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Gender Based Difference in Color Vision in Myopic Subjects

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ABSTRACT

Myopia is a refractory error of the eye generally produced due to elongation of the antero-posterior diameter. Since color vision i.e. ability to discriminate different colors is the function of photoreceptors-cones in the retinal layer of the eye, there seemed a need to view if elongation of AP diameter of myopic subjects produces some consequence in the color detection ability of eye in comparison to normal individuals which might of course be within normal range. Further, a gender based comparison placed the study still ahead. Study was undertaken on equal number of 192 emmetropic & myopic (corrected) males and 192 emmetropic & myopic (corrected) female subjects aged 17-20 yrs. The test was performed in bright sunlight by the help of '20 test color strips and 2 matching shade charts' based on Farnsworth –Munsell 100 hue (FM100) test. On univariate analysis and one way ANOVA, female subjects showed statistically significant better matching of colors in comparison to their male counter parts i.e. female myopic subjects can see more range of colors in comparison to male emmetropic as well as myopic subjects.

Key Words : *Myopia, Color Vision, Cones, Gender, Male - Female*

INTRODUCTION

Color vision is the ability of the eye to discriminate between light rays of different wavelengths, absorbed in three classes of cones in retina when exposed to light and better appreciated in photopic vision[1,2]. Myopia: a refractory error resulting from excessive elongation of antero - posterior diameter of eye – ball or a steeply curved cornea[3].

Myopia affects more than one in four people over age 40 in the United States and Western Europe while visually significant hyperopia afflicts about ten percent of individuals in the same age group. In some urban areas in East Asia, the prevalence of myopia among teenagers and young adults exceeds 70%[4]. Myopia is a risk factor for a number of ocular conditions including: peripheral retinal degenerations; age related cataracts; glaucoma; & choroidal neovascularization[5].

Myopia may be associated with hereditary vitreo-retinal or retinal diseases as in progressive cone degenerations, which are characterized by decreased visual acuity, color vision deficiencies and photophobia[6].

Since color vision is the function of photoreceptors i.e. cones in the retinal layer of the eye, there seemed a need to view – if elongation of AP diameter of myopic subjects produces some consequence in the color detection ability of eye in comparison to emmetropics which might of course be within normal range in both the sexes & the degree to which it differs in them.

MATERIAL & METHOD

Present study was carried out in the deptt of Physiology on equal number of 192 emmetropic & myopic males and 192 emmetropic & myopic female subjects aged 17-20 yrs. Chosen myopic subjects were having myopia of within minus 6 Diopter (mild to moderate myopia), visual acuity of 6/6, and fundus without degenerative changes. Informed consent was taken.

The subjects were divided in two groups as follows:

Group 1 – Males (192) : 96 Emmetropic males and 96 Myopic males

Group 2 – Females (192) : 96 Emmetropic females and 96 Myopic females

- '20 test color strips' & '2 matching shade charts' based on Farnsworth Munsell 100 hue

  (FM100) test having various shades of different colors & numbered with codes were given to each subject[7].
- Test was done in bright sunlight between 12.00-3.00 pm. Each subject was asked to match all the test color strips one by one with the shade charts and the code numbers were noted down. Total number of correct answers was evaluated.
- Statistical analysis was done by 'univariate analysis of variance' by using SSPS computer software.

FINDINGS

- Univariate analysis showed statistical significant difference in the color vision of emmetropic & myopic male and female subjects. ($F_{4, 1900} = 3.30$, p = <0.01) (Table1).

