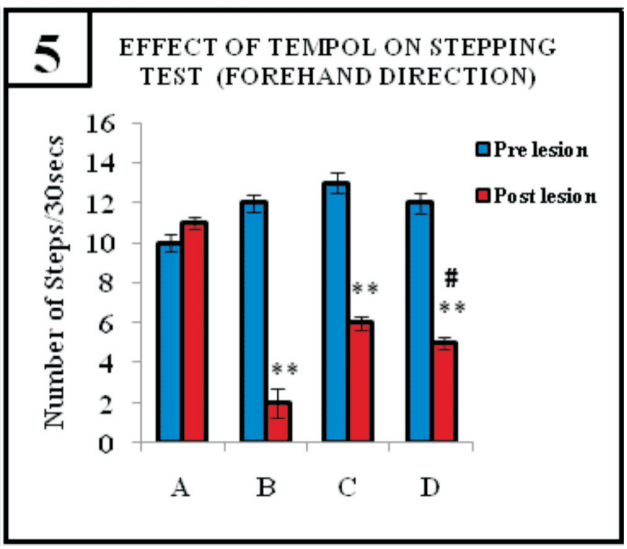

Fig. 5. Intraperitoneal administration of tempol rectifies the stepping test in forehand direction in aged rats.

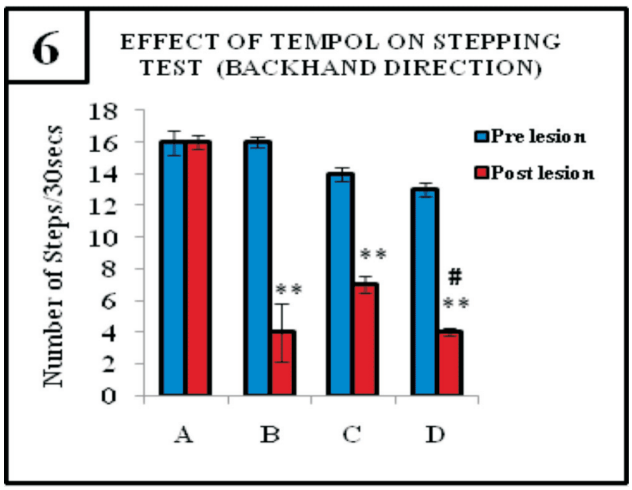

Fig. 6. Intraperitoneal administration of tempol improves the stepping test in backhand direction in aged rats.

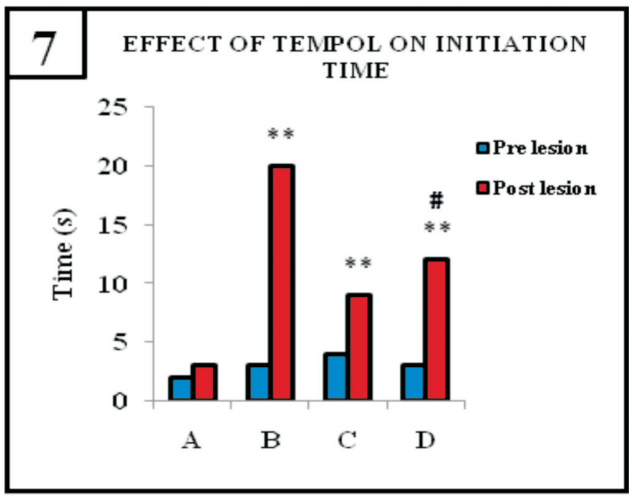

Fig. 7. Intraperitoneal administration of tempol rectifies the initiation time in aged rats.

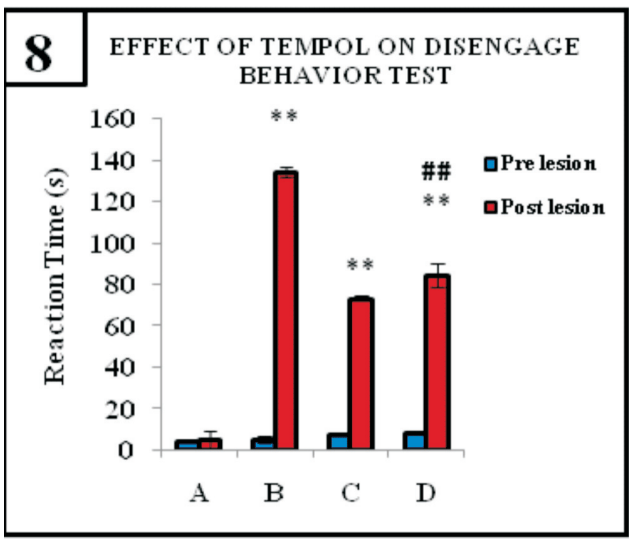

Fig. 8. Intraperitoneal administration of tempol rectifies the disengage behavior in aged rats.

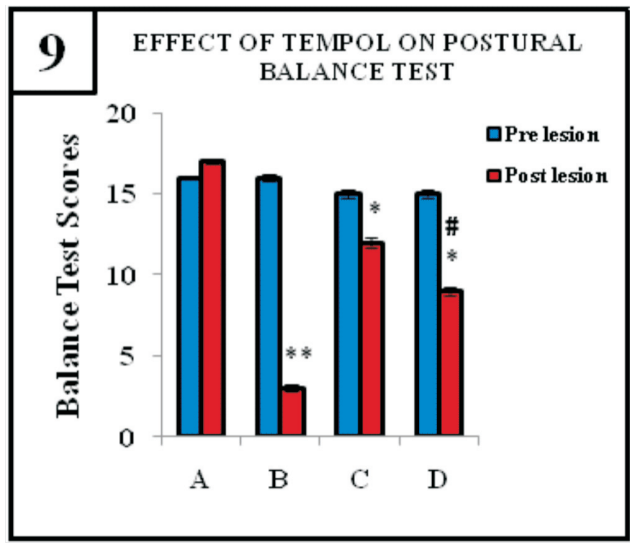

Fig. 9. Intraperitoneal administration of tempol rectifies the postural balance test in aged rats.

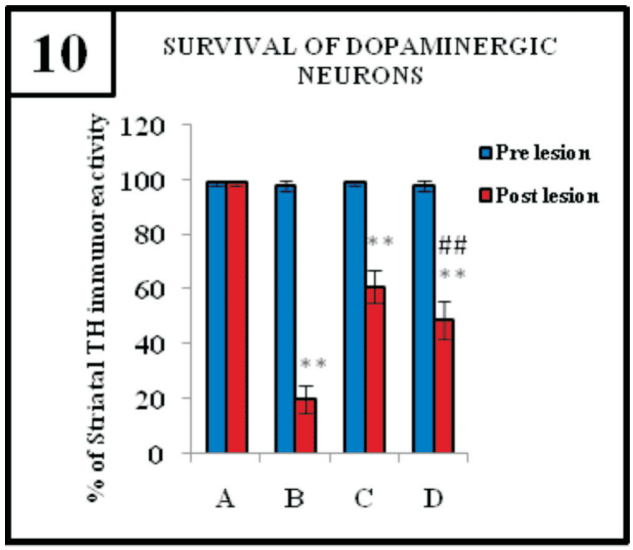

Fig. 10. Intraperitoneal administration of tempol increases the survival of striatal dopaminergic neurons in aged rats.

DISCUSSION

The present study demonstrates that intraperitoneal administration of tempol protects dopaminergic neurons in rats caused by intrastriatal injection of the neurotoxin 6-OHDA. Various behavior tests act as an index of striatal dopaminergic function. Tempol improved these behavior tests in young and aged 6-OHDA induced rat model of PD. Our findings are consistent with earlier report of improved activity in PD[5, 6, 17, 18]. It had been reported earlier that tempol protected mice from intrastriatal 6-OHDA-induced cell and dopamine metabolite loss in the striatum. It

protected mice against the 6-OHDA-induced rotational behavior elicited by d-amphetamine[5]. It protected mice from the ptosis, activity level decrement, and mortality induced by 6-OHDA. It also protected dopaminergic mesenchephalic cells in culture from 6-OHDA-induced apoptosis[5]. Tempol prevents catecholaminergic oxidative toxicity by 4-hydroxy-2, 2, 6, 6-tetramethylpiperidine-1-oxyl and its recycling complex with polynitroxylated albumin[17]. Tempol and Salen-Mn (III) complex of o-vanillin (EUK-134) delayed apoptosis after an exogenous oxidative insult[18]. The free radical spin trap tempol also produced significant protection against MPTP neurotoxicity[6].

The present study is different from the earlier report[5]. They examined the efficacy of tempol in cell culture. In present study, the possible neuroprotectory effect of tempol was investigated in the rat (i). They studied mice models of the central and peripheral dysfunction associated with Parkinson's disease. In the present study, a rat model was studied (ii). They studied rotational behavior elicited by intrastriatal administration of d-amphetamine. In the current study, apomorphine induced rotations were observed in response to apomorphine (Sigma, 0.05mg / kg s.c.). Apomorphine induced rotations are considered better index than amphetamine induced rotations (iii).

The neuroprotective effects of tempol appear to be mediated by the antioxidant capacity. It detoxifies oxygen metabolites by redox cycling via one-electron transfer reactions[19]. It has superoxide dismutase mimetic activity and confers catalase activity to heme proteins[20]. It protects cells and animals from oxidative stress[3].In the present study the extent of protection against 6-OHDA induced dopaminergic neurotoxicity is less in aged hemiparkinsonium animals. It may be due to neurochemical and cellular changes in the nigrostriatal dopaminergic changes during aging. There are reductions in striatal levels of dopamine as well as dopaminergic receptors[21]. Neuronal loss in the substantia nigra reaches about 50 % by the ninth decade in humans[22]. Reduction in high affinity dopaminergic uptake sites[23], dopaminergic transporter messenger RNA[24] and TH messenger RNA[25] also become evident as individual's age.

CONCLUSION

In conclusion, the present study demonstrated that intraperitoneal administration of tempol protects significantly striatal dopaminergic neurons against 6-OHDA neurotoxicity in aged rat. The effect is accompanied by a significantly recovery in behavior and immunohistochemical tests. Less neuroprotection was found in aged rats than young rats. Further studies, both basic science and clinical in nature, will be needed to tests these speculations.

ACKNOWLEDGMENT

One of the authors, Bal Krishna, is grateful for the financial support from Indian Council of Medical Research, New Delhi.

Conflict of Interest: No conflicts of interests, financial or otherwise are declared by the authors.

Ethical Clearance: Animals were maintained according to Institutional Animal Ethics Committee for the care and use of laboratory animals. Necessary ethical clearance has been taken from the Committee for the purpose of control and supervision of experimental animal (CPCSEA).

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DOI Number: 10.5958/j.2320-608X.2.1.025

A Study to Evaluate the effect of Menopause on Oxidative Stress

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ABSTRACT

Background & Objectives: Free oxygen radicals have been proposed as important causative agents of ageing and menopause is a natural step in the process of ageing. The intricate balance between antioxidants and reactive oxygen species seems to be disturbed in post-menopausal women due to deficiency of estrogen, which is a powerful antioxidant. In view of this background, present study was carried out to find correlation between menopause and oxidative stress, if any.

Method: Oxidative stress was evaluated in 105 women by estimating levels of superoxide dismutase, ascorbic acid, and malondialdehyde in blood/serum spectrophotometrically. The subjects consisted of 35 women of three distinct groups, namely, reproductive age, peri-menopausal, and post-menopausal. Data obtained was analyzed by student's t- test, ANOVA, and Pearson's correlation coefficient (r). $P < 0.05$ was considered significant.

Results: Peri- and post-menopausal women exhibited significantly low erythrocyte SOD and serum ascorbic acid levels and significantly high serum MDA levels as compared to the women of reproductive age.

Interpretation & Conclusion: Findings of this study corroborate the hypothesis that gradual loss of ovarian function is associated with a concomitant increase in oxidative stress as exhibited by increased MDA levels and decreased levels of antioxidants.

Keywords: *Antioxidants, Ascorbic Acid, Menopause, Oxidative Stress, Malondialdehyde, Superoxide Dismutase*

INTRODUCTION

Oxidative stress is an imbalance between pro-oxidant and antioxidant forces resulting in an overall pro-oxidant insult. It may also be defined as an imbalance between reactive oxygen species (ROS) and antioxidants, favouring an overabundance of ROS. The consequence of overproduction of ROS can be observed as increased levels of markers of oxidative stress, such as lipid peroxides[1]. Free radicals are responsible for widespread and indiscriminate oxidation and peroxidation of lipids, denaturation of proteins, depolymerization of polysaccharides, breakage and modification of DNA or any other cell structure, causing cell death or organ damage[2]. Antioxidants help to defend the body against free radical attack and human body has got well developed endogenous antioxidant defense system like cellular enzymes and vitamins. Vitamin C forms the first line of antioxidant defence in human plasma exposed to a variety of oxidant insults[3]. A group of antioxidants present in RBC that prevent lipid peroxidation consists of SOD, GPX, catalase and reduced glutathione[4].

Oxidative stress influences the entire reproductive lifespan of a woman and even thereafter i.e.

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menopause[5]. Menopause is a natural step in the process of ageing and free oxygen radicals have been proposed as important causative agents of ageing[6]. Estrogens have free radical scavenging structures[7] and have been shown to have *in vitro* antioxidant effects on membrane phospholipid peroxidation[8]. The process of ageing is enhanced due to the damage caused by free radicals; hence menopausal women are proposed to develop oxidative stress because of estrogen deficiency and advancing age[9].

In view of this scientific background, present study was carried out to evaluate the effect of menopause on oxidative stress.

MATERIALS & METHOD

This study was conducted in the Department of Physiology, S.M.S. Medical College, on 105 women volunteers. The subjects were categorized as:

Women of Reproductive Age: Normally menstruating women of age 21 – 40 years. This group was further subdivided, on the basis of age of the subjects, into two sub-groups to ascertain the effect of ageing on the extent of oxidative stress as women of both these sub-groups were menstruating normally.

Sub-Group A: Women of age 21 – 30 years.

Sub-Group B: Women of age 31 – 40 years.

Peri-menopausal Women: Women of the age group 41 – 45 years. Both normally menstruating, and women with some sort of menstrual disorders e.g. irregular menses, menorrhagia, etc. were included in this group; but women experiencing amenorrhea were excluded.

Postmenopausal Women: Women who had at least one year of amenorrhea, and were not receiving hormone replacement therapy; age: 46 – 50 years.

All subjects were screened for their general and medical history, especially menstrual and reproductive. The subjects suffering from any disease and/or showing any pathology were excluded from the study. Women taking oral contraceptives, antioxidants or any other drug were also excluded from the study. Clinical examination was carried out with the aid and advice of a competent gynaecologist. Using aseptic techniques, 5 ml venous blood was drawn from the antecubital vein of the volunteers after informed consent. We evaluated the status of an enzymatic antioxidant – superoxide dismutase (SOD), a non-enzymatic antioxidant – ascorbic acid (Vitamin C), and a marker of lipid peroxidation – malondialdehyde (MDA) in the blood/sera of the subjects to find out the correlation, if any, between menopause and oxidative stress.

SUPEROXIDE DISMUTASE ESTIMATION

Ransod kit, manufactured by Randox Lab. Ltd, was used for the estimation of SOD activity in the erythrocytes. 0.5 mL of whole blood was centrifuged for 10 minutes at 3000 rpm, and the plasma was aspirated off. Erythrocytes were washed four times with 3.0 mL of 0.9% NaCl solution and were centrifuged for 10 minutes at 3000 rpm after each wash. Lysate was prepared by suitable dilution with cold redistilled water and was further diluted with 0.01 mol/L phosphate buffer (pH 7.0). SOD activity was estimated in thus prepared samples and standards as per the procedure described in the kit literature[10].

ASCORBIC ACID ESTIMATION

0.2 ml of serum was added to 0.8 ml of 10% TCA and mixed well. Tubes were allowed to stand for 5 minutes and were centrifuged at 2000 rpm. 0.5 ml of supernatant was transferred to a small test tube and 0.2 ml of DNPH reagent was added. Capped tubes incubated at 37°C for 3 hours. Tubes were then chilled on ice-bath and 0.8 ml of cold 65% H_2SO_4 was added, and mixed well. Tubes were allowed to stand for 30 minutes at R.T. Blank comprised of 0.5% TCA, treated as for serum. Standard comprised of the 1.0 mg/dl ascorbic acid. Absorbance was read against the blank at 520 nm on a spectrophotometer[11].

MALONDIALDEHYDE ESTIMATION

Serum malondialdehyde, was estimated as Thiobarbituricacid Reacting Species (TBRS) by the method described by Slater TF & Sawyer BC, 1971[12], and Satoh, 1978[13]. To 0.5 ml serum, 2.5 ml of 20% TCA was added and the tube was left to stand for 10 minutes at room temperature. After centrifugation at 3500 rpm for 10 minutes, the supernatant was decanted and the precipitate was washed once with 0.05 M H_2SO_4. 2.5 mL of 0.05 M H_2SO_4 and 3.0 ml of 0.67% thiobarbituric acid reagent in 2M sodium sulfate solution were added to the precipitate. The coupling of lipid peroxide with thiobarbituric acid was carried out by heating the mixture in a boiling water bath for 30 minutes. After cooling, the resulting chromogen was extracted with 4.0 ml of n-butyl alcohol by vigorous shaking. The separation of the organic phase was facilitated by

centrifugation at 3000 r.p.m. for 10 minutes. Blank comprised of distilled water, treated as for serum. Standard comprised of 0.5 mL of the 10 nmol/mL malondialdehyde. Absorbance of the organic phase was determined at the wavelength of 530 nm on a standard spectrophotometer. Thiobarbituric acid reagent and malondialdehyde-bis-diethyl-acetal (1,1,3,3, tetraethoxy propane) were procured form Sigma-Aldrich, New Delhi.

Statistical Analysis

Data obtained for various parameters was subjected to statistical analysis. Arithmetic means and standard deviations were calculated to compute 't values' (student's t- test). ANOVA test (analysis of variance) was also employed and 'F values' (Fischer's test) were calculated. On the basis of t and F values 'P' (probability) was determined. Pearson's correlation coefficients (r) were also calculated to test inter-parameter correlations. $P < 0.05$ was considered significant for all tests[14].

RESULTS

Mean values of the parameters studied are presented in table: 1. Superoxide dismutase levels were found to be low in both pre-menopausal women and post-menopausal women in comparison to women of reproductive age. The decrease was, however, more marked in post-menopausal women. Further, difference between SOD levels of women of reproductive age and post-menopausal women was statistically significant.

Serum ascorbic acid levels were also significantly decreased in pre-menopausal and post-menopausal women in comparison to those observed in women of reproductive age. Post-menopausal women exhibited lowest ascorbic acid levels.

Serum malondialdehyde concentrations were recorded highest in post-menopausal women, intermediate in pre-menopausal women, and lowest in women of reproductive age. It's noteworthy that the pattern exhibited by MDA values in the three groups is opposite to the pattern exhibited by both SOD and Ascorbic Acid. SOD and Ascorbic acid are anti-oxidants while MDA is a marker of lipid peroxidation or oxidative stress. The trends exhibited by the three parameters establish that levels of both enzymatic and non-enzymatic anti-oxidants gradually decrease while the MDA levels increase steadily among the groups in the following order: women of reproductive age, pre-menopausal women, and post-menopausal women.

Table 1: Mean values of the parameters studied in the three groups of subjects

Parameters	Groups			Groups Compared		
	Reproductive Age N=35	Pre-Menopausal N=35	Post-Menopausal N=35	Rep. Age v/s Pre-Meno	Rep. Age v/s Post-Meno	Pre-Meno v/s Post-Meno
SOD (U/mL)	179.56 ± 82.69	155.84 ± 57.48	139.15 ± 54.31	> 0.05	< 0.05*	> 0.05
Ascobic Acid (mg/dL)	1.01 ± 0.24	0.90 ± 0.19	0.79 ± 0.22	< 0.05*	< 0.001*	> 0.05
MDA (nmol/mL)	3.33 ± 0.87	4.07 ± 1.56	6.10 ± 1.93	< 0.05*	< 0.001*	< 0.05*

* Significant

Analysis of variance (ANOVA) showed that - within group variations, of all the three parameters studied, were significantly less in comparison to the inter-group differences, as depicted in table no.: 2. These findings reaffirm the significance of variance deduced by student's t test and indicate that subjects of a group exhibit some sort of uniformity in regard to the extent of oxidative stress present.

Table 2: Analysis of Variance (ANOVA) in the parameters studied

Parameter	F Value	P Value
SOD	5.56	< 0.05*
Ascorbic Acid	5.86	< 0.05*
MDA	21.36	< 0.001*

* Significant

Table 3 depicts the mean values of SOD, Ascorbic acid, and MDA in the two sub-groups of women of reproductive age. No significant difference was observed in any of the parameters of the subjects of the two sub-groups.

Table 3: Mean values of the parameters studied in two Sub-Groups of Reproductive Age Women

Parameter	Reproductive Age Women Sub-Groups A	B	P Value
	21 – 30 years (n=17)	31 – 40 years(n=18)	
SOD (U/mL)	184.30 ± 76.79	175.09 ± 83.42	> 0.05
Ascorbic Acid (mg/dL)	0.99 ± 0.18	1.02 ± 0.27	> 0.05
MDA (nmol/mL)	3.12 ± 0.69	3.53 ± 1.03	> 0.05

Significant positive correlation was found in superoxide dismutase and ascorbic acid; while significant negative correlations were observed between superoxide dismutase and malondialdehyde, and between ascorbic acid and malondialdehyde as illustrated in figures: 1, 2, and 3 respectively. These correlations strengthen the hypothesis that menopause (or gradual ovarian dysfunction) decreases antioxidant levels, and increases lipid peroxidation, simultaneously.

DISCUSSION

Various studies conducted by different authors, exhibit a fair measure of ambiguity with regard to the effect of menopause on SOD levels. Shrivastava V et al reported that post-menopausal women had significantly lower concentrations of SOD in comparison to pre-menopausal women[9]. Krstevska M *et al* observed that SOD levels were decreased in peri-menopausal and post-menopausal women as compared with normally menstruating women; however, the variations were statistically non-significant[15]. Bednarek-Tupikowska G et al stated that SOD activity did not differ between pre-menopausal and post-menopausal women[16]. However, Gurdol F et al found increased SOD activity in menopausal women, but only at an older age[17].

Relatively few studies have been conducted on the association of menopause and serum ascorbic acid concentration; however, studies reviewed for this study indicate that post-menopausal women exhibit lower serum ascorbic acid levels. Oner P et al found mean leukocyte and plasma ascorbate values in postmenopausal women significantly less but within acceptable ranges as compared to normally menstruating women[18]. According to these observations, plasma and leukocyte ascorbic acid concentrations decreased after the cessation of ovarian hormone production. Vural P et al also reported a significant decrease in plasma ascorbic acid in postmenopausal women, in comparison to healthy control women[19].

Various authors have suggested that ageing and menopause lead to increase in lipid peroxidation and hence increased serum malondialdehyde levels are observed in post-menopausal women. Banu O et al observed significantly higher MDA in the postmenopausal group than the control group and the age-matched male group[20]. Shrivastava V et al reported that post-menopausal women had higher levels of MDA in comparison to pre-menopausal women[9]. Bednarek-Tupikowska G et al reported significantly higher lipid peroxide levels in the post-menopausal women than in the control group[21].

Mean ages of women of reproductive age, pre-menopausal women and post-menopausal women were 30.74 ± 5.72 years, 43.06 ± 1.49 years and 47.91 ± 1.40 years respectively. It is qualified to doubt that the differences observed among these groups may be due to differences in the age of the subjects because increased oxidative stress is an attribute of ageing. Since ovarian dysfunction and menopause are also implications of ageing, so to evaluate general increase in oxidative stress due to ageing - women of reproductive age were divided into two sub-groups i.e. sub-group A including women of 21–30 years while sub-group B comprising women of 31–40 years. The mean age of sub-group A was 25.76 ± 3.01 years, while that of sub-group B was 35.44 ± 2.94 years. However, no significant variation was observed between the two

sub-groups of reproductive age women, in any of the analytes (Table: 3) in spite of difference of ten years in the mean age of subjects of the two sub-groups. Therefore, the increased oxidative stress evident in post menopausal women as compared to the peri-menopausal women cannot be attributed to ageing alone; the difference in mean age of the subjects of the two groups being less than five years.

Women with proper ovarian function (pre-menopausal) exhibited highest values of SOD and ascorbic acid and lowest value of MDA, intermediate values of the two antioxidants studied and MDA were represented by women with mild ovarian dysfunction (pre-menopausal) while the highest levels of MDA and the lowest levels of SOD and ascorbic acid were observed in women suffering from ovarian dysfunction (post-menopausal). This order indicates that ovarian dysfunction may be responsible for the oxidative stress evident in both pre-menopausal and, more remarkably, in post-menopausal women.

CONCLUSION

Findings of this study corroborate the hypothesis that loss of ovarian function is associated with a concomitant rise in oxidative stress as exhibited both by decreased levels of antioxidants and increased lipid peroxidation in post menopausal women. We suggest further studies on this issue so that the intricate relationship between menopause and oxidative stress is understood more clearly and such knowledge may contribute in attenuation of distress caused by menopause to half of the world's population.