Table 1 Univariate analysis

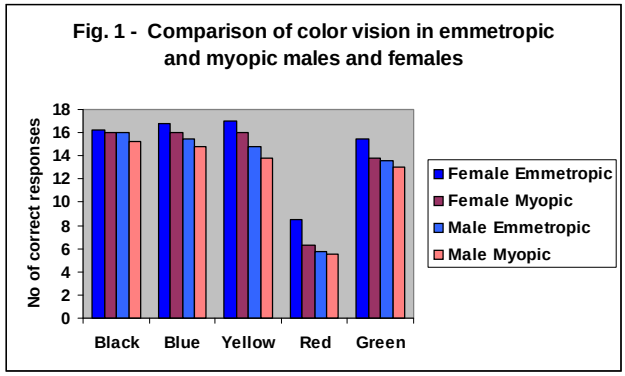
Source		Type III Sum of Squares	df	Mean Square	F	Sig.
Intercept	Hypothesis	349596.075	1	349596.075	53.763	.001
	Error	29094.616	4.474	6502.575[a]		
Gender	Hypothesis	957.675	1	957.675	19.675	.084
	Error	69.616	1.430	48.675[b]		
Visual status	Hypothesis	421.875	1	421.875	23.936	.492
	Error	4.311	.245	17.625[c]		
Different colors	Hypothesis	24360.300	4	6090.075	243.847	.040
	Error	26.648	1.067	24.975[d]		
Gender * Visual status *Different colors	Hypothesis	99.300	4	24.825	3.302	.010
	Error	14284.500	1900	7.518[f]		

- All females irrespective of visual status, had better color vision in comparison to males (Table 2 & Fig 1).

Table 2 Comparison of color vision of emmetropic & myopic male & female subjects

Gender	Visual status		Black	Blue	Yellow	Red	Green
Male		Mean±S.d.	16	15.5	14.75	5.75	13.63
	Emmetropic		± 3.7	±1.6	±2.5	±2.7	±1.2
		Mean±S.d.	15.25	14.75	13.75	5.5	13
	Myopic		±4.2	±2.5	±3.7	±1.1	± 3.4
Female		Mean±S.d.	16.25	16.75	17	8.5	15.5
	Emmetropic		±1.7	±2.3	±0.71	±2.1	±3.3
		Mean±S.d.	16	16	16	6.25	13.75
	Myopic		±2.9	±3.1	±0	±2.3	±3.9

Figure - 1



- One way ANOVA analysis on gender based comparison of color vision showed :
  - Emmetropic & myopic females had better color vision for all colors in comparison to emmetropic & myopic males respectively but not statistically significantly better for black in case of emmetropics and for black & green in myopics (Table 3 & 4).

Table 3 Univariate analysis between Emmetropic male and female subjects

		Sum of Squares	df	Mean Square	F	Sig.
Black	Between Groups	3	1	3	0.35	0.56
	Within Groups	1650	190	8.68		
	Total	1653	191			
Blue	Between Groups	75	1	75	17.59	.000
	Within Groups	810	190	4.26		
	Total	885	191			
Yellow	Between Groups	243	1	243	66.91	.000
	Within Groups	690	190	3.63		
	Total	933	191			
Red	Between Groups	363	1	363	57.76	.000
	Within Groups	1194	190	6.28		
	Total	1557	191			
Green	Between Groups	168.75	1	168.75	25.97	.000
	Within Groups	1234.5	190	6.50		
	Total	1403.25	191			

  - On intragroup evaluation between emmetropic & myopic males, for each color myopics showed poor color vision results and this difference was statistically significant for blue and yellow colors (Table 5). Similarly myopic females had statistically significant poor color vision for yellow, red & green colors in comparison to emmetropic females (Table 6).

Table 4 Univariate analysis between myopic male and female subjects

		Sum of Squares	df	Mean Square	F	Sig.
Black	Between Groups	27	1	27	2.04	0.16
	Within Groups	2514	190	13.23		
	Total	2541	191			
Blue	Between Groups	75	1	75	9.17	0.003
	Within Groups	1554	190	8.18		
	Total	1629	191			
Yellow	Between Groups	243	1	243	33.90	.000
	Within Groups	1362	190	7.168		
	Total	1605	191			
Red	Between Groups	27	1	27	7.70	0.006
	Within Groups	666	190	3.51		
	Total	693	191			
Green	Between Groups	27	1	27	1.966	0.163
	Within Groups	2610	190	13.74		
	Total	2637	191			