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DOI Number: 10.5958/j.2320-608X.2.1.026

Unilateral Juvenile Hypertrophy of Breast

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ABSTRACT

Juvenile hypertrophy of the breast (JHB) is an uncommon, benign disorder and typically starts at the adolescence in females. It is characterized by rapid enlargement of breasts, either unilateral or bilateral. The definitive diagnosis is made by histopathologic examination. Treatment recommendations include surgery and hormonal therapy, although hormonal manipulation is still controversial in pediatric patients. Here we report an adult female 35-year-old with right sided JHB who did not undergo surgery or medical treatment.

Keywords: *Juvenile Hypertrophy of Breast*

INTRODUCTION

Juvenile hypertrophy of the breast or virginal hypertrophy of the breast or juvenile gigantomastia or macromastia is an uncommon, benign disorder and typically occurs in adolescent females usually sporadically.However some familial cases are also reported[1,2]. It occurs more commonly in girls between 8 to 16 years of age, and is clinically characterized by rapid enlargement of the breast[1,3]. The overgrowth of the breasts is usually bilateral[4,5,6,7].

Tenderness of breast, back and neck pain, dilatation of superficial veins on the breast are some common clinical presentations. In some cases, skin ulcerations can be found. Psychological disturbances owing to the cosmetic reasons are also noted.

We present a patient with unilateral JHB who did not undergo any treatment.

CASE REPORT

A 35 year old married female presented with a chief complaint of enalargement of right breast for more than 15 years .The present size was almost double the size of the left breast. Some tenderness ,stretching of skin , erythema and prominence of veins was seen on the right breast seen but no lump or nodule was palpated. No nipple discharge or retraction was seen. Axillary lymph nodes were not enlarged.

No history of trauma, infection or surgery could be obtained.

Complete blood count, erythrocyte sedimentation rate, peripheral smear and chest radiography were normal. Ultrasonographic examination of the right breast showed an abnormal hyperechoic mass lesion that suggested a giant fibroadenoma of the breast.

FNAC was done with 23 G needle and fatty material aspirated . MGG and Pap staining was done and the smears examined . Cytological smears revealed large sheets of normal breast epithelium along with dense fibrocollagenous tissue. A diagnosis of giant fibroadenoma was reached at.

Histopathological examination demonstrated proliferation of both stromal and ductal epithelial elements. There was also myoepithelial proliferation with budding in ductal structures with normal tubular structures in some areas, which were compatible with JHB.

DISCUSSION

Juvenile gigantomastia is a benign disorder of the breast in which one or both of the breasts show gradual macromastia or sudden massive increase in size during adolescence.Thelarche ,the first sign of puberty is the result of complex hormonal influences. Ductal and lobular-alveolar development is mainly influenced by

estrogen and progesterone, respectively[3,5]. In one categorization, ideal breast size was reported as 250 mm^3 to 300 mm^3, and the size between 400 mm^3 to 600 mm^3 was considered as moderate hypertrophy and more than 1500 mm^3 as gigantomastia[4].Juvenile hypertrophy of the breast is a very uncommon disorder that results in pathologic overgrowth of the breasts[1,11]. Bauer et al[9] reviewed all pediatric breast pathologies over an 11-year period and found only five cases (12.5%) with the diagnosis of JHB among 40 adolescent patients. In JHB, the overgrowth of the breasts is usually bilateral, although unilateral JHB has been described, as in our patient[4,5,6,7]. Initially, rapid enlargement of the breast occurs for about three to six months followed by continuous but slow growth of the breast[1,3].In JHB, the breasts are usually pendulous and diffusely firm, without any discrete mass lesions, but ropelike thickenings may develop. It can cause breast pain, and back and neck pain. Dilatation of superficial veins or skin ulcerations may be present. Physical and psychological problems may develop.The etiology of JHB is uncertain. In these individuals hormonal studies are normal, and the number of estrogen receptors is not different from healthy adolescents[1,5]. Some authors have suggested that JHB may develop due to an endorgan hypersensitivity and exaggerated response to normal levels of sex steroids[1,3,5].Lesions mimicking JHB include fibroepithelial tumors of the breast such as juvenile phyllodes tumor and fibroadenomas, pseudo-gigantomastia associated with obesity, gravid hypertrophy of the breast, malignant tumors such as lymphomas and sarcomas, breast hypertrophy secondary to endocrine disorders , pseudoprecocious puberty resulting from ovarian granulosa cell tumors, follicular cysts, adrenocortical tumors, and exposure to a variety of hormones, including gonadotropins, estrogens, testosterone, and corticosteroids.Ultrasonographic (US) examination of the breasts is rarely useful. USG breast examination of our patient showed a regular, hyperechoic, giant mass in the right breast, which suggested a giant fibroadenoma. Fibroadenomas should be considered in the differential diagnosis of JHB. Especially juvenile and giant forms of fibroadenomas are more likely to mimic JHB[3,9]. Both entities result from end-organ hypersensitivity to normal levels of hormones. Although histological findings are similar in these two entities, tumor capsule is not present, stroma is less organized and ductal proliferation is more prominent in JHB than in fibroadenomas[1,3].In our patient, the final diagnosis of JHB was made by histopathological examination. Histologically, this condition is an exaggeration of the normally developing breast showing varying degrees of stromal and ductal hyperplasia with dilatation and cystic degeneration of the ducts, and interstitial and periductal edema[1,3].(Fig. 1)Reduction mammoplasty is the definitive treatment in most cases. Mastectomy with prosthetic implant and hormonal manipulation are other modalities as per the patient's age and need.Appropriate surgical intervention should be performed in late adolescence or early adulthood when breast growth rate stabilizes and ideally when no change in size is detected over the last 12 months[1,3,4,5,9]. Breast reduction surgery is usually the treatment choice. The most commonly applied procedure is reduction mammoplasty with sparing of the nipple areola complex[2,3]. The recurrence of breast hypertrophy requiring additional surgery is a major problem.Hormonal manipulation remains controversial because of unknown long-term effects. Antiestrogen drugs such as medroxyprogesterone, dydrogesterone, and tamoxifen citrate have been shown to be useful as they cause reduction in the breast size . Tamoxifen citrate is found to be the most effective agent for preventing recurrence[2,3]. However, potential side effects of tamoxifen citrate limit its use in children.In conclusion, JHB is a rare benign disorder that should be kept in mind during the differential diagnosis of abnormal breast enlargement in pubertal girls. Diagnosis can be challenging especially when it is unilateral. Definitive diagnosis can be made by histopathological examination. Patient' symptoms and psychological condition plays a role in deciding the treatment. Unnecessary interventions should be avoided.

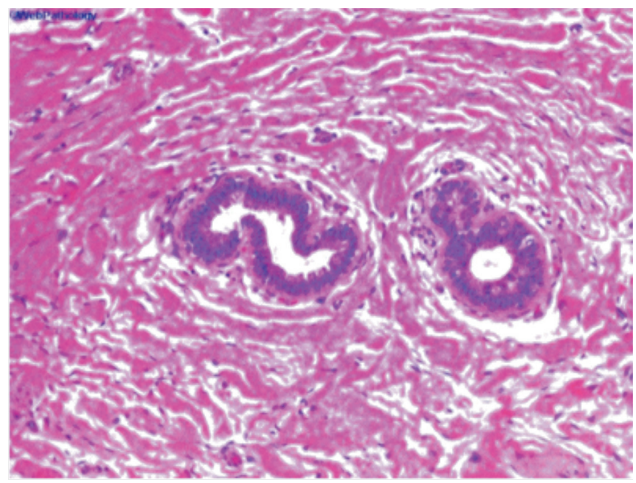

Fig. 1. H & E showing ductal and stromal hyperplasia(40X)

Source of Funding: Nil

Ethical Clearance: Taken

Conflict of Interest: Nil

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DOI Number: 10.5958/j.2320-608X.2.1.027

Study of Some Hematological Parameters in Normal Pregnancy and Pregnancy Induced Hypertension

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ABSTRACT

Introduction: Pregnancy Induced Hypertension (PIH) is defined as hypertension that occurs in pregnancy for the first time after 20 weeks of gestation and disappears following delivery. It affects approximately 6-8% of all pregnancies, most often the primigravidas. It is one of the most important causes of maternal and fetal morbidity and mortality.

Material & Method: About 140 female are randomly selected with the age ranging from 18 to 45 years from the OPD, Department of Obstetrics & Gynaecology, out of which 70 pregnancy induced hypertensive female at gestational age of > 20 weeks as study group and 70 normotensive pregnant female at gestational age of > 20 weeks as control group. The control group is free from any systemic disease. Now the study group i.e. case and control group are further divided into group A, B and C respectively. The haematological analysis include Haemoglobin, Total leucocyte count, Platelet Count, RBC count, Differential Leucocyte count, Prothrombin time, activated partial thromboplastin time (aPTT), SGOT, SGPT, Serum Total protein, S. Albumin, S. Globulin and A: G Ratio.

Result: In group C there is significant difference in Haemoglobin and Total Leucocytes count (TLC) of case and control. Platelet Count there is significant difference in between case and control of group A, B and C. Serum Globulin, A/G Ratio there is significant difference in between case and control of group, B and C. PT and aPTT there is highly significant difference in between case and control of group A, B and C.

Conclusion: We found that there is a significant correlation between the Platelet Count, PT and aPTT and the severity of PIH.

Keywords: *Pregnancy Induced Hypertension, Primigravidas, Platelet Count, Prothrombin Time, Activated Partial Thromboplastin Time*

INTRODUCTION

During Pregnancy there is progressive anatomical & physiological changes not only confined to the genital organs but also to all systems of the body.This is principally a phenomenon of maternal adaptation to the increasing demands of the growing fetus.[1]

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Pregnancy Induced Hypertension (PIH) is defined as hypertension that occurs in pregnancy for the first time after 20 weeks of gestation and disappears following delivery. Out of all the haematological changes that occur in pre-eclampsia and eclampsia, thrombocytopenia is the most common haematological abnormality found. The prothrombin time and activated partial thromboplastin time (aPTT) are found to be altered.[2] It affects approximately 6–8% of all pregnancies, most often the primigravidas. It is one of the most important causes of maternal and fetal morbidity and mortality.[3]Considering the haematological changes that occur in pregnancy,

leucocytosis occurs in the later part of normal pregnancy mainly due to polymorphonuclear leucocytosis.[4] No significant alteration is observed in the no. of circulating Lymphocytes, although their function may alter in pregnancy.[5] The RBC mass is increased to the extent of 20%-30 %. Recent studies regarding Platelet count however gives a conflicting picture showing the rise, static or even a fall to the extent of 15% of pre-pregnant level. It may be due to increased platelet consumption.

HELLP Syndrome (Hemolysis, Elevated liver enzyme, low Platelet count <1 lacs/ mm3) is variant of severe pre-eclampsia [note: hypertension may be absent (12% to 18%), mild (15% to 50%) or severe (50%)] where protienuria may be absent as well; A platelet count of less than 100,000/mm^3 is the most consistent finding in HELLP Syndrome.[6] Hence early assessment of severity of PIH is necessary to prevent complications like HELLP syndrome and increased maternal and fetal morbidity and mortality.

As such the present study has been undertaken to evaluate the relationship between haematological parameters in normal pregnancy and Pregnancy induced hypertension

MATERIAL & METHOD

The present study was conducted in department of Physiology in collaboration with the department of Obstetrics and Gynecology after the approval of ethical committee of the institute. About 140 female are randomly selected with the age from 18 to 45 years from the OPD, Department of Obstetrics & Gynaecology, between the periods ranging from January 2012 to December 2012. Out of which 70 pregnancy induced hypertensive female at gestational age of > 20 weeks as study group and 70 normotensive pregnant female at gestational age of > 20 weeks as control group. The control group is free from any systemic disease. Now the study group i.e. case and control group further divided into group A, B and C respectively. The anthropometric parameter like Age Height Weight and BMI of case and control does not have significant different. Group A (n=30) is female with Gestational Hypertension (GH), Group B (n=22) is female with Pre-eclampsia (PE) and Group C (n=18) is female with Eclampsia(E) and compare with respective number of female of control group.

Specimen Collection: About 5 ml of venous blood will be obtained after 10-12 hours of fasting through routine method applying aseptic technique and tourniquet for as short a time as needed. In case of Eclampsia, the venous blood will be considered as random as patient will be on I.V. fluid containing dextrose and not on normal diet. Haematological analysis include Haemoglobin, Total leucocyte count, Platelet Count, RBC count, Differential Leucocyte count, Prothrombin time, activated partial thromboplastin time (aPTT), SGOT, SGPT, Serum Total protein, S. Albumin, S. Globulin and A: G Ratio

Statistical Analysis: The data was statistically analysed by using SPSS (version17) for the determination of the significant relation by paired student t test between hematological parameters with pregnancy induced hypertension and normal pregnancy.

RESULT

In the present study about 140 female are randomly selected with the age from 18 to 45 years from the OPD, Department of Obstetrics & Gynaecology, Out of which 70 pregnancy induced hypertensive female at gestational age of > 20 weeks as study group and 70 normotensive pregnant female at gestational age of > 20 weeks as control group and they are further divide into Group of A, B and C. Table1 shows the anthropometric parameter of case and control of different groups. Table 2 represents the Haematological parameter are different within the group of case and control. The mean value of Haemoglobin and Total Leucocyte count (TLC) of case and control of group A and B are decrease but not significantly , but in group C there is significant difference in Haemoglobin and Total Leucocyte count (TLC) of case and control. Total Red Blood Count (TRBC) there is no significant difference between case and control of group A, B and C. Platelet Count there is significant difference in between case and control of group A , B and C($p< 0.01$). There is no significant difference in Total Protein, Serum Albumin of case and control of group A,B and C There is significant difference in Serum Globulin, , A/G Ratio of case and control of group, B and C, but not in group A. PT (Prothrombin time), aPTT (Activated partial thromboplastin time) there is highly significant difference in between case and control of group A, B and C($p< 0.01$).

Table1: Comparison of Anthropometric Parameters between the case and control within Group A, B and C

PARAMETER	Group A (n=30)		Group B (n=22)		Group C(n=18)	
	Case Mean±SD	Control Mean±SD	Case Mean±SD	Control Mean±SD	Case Mean±SD	Control Mean±SD
Age	25.07±4.45	25.37±4.29	23.45±3.07	24.32±3.99	25.17±5.54	26.28±5.37
Height	157.20±4.50	158.83±3.97	160.68±6.06	157.77±5.37	158.94±6.08	157.78±4.57
Weight	59.63±7.70	60.73±7.73	62.55±8.84	60.95±6.04	63.17±7.73	61.06±8.51
BMI (Kg/m^2)	24.10±2.65	24.09±3.08	24.15±2.45	24.61±3.29	24.94±1.89	24.61±3.87

Table 2: Comparison of Hematological Parameters between the case and control within Group A, B and C

PARAMETER	Group A (n=30)		Group B (n=22)		Group C(n=18)	
	Case Mean±SD	Control Mean±SD	Case Mean±SD	Control Mean±SD	Case Mean±SD	Control Mean±SD
Hb	10.49±1.52	10.62±1.11	10.53±1.44	10.86±0.95	8.42±1.32	10.13±1.74*
TLC	7480.00±1939.14	7043.33±2010.44	8172.73±1928.53	8310.45±2133.58	6161.11±1794.15	8283.33±2462.24*
TRBC	4.64±0.44	4.76±0.29	4.72±0.29	4.82±0.27	4.30±0.47	4.55±0.52
PL	2.15±0.26	2.43±0.49**	2.18±0.30	2.46±0.46**	1.64±0.26	2.52±0.65**
TP	5.72±0.48	5.81±0.55	5.77±0.47	5.99±0.40	5.83±0.31	5.80±0.45
SA	3.04±0.29	3.08±0.31	3.09±0.31	3.08±0.17	3.09±0.21	2.99±0.21
SG	2.68±0.29	2.73±0.34	2.67±0.26	2.86±0.27^	2.70±0.22	2.81±0.26^
A/G	1.14±0.13	1.14±0.15	1.16±0.13	1.08±0.09^	1.15±0.11	1.07±0.06^
PT	12.63±0.63	11.54±0.48^^	12.89±0.74	11.55±0.38^^	13.86±0.56	11.62±0.66^^
aPTT	28.84±2.56	22.81±0.96^^	29.57±2.05	23.43±1.36^^	31.54±1.03	23.49±1.38^^

Hb- Haemoglobin, TLC- Total Leucocyte Count, TRBC- Total Red Blood Count,PL- Platelet Count, TP- Total protein, SA- Serum Albumin, SG- Serum Globulin A/G- Serum Albumin Serum Globulin Ratio, PT- Prothrombin time, aPTT- activated partial thromboplastin time

*Significant difference of Haemoglobin($p<0.001$) and TLC($p<0.05$) of case w.r.t control within Group C.

**Significant difference of Platelet Count of case w.r.t control within Group A.($p<0.01$), B.($p<0.05$) and C($p<0.001$)

^ Significant difference of Serum Globulin of case w.r.t control within Group B($p<0.05$) and C($p<0.001$) but A/G Ratio Group B($p<0.05$) and C($p<0.05$)

^^ Significant difference of PT and aPTT of case w.r.t control within Group A,B and C ($p<0.001$)

DISCUSSION

The present study was conducted in Department of Physiology and Department of obstetrics and gynacology. The study of S. Mohapatra *et.al.* concluded that there is an inverse relationship between the severity of PIH and platelet numbers. Which means in severe eclampsia there is decrement of platelet count occur our study also have similar result.[2] Vamseedhar Annam *et.al.* concluded that although it is generally accepted that the hemoglobin concentration decreases and white cell count increases during normal pregnancy, there is less accord regarding changes in platelet indices. The aim of this study is to find out the relationship between platelet indices and platelet counts with pre-eclampsia and eclampsia. But In our study there is no significant difference in Haemoglobin and total leucocyte count there is no significant difference in Group A and B But in group C there is significant difference Haemoglobin and total leucocyte count which is almost similar to the study of Vamseedhar Annam *et.al.* In the platelet count our study also reassembles with the study of Vamseedhar Annam *et.al* which state that the platelet count, mean platelet volume, platelet distribution width and platelet large cell ratio were compared,[3]. The platelet counts were lower while the mean platelet volume, platelet distribution width and platelet large cell ratio were increased in pre-eclampsia and eclampsia as compared to control group. We found a relationship between platelet indices and severity of pre-eclampsia. The estimation of platelet indices can be considered as an early, simple and rapid procedure in the assessment of severity of pre-eclampsia.

Other study also support my study are study by Magann EF *et.al.* concluded that platelet count determinations are the best tests of disease severity and progression/recovery with HELLP syndrome[7] and study of Soldo V *et.al.* said that Thrombocytopenia is

the second most common blood disorder in pregnancy. It is encountered in 7-8 % of all pregnancies. Gestational thrombocytopenia accounts for almost three fourths of all cases of thrombocytopenia. It usually develops in the third trimester, detected incidentally, patients are asymptomatic with no prepregnancy history of low platelets or abnormal bleeding, it is mild thrombocytopenia (counts more than 70.000/ ìL)[8]. In case of Serum Albumin, Serum Globulin and Serum Albumin Serum Globulin Ratio the result of our study is to the study of G.K. Pal *et. al*. found that A/G ratio was significantly high in PIH group in comparison to risk group and control group subjects.[9]

PT (Prothrombin time) aPTT (Activated partial thromboplastin time) there is highly significant difference in between case and control of group A, B and C. The observation made by Mary Pat FitzGerlad *et.al.* in their studies whether a normal platelet count is a reliable predictor of the absence of other coagulation abnormalities in patients with hypertensive disorder of pregnancy & found that a normal platelet count was present in 44% of simultaneous samples that had a prolonged PT, in 26% of those with low fibrinogen, and in 44% with positive D-dimer or fibrin split products. They also observed that the repetitive testing of liver enzymes in this group of patients is of uncertain benefit. Studies report the frequency of abnormal PT and PTT in patients with pre-eclampsia and eclampsia to be between 0% and 50 %.[10] Mc. Crae *et.al.* noted that PT, aPTT, fibrinogen level remains normal, in patients of thrombocytopenia.[11]

CONCLUSION

So the above study we concluded that there is a significant correlation between the Platelet Count, PT and a PTT and the severity of PIH.

ACKNOWLEDGEMENTS

We would like to thank our principal for allowing to do the research work and all the staff of department of physiology Rohilkhand Medical college and Hospital Bareilly for extending all kind of cooperation during the study.

Conflict of Interest: None

Source of Funding: None

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DOI Number: 10.5958/j.2320-608X.2.1.028

A Study to assess, the Extent of Autonomic Dysfunction Based on the Standard Cardiovascular Tests in Different Grades of Alcoholics

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ABSTRACT

Aim: Autonomic system is the one which extensively supplies the inner organs. Much attention is not given to it clinically and there are few tests available to assess it. The tests which are available are less used in patients to assess the autonomic function. Alcoholism is a factor which affects most of the system in the human body. Its effect on autonomic nervous system is extensive. As a result of this autonomic failure there would be damage to multiple systems.

Study design: In this study the effect of alcoholism in a group of people grading them as social drinkers, chronic alcoholics and alcoholic cirrhotics have been done using the seven standard autonomic function tests. The extent of autonomic damage in all these different groups was done. The results were compared against a group of controls.

Results: There was autonomic damage observed in all three groups with a distribution of 50% mild damage and 30% of moderate damage in social drinkers. A 20% of severe damage (combined damage) in chronic alcoholics and 90% of severe damage in alcoholic cirrhotics were obtained. A significant difference was observed between all groups of alcoholics and the controls ($p< 0.01$)

Conclusion: The extent of autonomic damage seems to be underestimated in alcoholics. More care should be given to high social drinkers as they too exhibited autonomic damage. Also these simple tests should be performed as a routine on all alcoholics for an early detection of the situation.

Keywords: *Autonomic Dysfunction, Social Drinkers, Alcoholic Cirrhotics, Alcoholics*

INTRODUCTION

Alcoholism is a preventable universal problem, the prevalence being quite high in our country. Despite the low socio economic status, the lower income group spend majority of their earnings towards this habit. Also this particular habit has a dual ill effect. One is the economic hazard and next is the health hazard. It is this area that we are concerned as health care providers.

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Alcohol called as 'ethanol' is a weakly charged molecule which moves easily through cell membrane. One factor to be kept in mind is that once the body cells have adapted to chronic ethanol exposure, the structural or biochemical changes may not return to normal for several weeks or more.

Subjects with alcoholic fathers had lower levels of response to alcohol ie to explain, less intense feeling of intoxication, less impairment in cognitive tests, less prolactin and cortisol secretion. 'This low level response is a powerful predictor of alcoholism a decade later'. Ultimately these facts underscore the probability that alcoholism is biologically influenced and not related to a 'lack of morality'.

However the alcoholic if continues to drink, the life span is shortened by 15 years. The reasons for short life span being cancer, accident, suicide, and systemic diseases of the cardiovascular system, Central nervous system, liver, Gastrointestinal system etc.

Functional disturbance of all these organs is possibly due to the effect of this habit on autonomic nervous system. Abnormal parasympathetic (vagal) and sympathetic function occurs in alcoholics. Alcoholic neuropathy is a dying back neuropathy[1]. It means that "the most distal parts of the longest nerves are affected earliest and the shorter and sympathetic fibers are not affected until later stage of illness". Autonomic involvement may contribute to high morbidity rates in cirrhotics associated with alcoholism[2].

Duncan[3] in his work has reported the presence of parasympathetic neuropathy due to vagal damage. Situation like this can alter the efferent input from central volume receptors and baroreceptor, causing defective response to stress. Johnson[4] in his work says that clinical importance of ANS assessment in alcoholics derives from evidence that autonomic neuropathy is associated with high risk of mortality mainly attributing to cardio respiratory events causing sudden unexplained death. Hence this study was designed to explore the ill effects of alcohol consumption on autonomic functioning in various grades of alcoholics based on simple non invasive bedside tests[5]

MATERIALS AND METHOD

The study was carried out after obtaining the necessary approvals from the Institutional Human Ethics Committee and Institutional Research Committee.

4 groups of subjects were chosen on the basis of their drinking habit.

Group I (controls)	– non alcoholics	Group II (test)	– social drinkers
Group III (test)	– chronic alcoholics	Group IV (test)	– alcoholic cirrhotics

A sample of 10 subjects in each group was studied, accounting to a total sample size of 40. The grading of alcohol consumption as mentioned in the above list was selected on the basis of a questionnaire.

Identification of the test sample was done based on the questionnaire by a scoring system. There were a set of 10 questions each given a score of '0' or '1' each. If the score was between 1 to 5 they were grouped as social drinkers. If the score was between 6 to 10 they were grouped as chronic drinkers. The diagnosis of the alcoholic cirrhosis was made by the clinical examination, biochemical, laboratory parameters, ultrasound findings & presence of oesophageal varicies. The possibilities of other etiologies were ruled out by doing the viral markers. All patients (cirrhotics) were negative for HbsAg, & HCV antigens.

The study was done on the patients after clearly explaining to them the purpose of the study and getting the written informed consent.