Table 5 Univariate analysis between emmetropic and myopic male subjects

		Sum of Squares	df	Mean Square	F	Sig.
Black	Between Groups	27.000	1	27.0	1.686	.196
	Within Groups	3042.000	190	16.01		
	Total	3069.000	191			
Blue	Between Groups	27.000	1	27.000	5.97	.015
	Within Groups	858.000	190	4.51		
	Total	885.000	191			
Yellow	Between Groups	48.000	1	48.000	4.55	.03
	Within Groups	2004.000	190	10.54		
	Total	2052.000	191			
Red	Between Groups	3.000	1	3.000	.66	.41
	Within Groups	858.000	190	4.51		
	Total	861.000	191			
Green	Between Groups	18.750	1	18.750	2.83	.094
	Within Groups	1258.500	190	6.62		
	Total	1277.250	191			

Table 6 Univariate analysis between emmetropic and myopic female subjects

		Sum of Squares	df	Mean Square	F	Sig.
Black	Between Groups	3.000	1	3.000	.508	.477
	Within Groups	1122.000	190	5.90		
	Total	1125.000	191			
Blue	Between Groups	27.000	1	27.0	3.40	.067
	Within Groups	1506.000	190	7.92		
	Total	1533.000	191			
Yellow	Between Groups	48.000	1	48.000	190.00	.000
	Within Groups	48.000	190	.25		
	Total	96.000	191			
Red	Between Groups	243.000	1	243.000	46.07	.000
	Within Groups	1002.000	190	5.27		
	Total	1245.000	191			
Green	Between Groups	147.000	1	147.000	10.80	.001
	Within Groups	2586.000	190	13.61		
	Total	2733.000	191			

- Myopic females showed better color vision results in comparison to emmetropic males although it was statistically significant only for yellow color (Table7, Fig 1).

Table 7 Univariate analysis between emmetropic male and myopic female subjects

		Sum of Squares	df	Mean Square	F	Sig.
Black	Between Groups	.000	1	.000	.000	1.00
	Within Groups	2160.000	190	11.368		
	Total	2160.000	191			
Blue	Between Groups	12.000	1	12.000	1.863	.174
	Within Groups	1224.000	190	6.442		
	Total	1236.000	191			
Yellow	Between Groups	75.000	1	75.000	22.196	.000
	Within Groups	642.000	190	3.379		
	Total	717.000	191			
Red	Between Groups	12.000	1	12.000	1.776	.184
	Within Groups	1284.000	190	6.758		
	Total	1296.000	191			
Green	Between Groups	.750	1	.750	.086	.770
	Within Groups	1660.500	190	8.739		
	Total	1661.250	191			

DISCUSSION

In our earlier study on sex variation in color vision, we found out that color perception was statistically significantly better in emmetropic female subjects to their emmetropic male counterparts[8]. Further in continuation of previous study, in myopic subjects also same relationship could be established. The reason may again be explained as per our earlier study i.e. sexual dimorphism in the gene that encodes the photo pigment of the long wavelength sensitive cones in the retina may be responsible for this[9]. Moreover only women have the potential for super color vision that is because the genes for the pigments in red and green cones lie on the x-chromosomes and only women have two x-chromosomes, creating the opportunity for one type of red cone to be activated on one x-chromosomes and other type of red cones on the other one and some of the women may also have two distinct green cones on either x-chromosomes[10].

As far as number of correct responses was concerned with specific colors, in both males and females, blue color showed maximum score. That further

proved a well known fact blue color cones (short wavelength cones) are most developed in human beings as tritanomaly and tritanopia are quite rare to occur as a cause of color blindness. We also found that all groups gave lesser responses for green color (i.e. middle wavelength cones) while least responses for red color (i.e. long wavelength cones). This again proved about the common occurrence of deuter & prot anopia and anomaly respectively[3].

On comparison of myopics with emmetropics, both myopic males & females showed lesser perception of colors than emmetropic males & females The reason behind this may be the stretching of photoreceptor layer during elongation of antero-posterior diameter of eyeball due to myopia give rise to a weaker cone system[3,7]. Although myopic females showed statistically significant lesser perception of colors for all the three cones system while myopic males showed this only for blue cones. It is a known fact that red & green cones are less developed in male subjects. Obviously myopics also do not seemed to affect these cone systems.

Myopic females although showed reduced color perceptibility in comparison to their counter part normal female subjects BUT still their perceptibility was better than the male emmetropics which reflects that the development of cone system in female sex is much ahead of the male sex. This might be due to the sexual dimorphism in the gene that encodes the photopigment sensitive cones in retina[9, 11].