Inclusion Criteria

1) Age groups of 20 to 60 years
2) Men alone were included
3) Controls were healthy volunteers with no history of alcohol consumption.
4) Only alcoholic cirrhotics were included in the study.

Exclusion Criteria.

1) Age group <20 and >60 not included.
2) Women were not taken up for the study.
3) Other etiologies of liver cirrhosis were excluded
4) Subjects on drugs that would cause autonomic damage were not included.
5) Persons with diabetes mellitus were excluded, as it would confound the interpretation of autonomic function test.

All the participants were subjected to seven standard autonomic function tests[6] for both parasympathetic and sympathetic function assessment. All the tests were non- invasive, simple and easy to understand and perform. The tests were performed 2 hours after meals and they were instructed to avoid caffeinated beverages at least 2

hours before test and not to consume alcohol 24 hours prior to the study.

The tests were carried out using the equipment BIOPAC SYSTEMS Inc which consists of MP 30 hardware unit, customized and configured with biopac student labpro software. The ECG recordings were done with this and blood pressure recordings were done using the sphygmomanometer.

The following tests were done;

1) Heart rate variation during deep breathing.

2) Heart rate response to Valsalva manoeuvre.

3) Heart rate response to standing.

4) 30: 15 ratio. (RR interval).

5) Blood pressure response to standing.

6) Sustained hand grip test.

7) Cold pressor test.

Out of the above mentioned tests, the first four are to evaluate the parasympathetic function and the last three are to evaluate the sympathetic function. A scoring system was done to assess the extent of the autonomic damage. For each test, '0' score was given for normal value, '1' for a borderline value and '2' for abnormal value.

Table 1. Interpretation of autonomic function tests

Test	Normal	Borderline	Abnormal
Heart rate variation	>15	11-14	<10
Valsalva ratio	>1.21	1.11-1.20	<1.10
Heart rate increase To standing	>20	19-13	<12
30:15 ratio	>1.04	1.01-1.03	<1.00
BP response toStanding	<10	11-29	>30
BP response toHand grip	>16	11-15	<10
Cold pressor test	>10	8-10	<8

The individual autonomic function score was determined for every subject. With that score, the total autonomic function scores of each group ie, controls(non alcoholics), social drinkers, chronic drinkers, and alcoholic cirrhotics were determined.

Based on these scores the patients were categorized as normal, early damage, definite parasympathetic damage and sympathetic damage and combined damage as follows;

Normal: if results of all the tests were within the normal range;

With early parasympathetic damage: if results of 1 to 2 tests of parasympathetic parameter were abnormal;

With definite parasympathetic damage: if > 2 tests of parasympathetic parameters were abnormal;

With combined damage: if any sympathetic test was abnormal in addition to parasympathetic damage.

The borderline values of parasympathetic parameters were interpreted as normal, however the borderline values of sympathetic damage were notified and grouped as early sympathetic damage. (TABLE - 2)

Based on this categorization, an attempt to classify the individuals was done.

The individuals with early parasympathetic changes were chosen to be mild cases.

The individuals with definite parasympathetic damage were chosen to be moderate cases. The individuals with both definite parasympathetic and sympathetic damage were chosen to be severe cases.

Statistical analysis.

A comparison of frequency of symptoms of autonomic neuropathy was made amongst the groups. The analysis was done with SPSS software.

The mean $\pm$ SD autonomic function score of the individual groups was obtained. Comparison of characteristics of mean scores of the inter groups was done using Analysis of Variance (one way ANOVA). Statistical Probability (p) of $p < 0.05$ was considered to be significant.

RESULTS

The data collection was done, then scoring was done and the individual autonomic function score was obtained. The total autonomic function scores of the groups. (Figure–1).

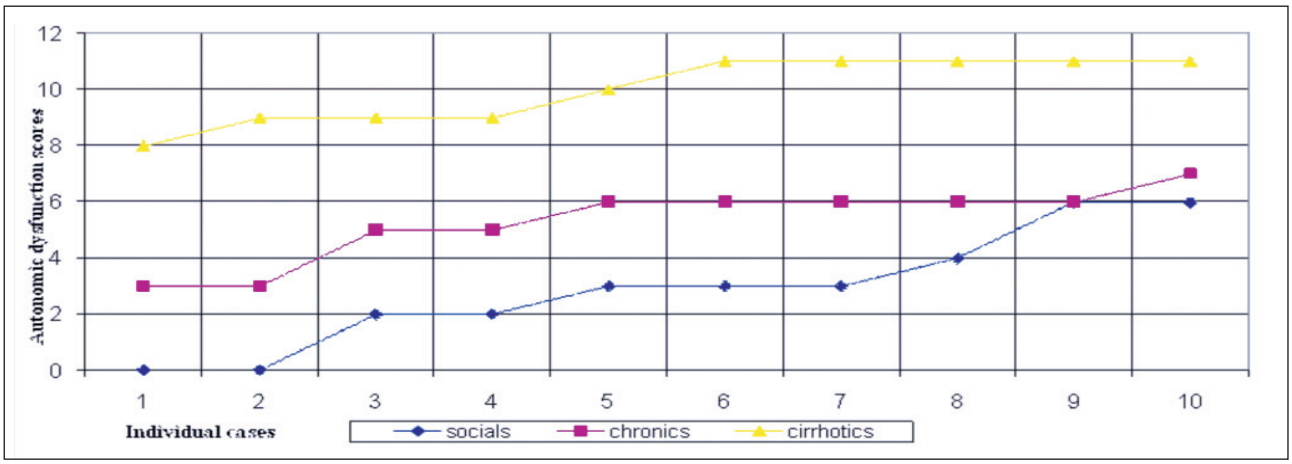

Fig. 1. The total autonomic scores in 3 groups of alcoholics

Based on the extent of autonomic damage the results of categorization of the groups of alcoholics are presented in table II

Table 2. Distribution of autonomic dysfunction in the groups of alcoholics.

Groups	Parasympathetic damage			Sympathetic damage			Combined
	Normal	Early	Definite	Normal	Early	Definite	
Socials (n=10)	2	5	3	8	2	0	0
Chronics (n=10)	0	2	8	2	6	2	2
Cirrhotics (n=10)	0	0	10	0	1	9	9

Based on this categorization the classification of the groups as mild, moderate, and severe was done and the results are presented in table 3;

Table 3. Classification of different grades of alcoholics.

Grading	Social drinkers	Chronic alcoholics	Cirrhotics
Mild	5	2	0
Moderate	3	6	1
Severe	0	2	9
Total	8	10	10

Wherever there was a glaring sympathetic damage there was a coexisting definite parasympathetic damage also. None of the patients had sympathetic damage alone[7].

Among the social alcoholics 80% of them had the problem out of which 50% of them were mild and 30% were moderate. All the chronic alcoholics and cirrhotic alcoholics had some form of damage. The distribution was as, among the chronic alcoholics 60% had moderate damage and 20% had a severe (combined) damage. The reverse was in the case of cirrhotic alcoholics. 90% of them had a severe (combined) damage and 10% of them had moderate damage. (figure 2)

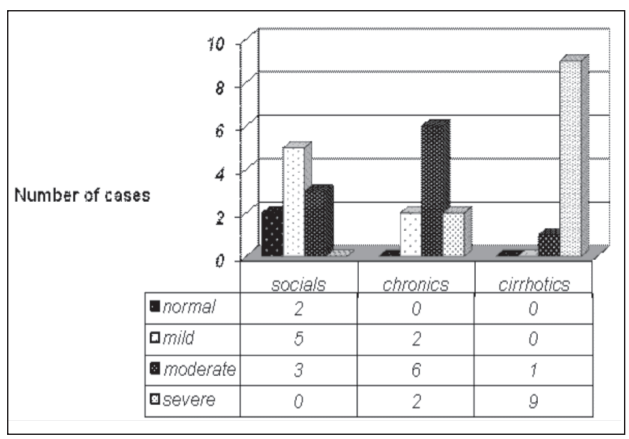

Fig. 2. Comparison of grading of autonomic dysfunction in different grades of alcoholics

If we see the percentage distribution of the cases 23.3% had early parasympathetic damage.70.10% had severe autonomic damage. Of this 70.10% of people to precisely mention 36.6% had a combined damage and 33.5% had definite parasympathetic damage.

Variance analysis done showed the mean of total autonomic function score to be highly significant between the control and groups of cases.

The mean ± SD total autonomic function scores in socials and controls were 2.9 ± 2.08 and 0.8 ± 1.32 respectively and was found to be highly significant. The mean ± SD total autonomic function scores in chronics and controls were 5.3 ±1.34 and 0.8 ±1.32 respectively and was found to be highly significant. The mean ± SD total autonomic function scores in cirrhotics and controls were 10 ±1.15 and 0.8 ±1.32 respectively and was found to be highly significant. Comparison of the mean autonomic scores between the study groups and the control group were found to be highly significant ($p < 0.01$). (TABLE – 4).

Table 4. Comparison of significance of mean autonomic scores between cases and controls

Group	MAS	p value
Cirrhotics (n=10)Controls (n=10)	10 + 1.150.8 + 1.32	< 0.01**
Chronics (n=10)Controls (n=10)	5.3 + 1.340.8 + 1.32	< 0.01**
Socials (n=10)Controls (n=10)	2.9 + 2.080.8 + 1.32	< 0.01**

MAS-Mean Autonomic Score Values are Mean + SD

**Significantly different from controls

DISCUSSION

By this study a significant deterioration of autonomic reactivity has been found. Also a significant deterioration of autonomic function in all three groups was found. This clearly indicates that autonomic damage is sure to exist in any alcoholic irrespective of the type of consumption[8].

The social drinkers have also shown an extent of damage in the autonomic system. Among the social drinkers 50% of them presented with mild damage, whereas 30% of them had moderate damage. The general view that prevails is light to moderate alcohol consumption is good for health and is associated with decreased rates of myocardial infarction, stroke. Analysing the benefits and risks of social drinking it has been highlighted that the risks of high social drinkers is that they would present with GI abnormalities, neurologic abnormalities[9] and also will be unable to appreciate an impairment[10]. This study clearly indicates that the risk prevailing among the social drinkers is highly underestimated.

Mirralles .R [11] has reported that a total of 22 cases out of 30 chronic alcoholics had abnormal autonomic function. The chronic alcoholics in this study presented as follows, 20% had mild damage, 60% had moderate damage, 20% had severe damage. Among this group 20% had a combined damage. The total life time dose of ethanol dependence and the duration of dependence are important factors contributing to the pathogenesis[12]. This study favors this statement ie the social drinkers and chronic drinkers are affected but the socials are also affected but may be less affected than the chronic drinkers.

The alcoholic cirrhotics showed predominant autonomic dysfunction. The presentation was 10% of them had moderate damage whereas 90% of them had severe damage. Prevalence of autonomic neuropathy in cirrhotics is almost an accepted statement and the alcohol abuse exaggerates the damage. *Gentile .S* [13] has reported autonomic damage in 71% of cases who were alcoholic cirrhotics and only a 57% of autonomic damage in non alcoholic cirrhotics.

Bajaj.B.K [14] in his study found that 90% of the cases had autonomic damage. Out of this 40% had combined sympathetic and parasympathetic damage. In this study a result of 93% of the case population had autonomic damage, out of which 36% had a combined damage.

CONCLUSION

Based on this study we can definitely say that consuming alcohol irrespective of any grade (social, chronic, cirrhotic) causes autonomic damage with varied severity. Prolonged use of alcohol and binge drinking causes liver damage. This condition leads to cirrhosis. Liver failure with autonomic failure is a poor prognostic indicator. All these factors ultimately decrease the survival rate. This way the whole process is a vicious cycle. Autonomic neuropathy when present along with liver disease is an independent predictor of mortality[15]. The survival analysis shows a significantly higher mortality in patients with autonomic neuropathy.

However the situation is not so grim, there is a ray of hope for improvement. A significant increase in heart rate variation after 6 months of total abstinence in a group of "chronic alcoholics" is possible[16]. Also it has been proven that abstinence improves blood

pressure levels in "chronic alcoholics"[17]. Hence there seems to be an area available for the improvement of the system just by abstinence even after hitting the chronic grade.

There are two major issues of concern,

1) As autonomic system damage is prevalent in all grades of alcoholism including the social drinkers, routine examination to assess the autonomic status of every alcoholic is a must. This helps in early detection and hence a better recovery.

2) The damage is reversible up to a certain extent. This fact should be made use of appropriately. We as health care providers should be able to identify, council and convince the patients and help them recover back to normal.

Hence autonomic examination which is not done routinely in alcoholics is strongly recommended in every alcoholic for an early detection of the problem.

Conflict of Interest: None

Source of Funding: Nil

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DOI Number: 10.5958/j.2320-608X.2.1.029

Assessment of Pulmonary Functions in Young Obese Medical Students

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ABSTRACT

Obesity is common problem in people of high socioeconomic status of all age group. This is usually seen with reduced work capacity, early fatigability, mental irritation, dypnoea etc. Despite of good and easy availability of nutritional food , people of high socioeconomic status still remain unhealthy mainly due to lack of adequate physical exercise and overeating which leads to obesity in the family. Present study was conducted to assess the pulmonary functions in young obese medical students belonging to high socioeconomic status. Based on BMI subjects were divided in to 2 groups. Group 1 comprised of obese students (BMI>30) and group 2 comprised of non-obese students (BMI<25). Data obtained were analyzed using t-test. Inspiratory Reserve Volume, Expiratory Reserve Volume, Functional Residual Capacity and Maximum Voluntary Ventilation were found significantly lower in obese group students.

Keywords: *Obesity, Pulmonary Function, BMI*

INTRODUCTION

Obesity is a state of excess adipose tissue mass. Although lean, very muscular individuals may be overweight by arbitrary standards without having increased adiposity. Body weights are distributed continuously in populations, so that a medically meaningful distinction between lean and obese is somewhat arbitrary. Obesity is therefore more effectively defined by assessing its linkage to morbidity or mortality. Although not a direct measure of adiposity, the most widely used method to gauge obesity is the body mass index (BMI), which is equal to weight/height^2 (in kg/m^2) .

Other approaches to quantifying obesity include anthropometry (skin-fold thickness), densitometry (underwater weighing), computed tomography (CT) or magnetic resonance imaging (MRI), and electrical impedance. Using data from the Metropolitan Life Tables, BMIs for the midpoint of all heights and frames among both men and women range from 19 to 26 kg/m^2; at a similar BMI, women have more body fat than men. Based on unequivocal data of substantial morbidity, a BMI of 30 is most commonly used as a threshold for obesity in both men and women. Large-scale epidemiologic studies suggest that all-cause, metabolic, cancer, and cardiovascular morbidity begin to rise (albeit at a slow rate) when BMIs are e" 25, suggesting that the cut-off for obesity should be lowered. Some authorities use the term overweight (rather than obese) to describe individuals with BMIs between 25 and 30. A BMI between 25 and 30 should be viewed as medically significant and worthy of therapeutic intervention, especially in the presence of risk factors that are influenced by adiposity, such as hypertension and glucose intolerance. The distribution of adipose tissue in different anatomic depots also has substantial implications for morbidity. Specifically, intra abdominal and abdominal subcutaneous fat have more significance than subcutaneous fat present in the buttocks and lower extremities. This distinction is most easily made by determining the waist-to-hip ratio, with a ratio >0.9 in women and >1.0 in men being abnormal.

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Many of the most important complications of obesity, such as insulin resistance, diabetes and hypertension in women, are linked more strongly to intra abdominal and/or upper body fat than to overall adiposity. The mechanism underlying this association is unknown but may relate to the fact that intra abdominal adipocytes are more lipolytically active than those from other depots. Release of free fatty acids into the portal circulation has adverse metabolic actions, especially on the liver. Though the molecular pathways regulating energy balance are beginning to be illuminated, the causes of obesity remain elusive. In part, this reflects the fact that obesity is a heterogeneous group of disorders. Chronic excess of nutrient intake relative to the level of energy expenditure leads to obesity. However, due to the complexity of the neuro-endocrine and metabolic systems that regulate energy intake, storage, and expenditure, it has been difficult to quantitatively analyze all the relevant parameters (e.g., food intake and energy expenditure) over time in human subjects[1, 2].

Obesity may be associated with a number of pulmonary abnormalities. These include reduced chest wall compliance, increased work of breathing, increased minute ventilation due to increased metabolic rate, and decreased total lung capacity and functional residual capacity. Severe obesity may be associated with obstructive sleep apnea and the "obesity hypoventilation syndrome"[1, 3].

Pulmonary function test (PFT) is a vey useful tool to find out the effect of obesity on respiratory system. The factors affecting pulmonary function tests are age, gender, height, race , obesity etc. with advancement of age lung volumes and capacities decrease. Lung volumes and capacities are larger in males than females. In same age group shorter people have lower PFT values in comparison to taller one in male as well as in females[1, 4-5].

Obesity may adversely affect pulmonary function tests including impairment on pulmonary function testing, small airway dysfunction and expiratory flow limitation, alterations in respiratory mechanics, decreased chest wall and lung compliance, decreased respiratory muscle strength and endurance, decreased pulmonary gas exchange, lower control of breathing, and limitations in exercise capacity .

Obesity is a common morbid clinical condition in population of high socioeconomic status of all age group including children and young adults, so present study was done to assess the status of pulmonary functions in young medical student of high socioeconomic status[1, 6-7].

MATERIAL AND METHOD

The present study was conducted in the department of physiology, Saraswathi Institute of Medical Sciences, Hapur. A total of 60 (30 males, 30 females) non-smoking healthy young subjects of age 18-25 years, were chosen for the study with no history of pulmonary diseases. Based on BMI, 30 subjects were obese (15 males, 15 females) and 30 subjects were non obese (15 males, 15 females). Subjects were divided in to two groups, group A comprising of non obese subjects (BMI<25) group B comprising of obese subjects (BMI>30). Subjects were asked to report the laboratory after 2 hours of taking light breakfast in the morning. Procedure was well explained to all the subjects and written consent was taken to conduct the study. Pulmonary function tests were done using computerized spirometer. All data were collected and statistical analysis was done by t-test using the window SPSS Statistics 17.0 version.

FINDINGS

Table 1: Comparison of pulmonary functions in obese and non-obese subjects

S.N.	Respiratory Parameters	Non - Obese (n=30)	Non – Obese (n=30)
1	Forced Vital Capacity (L)	4.54 ± 0.12	4.48±0.12
2	FEV1 (L)	3.76±0.13	3.66±0.08
3	Inspiratory Reserve Volume (L)	2.52±0.07	2.91±0.07*
4	Expiratory Reserve Volume (L)	0.86±0.03	0.73±0.04*
5	Functional Residual Capacity (L)	2.2±0.08	1.9±0.05*
6	Maximum Voluntary Ventilation (L/min)	14.3±0.51	12.31±0.56*

*p<0.05

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

Table – 1 shows that On comparison between the obese group and the non-obese group, no significant difference was found in forced vital capacity (FVC) & forced expiratory volume in one second (FEV1). Inspiratory reserve volume was significantly higher while expiratory reserve volume, functional residual capacity (FRC) and maximal voluntary ventilation (MVV) were significantly lower in obese subjects.

CONCLUSION

Obesity reduces the pulmonary as well as cardiac efficiency of subjects. Reserve volumes as well as MVV decrease markedly in obese subjects and make them prone for easy fatigability and may lead to dyspnea Body fat distribution has independent effects on lung function. Obesity is an important risk factor for asthma. However, since obesity can cause dyspnea through mechanisms other than airflow obstruction, diagnostic misclassification of asthma could partially account for this association. So it is very clear that obesity badly affects the pulmonary functions of the body which may result in to a cascade of diseases involving cardiovascular system , mental status and wellbeing of person . So one should keep his weight with in normal limits and avoid obesity.

Acknowledgements: Nil

Conflict of Interest: Nil

Source of Funding: Nil

Ethical Clearance: Procedures followed in the present study were in accordance with the ethical standards of the responsible committee on human experimentation (institutional and national) and with the Helsinki Declaration of 1975, as revised in 2000 (5). Informed concent was obtained from the subjects.

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DOI Number: 10.5958/j.2320-608X.2.1.030

A Study of effects of Yoga Versus Physical Exercise on Psychological Parameters, Hand Grip Strength and Reaction Time During Examination Stress in Young Female Medical Students

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ABSTRACT

Present study was carried out on 60 first-year MBBS students who were assigned into two groups- yoga group (Group 1) and physical exercise group (Group 2) (30 each). Group 1 underwent yoga practices and Group 2 underwent exercise on bicycle ergometer for 40 minutes daily for twelve weeks. Formative examinations were conducted at 6 weeks (stressor 1) and 12 weeks (stressor 2). Following recordings were taken at baseline, stressor 1 and 2: Auditory (ART) & Visual reaction time (VRT), Handgrip strength endurance (HGE), Speilberger's State anxiety inventory for adults (STAI-A) and inventories developed by Defense Institute for Physiology & Applied Sciences (DIPAS). In our study, it was observed that there was significant decrease in STAI-A scores in Group 1 subjects at both stressors ($p < 0.001$) with no change seen in Group 2 subjects. There was significant decrease in trait anxiety and depression scores at both stressors in both the groups. However, significant reduction in depression from stressor 1 to 2 occurred in only group 1 subjects. There was significant improvement in sense of wellbeing at both stressors 1 and 2 ($p < 0.001$) in Group 1 subjects whereas significant improvement occurred in Group 2 subjects only at stressor 2 ($p<0.01$). There was improvement in HGE in both groups at both stressors with more improvement from stressor 1 to 2 in Group 2 subjects. Also, there was significant reduction in ART in only Group 1 subjects ($p <0.05$) at stressor 2 with no change in Group 2 subjects. Our study demonstrates that both forms of intervention i.e. yoga training and physical exercises are beneficial for the subjects in reducing the effect of examination stress but the effect of effect of yoga is immediate and more pronounced on all parameters except HGE.

Keywords: *Yoga, Exercise, Psychological Parameters, Hand Grip Strength, Reaction Time, Stress*

INTRODUCTION

Stress is defined as an organism's total response to environmental demands or pressures. Medical education is well known to be highly competitive in nature and previous studies have already documented that perceived stress scores are higher in medical students compared to other age controlled students[1,2] which accentuates during examination. Exercise and yoga are known to play an important role in reducing the stress. Scientific evidence supports the belief that yoga benefits physical and mental health via down-regulation of the hypothalamic–pituitary–adrenal (HPA) axis and the sympathetic nervous system (SNS)[3]. Malathi et al have reported that there is significant reduction in examination stress with better academic performance and sense of wellbeing in students practicing yoga. Studies comparing effects of yoga and exercise indicate that in both healthy and diseased populations, yoga may be as effective as or better than exercise at improving a variety of health-related outcome measures[1]. Therefore, present study was conceived.

MATERIALS AND METHOD

Study Design: Present study is a non-randomized control trial. Prior permission was taken from the institutional ethical committee. Lady Hardinge medical college, New Delhi, India offers MBBS course only for girl candidates, hence, only female subjects in the age group of 18-20 years were selected for the present study. After meeting inclusion and exclusion criteria of the study, consecutive, consenting, 60 first year MBBS female student volunteers were selected and enrolled into the study. Based on their preference for yogic training or physical exercises, students were divided into two groups as follows:

Group1 (n=30): subjects who underwent yoga training

Group 2 (n=30): subjects who practiced physical exercises (PE) on stationary bicycle

Inclusion Criteria

- Healthy female subjects in the age group of 17-20 years.

Exclusion Criteria

- Subjects who have practiced any other yogic exercises including meditation or biofeedback relaxation technique in past one year
- Subjects who have participated in athletic events in past one year

Intervention for both the groups (i.e. yogic exercises for Group 1 subjects and physical exercises for Group 2 subjects) was given for 40 minutes daily, six times per week for the duration of 12 weeks. All the subjects were then assessed thrice during the study as follows:

1. Baseline recordings when no examination stress was given (No stressor)
2. 6 weeks later formative assessment examination was conducted and recordings were taken one day before the examination (Stressor 1)
3. 12 weeks later, another formative examination was conducted and recordings were taken just before the examination (Stressor 2)

Yoga training: It was given by qualified yoga trainer from Moraji Desai National Institute of Yoga (MDNIY). Following yogic techniques were daily practiced.

- Sukshma Vyayam (minor exercise) 3 minutes
- Sthula Vyayama (macro/major exercise) 3 minutes
- Pranayam 5 minutes
- Nadishodhan
- Bhramari
- Asanas (postures): 20 minutes
- Suryanamaskar
- Urdhvahastottasan
- Katichakrasan
- Konasan
- Paschimottanasan
- Vajrasan
- Mandukasan
- Gaumukhasan
- Ardhamatsyendrasan
- Padmasan
- Dhanurasan
- Bhujangasan
- Shavasan: 2 minutes
- Dhyana (meditation) 7 minutes
- "Om" chanting
- Rajyog

Physical exercises: Group 2 subjects were administered exercises as follows using computerized bicycle ergometer (ergoline 900 supplied by Jaeger, Germany)

- Stretching exercises: 5 minutes
- Warm up exercise on bicycle for 5 minutes at the initial load of 20 watts followed by exercising at 55-75% of maximum heart rate calculated by formula HR_{max} = 220-age (years) for 20 minutes. Cool down exercise for 5 minutes by pedalling at 20 watts.

- Stretching exercises: 5 minutes.

All the subjects (n=60) were asked to present on the day of assessment between 9 AM to 11 AM at least 2 hours after taking light breakfast. All the subjects were then assessed on following tests:

Physiological Parameters

1) Handgrip strength endurance (HGE): Subjects were asked to pull Handgrip dynamometer (supplied by INCO, Ambala) with 80% of their maximum (T_{max} 80%) capacity and duration of time they are able to hold gives the handgrip strength endurance.

2) Audio & visual reaction time (ART & VRT): It was recorded on RTM 608 Audio-visual reaction time apparatus (supplied by MEDICAID systems, Chandigarh, India) in a room at 25°C. Subjects were asked to use the index finger of dominant hand for pressing response switch. Auditory stimulus was beep tone and visual stimulus was red light. Mean of 3 similar readings from minimum of 10 readings was considered.

3) Psychological tests:

1. Speilberger's State Anxiety Inventory Scale for adults (STAI-A)

2. Inventories developed by Defence Institute for Physiology & Applied Sciences, India (DIPAS) were used to measure traits of anxiety, depression and wellbeing as they are valid for Indian population.

- **Trait Anxiety:** It denotes "relatively stable individual differences in anxiety proneness" and refers to a general tendency to respond with anxiety to perceived threats in the environment and various situations.

- Depression: It consists of 10 items which includes variables like depressed mood, guilt, difficulty in sleeping, decision making, work and interests.

- Sense of wellbeing: It refers to that positive attribute, which enables the person to reach enhanced levels of mental health.

Statistical Analyses

Data was recorded and analyzed statistically by PASW version 16. For each variable group, mean and standard deviation of the mean scores were calculated according to accepted statistical methods. Normality of the continuous data was tested by using Kolmogrov-Smirnov test. Intergroup mean differences in the parameters were tested for significance by using students unpaired t test. For intra-group comparisons, Wilcoxon sign rank test was used. All statistical analysis were carried out at 5% level of significance and P value < 0.05 was considered as statistical significant

RESULTS

Table 1 shows comparison of baseline values of tested parameters between subjects of both groups. Group 1 subjects have higher STAI-A and Wellbeing scores. This demonstrates that at baseline, Group 1 subjects were having significantly higher anxiety and lesser feeling of wellbeing as compared to Group 2 subjects.

Table 1: Comparison of basal parameters (Mean±SD)

Parameter	Group 1	Group 2	P value
Age (years)	18.06±0.86	17.96±0.96	NS
Height (cm)	156.88±8.88	157.16±5.80	NS
Weight (Kg)	50.86±8.79	50.43±6.38	NS
STAI-A	52.30±8.00	39.40±10.84	<0.001***
Depression	14.70±4.33	12.56±4.05	0.0528
Trait anxiety	48.48±5.64	51.20±7.45	0.1163
Sense of wellbeing	74.93±21.58	58.56±21.03	0.0043**
Handgrip Dynamometer endurance (sec)	6.36±1.92	6.10±2.08	0.6168
Auditory Reaction time (msec)	225.7±54.8	218.6±54.8	0.6177
Light reaction time (msec)	266.7±54.8	260.8±54.8	0.6782

NS: Non significant, ** p <0.01, *** p <0.001, student's unpaired t test

Table 2 demonstrates changes occurring in all the tested physiological and psychological parameters in both the groups from baseline level to stressor 1 and stressor 2 and also compares the differences obtained between group 1 and group 2 subjects at both stressors.

Table 2: Comparison of basal parameters with examination stress in yoga and physical education group

Parameters	Group	Basal	Examination stressor 1	Examination stressor 2
State anxiety	Yoga	52.30±8.00	49.33±6.63***	46.60±6.19***##
	Physical group	39.40±10.84	38.40±9.97	39.83±8.82
Trait anxiety	Yoga	48.48±5.64	44.93±6.63***	44.00±7.23***
	Physical group	51.20±7.45	45.56±7.18***	43.70±5.97***
Sense of wellbeing	Yoga	74.93±21.58	61.56±23.17***	50.33±16.82***
	Physical group	58.56±21.03	55.33±19.06	50.20±17.91**#
Depression	Yoga	14.70±4.33	11.20±5.09***	9.76±5.20***#
	Physical group	12.56±4.05	9.80±4.38***	9.90±5.20***
Handgrip Dynamometer endurance	Yoga	6.36±1.92	7.30±2.79*	7.33±3.78*
	Physical group	6.10±2.08	6.09±1.59	7.70±3.23*###
Auditory Reaction time	Yoga	225.7±54.8	223.2±49.3	216.1±49.3*#
	Physical group	218.6±54.8	217.1±54.8	206.8±54.8
Light reaction time	Yoga	266.7±54.8	256.2±49.3	259.1±49.3
	Physical group	260.8±54.8	257.8±54.8	251.1±54.8

Compared with basal value<0.05,**<0.01,***<0.001, # Compared with 6 weeks value #<0.05, ##<0.01, ###<0.001

DISCUSSION

Group 1 subjects, having higher anxiety and lesser feeling of wellbeing as compared to Group 2 subjects at the baseline cannot be explained by the study, but probably it shows that more anxiety prone individuals with lesser wellbeing feeling chose yoga over stationary bicycle. In our study, it was observed that significant fall occurred in STAI-A scores in Group 1 subjects at both stressor 1 and 2 as compared to baseline which also continued from stressor 1 to 2. This demonstrates yoga practice significantly decreased 'state anxiety' in Group 1 subjects. Since it is a transitory emotional state which increases with stressor, our study shows that yoga enabled group 1 subjects to remain calm and less anxious in the event of examination stress. No change in STAI-A scores in Group 2 subjects at both stressors demonstrates that physical exercises can prevent the rise of anxiety state with stressor but cannot reduce it. Significant reduction in trait anxiety in both groups at both stressors ($p< 0.001$) compared to their baseline is in accordance with previous study done by Malathi and Damodaran[1]. Similarly, decrease in anxiety levels with PE was observed by Kubitz & Landers[1].These findings suggest that yoga training was more effective than PE in reducing 'state anxiety' of the subjects whereas, there was comparable improvement in 'trait anxiety' in both groups.

There was significant decrease in depression score in both groups at both stressors but significant decrease in score from stressor 1 to 2 was seen in only Group 1 subjects. Our results corroborate with findings of previous studies which demonstrated yoga practice is effective in the management of depression [1-3] and previous studies indicate that individuals who exercised two to three times per week experienced lesser depressive feelings[4].

There was significant improvement in the scores of wellbeing of Group 1 subjects at both stressors 1 and 2 whereas; improvement in Group 2 subjects was seen only at stressor 2. Another previous study found that 12-week yoga intervention was associated with greater improvements in mood and anxiety than a metabolically matched walking exercise [4].There was significant improvement in Handgrip endurance (HGE) time in both groups ($p< 0.05$) but there was continued improvement from stressor 1 to 2 in Group 2 subjects. Increase in HGE represents better physical strength and fitness of the individuals. Our results are similar to previous study which concluded that yoga interventions are equal to or superior to exercise in

nearly every outcome measured except those involving physical fitness[5].

In our study, we found that there is significant reduction in ART at stressor 2 in Group 1 subjects whereas no significant change was seen in Group 2 subjects. There was a trend towards non-significant decrease in VRT seen in both groups at both stressors.

Reaction time (RT) is an index of the processing ability of central nervous system and a simple means of determining sensory-motor performance. Shortening of RT can be explained by increase in sensory-motor conduction velocity and/or faster information processing in the central nervous system [4-6].Our results are similar to previous studies which found significant reduction in both ART & VRT with yoga training in healthy subjects.

Therefore, our study concludes that both yoga training and PE are beneficial for the subjects, however, effect of yoga training starts earlier and has comparatively more impact on measured psychological & physiological parameters as compared to physical exercises. Stress induces imbalance of the autonomic nervous system (ANS) with decreased activity of parasympathetic nervous system (PNS) and increased activity of sympathetic nervous system (SNS)[7]. Autonomic imbalance is closely associated with anxiety. Clinical studies and experiments in animals have shown that anxiety is associated with changes in neuro-autonomic control [7-10]. Spectral analysis of heart rate variability has confirmed stress causes increased sympathetic & reduced parasympathetic modulation, or both. This demonstrates that both yoga and PE for 12 weeks can lead to reduction of stress levels and thereby, prevent autonomic dysregulation. Reduction in perceived stress levels results in lesser negative feelings of anxiety, depression and improved sense of wellbeing, better sensory-motor performance and hand grip endurance. Previous studies also give evidence of link between high vagal tone and enhanced attention, effective emotion regulation, and organismic responsivity [7].

Differences that have been found between yoga and exercise training may be a result of how the two interventions differ in their effects upon the autonomic tone and HPA axis. Different levels of intensity of exercise have been shown to affect the HPA axis response to acute stress differently8. Low-intensity exercise repeatedly has been shown to decrease HPA axis lower cortisol levels [7, 8] and while higher intensity exercise leads to proportional increases in cortisol (7). Exercise stimulates SNS, raising plasma catecholamines [8, 9] whereas, yoga has been shown to lower SNS and therefore, reduces catecholamine level [10].When a sedentary subject starts practicing moderate intensity physical exercise, it causes stimulation of sympathetic nervous system (SNS), raising plasma epinephrine and norepinephrine. If physical exercise is continued for longer time, it also leads to better autonomic tone and HPA axis regulation.

Yogasanas are low intensity exercises which affect HPA axis positively bringing down sympathetic stimulation and significantly decreasing the release of catecholamines. Also, yoga corrects under activity of the PNS and GABA systems in part through stimulation of the vagus nerves, the main peripheral pathway of the PNS [11]. As integrated yoga practice includes aspects of exercise (asanas), breath manipulation (pranayama) and relaxation (meditation), effects of yoga are multi-dimensional and have immediate down-regulating effect on both SNS / HPA axis response to stress [12]. Regular practice of meditation has also been documented to reduce sympathetic activity, balance neuro-endocrine axis and decrease stress and anxiety levels[13, 14].

CONCLUSION

Our study demonstrates that both forms of intervention i.e. yoga training and physical exercises are beneficial for the subjects in reducing the effect of examination stress on tested parameters but effect of yoga practice starts immediately and is more pronounced on most of the tested parameters except HGE.

Limitations of Study: It is a non-randomized trial and results should be interpreted with potential rater bias. Other forms of physical exercises could not be included.

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DOI Number: 10.5958/j.2320-608X.2.1.031

Comparison of effects of Sahaj Yoga Meditation on Cognitive Functions in practising and non-practising Healthy Subjects

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ABSTRACT

Sahaj yoga meditation practice is already known to reduce stress, enhance parasympatho-dominance, alpha rhythm in the brain and change biochemical parameters favourably in healthy subjects and is also beneficial as an adjunct in psycho-somatic disorders. The presented randomized control study was carried out on 30 healthy subjects (19 Males and 11 females) in the age group of 18 to 45 years. Subjects were randomly divided into two groups: Group 1: (9 Males & 6 Females) Healthy subjects who practised Sahaj Yoga meditation. Group 2: (10 Males & 5 Females) Healthy subjects who did not practise Sahaj Yoga. Training of Sahaj yoga was conducted under the supervision of trained Sahaj Yogi for the period of 8 weeks. Cognitive test battery was administered to all the subjects both before and after the study period.

The observed data was statistically analyzed using Student's t test, Wilcoxon Signed Rank Test, Mann-Whitney U test. The results after 8 weeks showed that Group 1 subjects showed marked improvement only in the Letter cancellation test (time) ($p< 0.01$), number of Omissions ($p<0.01$) and Trail making test 'A' ($p< 0.01$) while no appreciable change was observed in Group 2. There was no significant improvement on rest of the tested parameters in subjects of group 1 and 2.The present study demonstrated that Sahaj Yoga practice by healthy subjects leads to improvement in attention span, concentration, visuo-motor speed but with no improvement in executive functions.

Keywords: *Sahaj Yoga, Meditation, Cognitive Functions, Executive Functions*

INTRODUCTION

Anxiety, stress, mental tensions and related psychosomatic illnesses have become inseparable part of human life in all spheres. Meditation is gaining popularity as the means of alleviating stress and enhancing psychological well being[1]. Also, meditation practice as a complementary alternative medicine (CAM) is increasing worldwide and in western world sahaj Yog has become one of the most commonly used CAM by the adults and children[2]. Sahaj yoga is a form of 'Kundalini' or 'Laya yoga', which describes a technique to arouse the latent potential of man by simple meditative process[3,4]. Previous studies have demonstrated that Sahaj yoga leads to parasympatho-dominance[5] and alpha rhythm[6] in healthy subjects. It has been found to be beneficial as an adjunct in the management of psycho-somatic disorders (viz. bronchial asthma, hypertension)[7], epilepsy[8] and depressive disorder[9]. In our previous study, it was found that 8 weeks of Sahaj yoga along with conventional medication was significantly more effective than antidepressants alone in improving cognitive functions including executive functions[10]. Executive functions refer to the mental activity involved in planning, initiating and regulating the goal directed behavior[11]. Cognitive functions are negatively affected by increased perceived stress[12, 13] and they improve with meditation practice even in novice meditators[14]. Sahaj Yoga meditation is widely practiced worldwide but there is paucity of data on the effects of Sahaj yoga meditation on cognitive functions in healthy subjects. Therefore, present study has been

conducted to study the cognitive enhancing effects, if any, by the practice of Sahaj yoga meditation in healthy subjects.

SUBJECTS AND METHOD

The present study was carried out in the Department of Physiology, Lady Hardinge Medical College and Smt. Sucheta Kriplani Hospital, New Delhi.

Study Design: Prior permission for the present project was taken from the institutional ethical committee. Age, sex, educational status, socio-economic status matched subjects were enrolled into the study after meeting inclusion and exclusion criteria.

Inclusion Criteria

- 18-45 years.
- At least six years of formal education.
- Non-smokers with no history of past or present drug addictions in any form.

Exclusion Criteria

- Practicing any other yogic exercises including meditation or biofeedback relaxation technique.
- History of previous or current organic diseases.
- History or current evidence of substance dependence.
- Epilepsy or mental retardation.
- Unwilling or unable to participate.

Experimental design

All the subjects were then randomly divided into following groups:

GROUP 1 (Sahaj yoga group) : n=15 (9 Males & 6 Females)

GROUP 2 (Control group) : n=15 (10 Males & 5 Females)

Sahaj yoga meditation

Sahaj yoga meditation was performed for 30 minutes, thrice a week for a period of eight weeks by Group 1. To ensure regularity and uniformity yoga training was given by Sahaj Yogi trained in the art of Sahaj Yoga enunciated by H.H. Shri Mataji Nirmala Devi.

The subjects practiced meditation in a quiet room sitting comfortably in a chair. A typical session consisted of questions and assertions by the subject. Thereafter, the subjects practiced silent meditation. They were instructed to simply witness the thoughts crossing the mind and not to flow deeper into it[3,4]. Sahaj yoga was also practiced at bedtime by sitting in silent meditation with the feet dipped in warm saline water. Group 2 subjects were provided the same environment and attention as Group 1 subjects. They were instructed to sit quietly with their eyes closed for the same duration.

All the subjects were asked to report at 9 A.M. Written informed consent was taken from all the subjects & semi-structured proforma was filled in with the socio-demographic details. At the start of the study (Pre test value), all Group 1 and Group 2 subjects were assessed on cognitive test battery in which tests were presented to all the subjects in the same order as mentioned below:

- Letter Cancellation test.
- Trail making Test 'A'
- Trail making Test 'B'
- Ruff Figural Fluency Test.
- Digit Span Forward and Reverse Test.

Above parameters were again assessed after two months of Sahaj yoga meditation practice (Post test value). The data was recorded and analyzed statistically.

Instruments of the study

- **Cognitive Test Battery**

In order to facilitate replication, only the tests available and frequently documented in the neuropsychological literature were employed[15].

- Letter Cancellation Test: This test assesses visual scanning, response speed and sustained attention. The subject is presented with letters of English alphabet, and is instructed to cancel out specific letters. The score is the time taken by subject to actually perform this task. In addition, the numbers of different errors (omissions and commissions) done by the subject are also counted.
- Trail Making Test:

  Part A: assesses visuomotor speed and attention. The subject is instructed to draw a straight line to connect 25 consecutive circles. The score is the time taken by the subject to complete the task.

Part B: In addition to visuomotor speed and attention, it requires the patient to shift strategy and hence, is a sensitive measure of executive function as well. In this the subject is instructed to connect 25 numbered and lettered circles by alternating between the two sequences. The score is the total time taken by the patient to complete the task.

- Ruff Figural Fluency Test: This test permits us to study the non-verbal fluency of a subject, which is an indirect measure of subject's ability to form a strategy to complete a given task. The objective is to draw dissimilar patterns by joining dots present in 40 boxes given in a paper in a specified period of time. The score is based on total number of dissimilar patterns and number of perseverations. Rotations were noted as they are considered to be the hallmark in the strategic approach (A measure of executive function).
- Digit Span:

Digits Forward: Assesses immediate verbal memory span. In the test, subjects must repeat back, sequences of digits of increasing length read out by the examiner. The score is maximum number of digits that the patient can recall.

Digits Backward: In addition to auditory attention and short-term retentive capacity this test also assesses the ability to manipulate information in the verbal working memory (and hence is sensitive measure of executive function). The subject has to repeat the sequences of numbers of increasing digit length in reverse order to what was said by the examiner. The score is the maximum number of such digits that the patient is able to reverse.

OBSERVATION

The Table1 shows the anthropometric and socioeconomic characteristics while the table 2 shows the basic cognitive test battery parameters in subject groups before meditation. Table 3 and 4 entail the changes in cognitive test battery parameters after 8 weeks of regular supervised Sahaj Yoga meditation.

Table 1: Subjects' characteristics

Parameters	Group 1 (n=15)	Group 2 (n=15)
Age (yr.) Mean±SD	31.13±8.67	31.80±9.07
Gender		
• Females	6	5
• Males	9	10
Height (cm) Mean±SD	161.47±10.55	163.6±8.76
Weight (cm) Mean±SD	62.40±8.45	60.53±7.93
Socioeconomic status		
• Upper	1	0
• Middle	12	10
• Lower	3	5

Students t test: *p<0.05, **p<0.01, ***p<0.001

Table 2: Baseline values of cognitive test battery parameters

Parameters	Group 1 (n=15)	Group 2 (n=15)
Letter Cancellation Test		
• Time (seconds)	131.47±33.74	128.27±27.67
• Omissions	6.27±4.56	4.40±3.83
• Commissions	0.013±0.35	0.40±0.83
Trail test 'A' (seconds)	81.13±28.17	84.73±43.81
Trail test 'B' (seconds)	124.63±33.14	140.27±54.09
Ruff Figural Fluency Test		
• Rotations	6.60±4.03	4.53±3.89
• Patterns	15.67±5.14	15.47±7.08
• Perseverations	17.73±6.52	20.00±8.35
Forward Digit Span Test	5.60±1.18	5.73±1.44
Reverse Digit span Test	4.13±1.68	4.20±1.70

Mann-Whitney U test *p<0.05, **p<0.01, ***p<0.001

Table 3: Changes in cognitive parameters from baseline to 8 weeks in Group 1 subjects (Mean±SD)

Parameters	Pre-test	Post-test
Letter Cancellation Test		
• Time (seconds)	131.47±33.74	120.87±26.27**
• Omissions	6.27±4.56	3.27±3.33**
• Commissions	0.013±0.35	0.13±0.52
Trail test 'A' (seconds)	81.13±28.17	69.20±24.20**
Trail test 'B' (seconds)	124.63±33.14	113.87±33.45
Ruff Figural Fluency Test		
• Rotations	6.60±4.03	6.40±3.94
• Patterns	15.67±5.14	15.80±5.39
• Perseverations	17.73±6.52	17.80±7.04
Forward Digit Span Test	5.60±1.18	5.80±1.01
Reverse Digit span Test	4.13±1.68	4.33±1.5

Wilcoxon Signed Rank Test *p<0.05, **p<0.01, ***p<0.001

Table 4: Changes in cognitive parameters from baseline to 8 weeks in Group 2 subjects (Mean±SD)

Parameters	Pre-test	Post-test
Letter Cancellation Test		
• Time (seconds)	128.27±27.67	124.00±24.83
• Omissions	4.40±3.83	3.00±2.73
• Commissions	0.40±0.83	0.40±0.83
Trail test 'A' (seconds)	84.73±43.81	83.33±42.24
Trail test 'B' (seconds)	140.27±54.09	133.60±55.74
Ruff Figural Fluency Test		
• Rotations	4.53±3.89	4.27±4.82
• Patterns	15.47±7.08	17.13±7.36
• Perseverations	20.00±8.35	18.60±7.75
Forward Digit Span Test	5.73±1.44	5.80±1.32
Reverse Digit span Test	4.20±1.70	4.47±1.13

Wilcoxon Signed Rank Test *p<0.05, **p<0.01, ***p<0.001

Statistical Analysis

For each group, Mean and Standard Deviation of the scores were calculated. Inter-group mean differences in cognitive parameters were tested for significance by using Mann-Whitney U test. Student's t test was used to determine inter-group differences in age distribution and modified Kuppuswamy's scale. For intra-group comparisons of cognitive parameters, Wilcoxon Signed Rank test was used. Interpretation of 'p' values was as follows: $p > 0.05$- not significant. $p < 0.05$- Significant. $p < 0.01$-Highly significant, $p < 0.001$-Very highly significant

RESULTS

Table 1 demonstrates that there is no statistically significant difference in the age, gender, anthropometric parameters & socio-economic status distribution between Group 1 and Group 2 subjects. Table 2 shows there is no statistically significant difference in the base-line values of cognitive parameters between Group 1 & Group 2 subjects. So, they are comparable for the study. Table 3 shows statistically significant change in L.C.T. (time and omissions) ($p<0.01$) & T.T.A. scores ($p<0.01$) in Group 1 subjects from pre-test to post-test levels. Table 4 shows that there was no significant change from pre-test to post-test levels in all the recorded cognitive parameters in Group 2 subjects.

DISCUSSION

Two groups were well matched for age, gender and socio-economic status and so they were comparable for the study. After 8 weeks of intervention (post-test), results on cognitive test parameters demonstrated

significant reduction in number of omissions ($p < 0.01$) and time taken ($p < 0.01$) to complete letter cancellation test (L.C.T.) in only Group 1 subjects, while no change was observed in Group 2 subjects. Similarly, there was significant reduction in time score to complete Trail making test A by Group 1 subjects ($p < 0.01$) while no statistically significant change was seen on this test in Group 2 subjects. These findings demonstrate that Sahaj yoga practice by Group 1 subjects led to improvement in the cognitive domains of attention, concentration, psychomotor speed and visual scanning speed. Improvement on letter cancellation task scores has also been documented by practicing various yoga breathing techniques (pranayama) [16, 17] and cyclic meditation[18]. Another study has also reported improvement on attention-related behavioral responses by practicing 8 weeks of mindfulness meditation[19]. There was no statistically significant change seen in Trail making 'B' score in both group 1 and group 2 subjects, although, trend towards decrease in Trail making test B time score was observed in only Group 1 subjects. This shows that improvement in executive functions had begun in the group 1 subjects but probably, changes in executive functions need longer duration and / or more intense meditation practice by healthy volunteers as compared to patients where cognitive dysfunction is evident. All other tested parameters showed no significant change in both the groups. Therefore, our study demonstrates that two months of Sahaj yoga meditation leads to improvement in only attention, concentration and psycho-motor speed with not much significant effect on executive functions of healthy volunteers. Our study further substantiates the claim that regular practice of meditation is beneficial for the mental health of healthy subjects. The mechanism by which the Sahaj yoga meditation causes cognitive enhancement cannot be deciphered from the present study. According to Sahaj yoga literature[3,4], actualization of kundalini awakening takes place in the limbic system and this probably 'conditions' the limbic system functioning modulating the activity of hypatholamic-hypophyseal-adrenal axis, bringing better neuro-effector communication, relaxed mental state, decreased stress and improvement in different cognitive domains of attention in the practitioners.

CONCLUSION

Sahaj yoga meditation practice done for two months can lead to improvement in attention span, concentration, psycho-motor and visuo-scanning speed of the healthy volunteer subjects with no significant improvement on tested executive functions.

Limitations of the Study

Pre-test I.Q. of the subjects was not attempted in the present study and also masking was not done. Further studies are needed for longer period and larger sample size to document whether the cognitive changes are permanent in the practitioners.

ACKNOWLEDGEMENT

The authors are grateful to all the participating volunteers, the faculty and staff of LHM College & VMM College, Delhi.

Conflict of Interest: None

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Published, Printed and Owned : Dr. R.K. Sharma
Designed and Printed : M/s Vineeta Graphics, B-188, Subash Colony, Ballabgarh, Faridabad
Mobile: 9990005734, 99900042
Published at : 4th Floor, Statesman House Building, Barakhamba Road,
Connaught Place, New Delhi-110 001
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