CONCLUSION

Myopic females showed better color vision in comparison to myopic males to the extent that their color vision status were even better than emmetropic males. Certainly we can say that females might see more range of colors i.e. world is more colorful for them.

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Dynamic Lung Functions as an Evaluation Tool in Assessment of Pulmonary System Adaptability in Trained Athletes

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ABSTRACT

Background : There are conflicting opinions about the degree of adaptability of the respiratory system in delivering the physiological needs in case of severe exercise. Role of the normal respiratory system in delivering oxygen to meet the demands of various degrees of exercise has been a topic of considerable debate .One view holds that the respiratory system is not normally the most limiting factor in the delivery of oxygen, others hold the absence of structural adaptability to physical training cause of limitation of the pulmonary system.

Methods : Pulmonary Function Tests were done before & after maximal exercise testing to assess dynamic lung functions in two groups' viz., athletes & non-athletes.

Results : On studying the differences in dynamic lung functions in two groups of non-athletes and athletes, there was no difference in FVC& FEV1, before or after exercise testing in either .The other flow rates MMEF, PEFR, MEF 25% to 75% were on the higher side in trained subjects which was consistently maintained after exercise testing .A higher adaptability of the respiratory system to the training stimulus in the form of a higher elastic recoil pressure of the lungs and a lower resistance of medium to small airways is suggested as the mechanism of adaptability in this study.

Key Words: *Exercise Testing, Airflow Limitation, Dynamic Lung Functions, Ventilatory functions*

INTRODUCTION

There are conflicting opinions about the degree of adaptability of the respiratory system in delivering the physiological needs in case of severe exercise. There are 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].

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.

MATERIAL AND METHOD

The present study was conducted in the department of physiology, Karnataka Institute of Medical Sciences, Hubli as a part of cardio-pulmonary efficiency studies on two groups of non-athletes (n=30) and athletes (n=30) comparable in age & sex.

Informed consent was obtained and clinical examination to rule out any underlying disease was done. Healthy young adult males between 19-25 years who regularly undergo training and participate in competi-

tive middle distance (800 meter, 1500 meter) running events for at least past 3 years were considered in the athlete group whereas the non-athlete group did not have any such regular exercise program. Smoking, clinical evidence of anemia, obesity, involvement of cardio-respiratory system was considered as exclusion criteria.

Detailed procedure of exercise treadmill test and 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. All subjects were made to undergo maximal exercise testing to VO2 max levels on a motorized treadmill.

After exercise, the assessment of dynamic lung functions was repeated. All these set of recordings were done on both the non-athlete as well as the athlete 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 < 0.01 was considered as significant.

RESULTS

Table No: 1 Comparison of anthropometric data & VO2 max of non-athletes & athletes with statistical analysis.

Parameter	Non-Athletes	Athletes	T-value	P- value	Remarks
Age (Yr)	22.49 ± 2.62	22.45 ± 2.84	0.05	< 0.10	NS
Height (cm)	169.70 ± 7.50	165.90 ± 7.24	1.94	< 0.10	NS
Weight (kg)	62.66 ± 5.64	59.43 ± 6.26	2.06	<0.05	NS
BMI (kg/m²]	22.02 ± 2.47	21.60 ± 1.75	0.74	< 0.10	NS
VO2 max(lit/min)	2.98±0.16	3.01±0.27	13.0	< 0.001	HS

NS=Not significant

P< 0.01 Significant

P< 0.001 Highly Significant

Degree of freedom=58

Table No: 2 Comparison of Dynamic Lung Functions of Non- Athletes before exercise testing (BE) & after exercise testing (AE) with statistical analysis.

NON-ATHLETES (n=30)

Parameter	BE	AE	T-value	P- value	Remarks
FVC (L)	3.59 ± 0.52	3.31 ± 0.56	1.84	< 0.10	NS
FEV1 (L)	3.52 ± 0.50	3.27 ± 0.05	2.08	< 0.05	NS
FEV1/FVC	0.95	0.96			
MMEF (L/S)	4.94 ± 1.31	4.95 ± 1.46	0.02	< 0.10	NS
PEFR (L/S)	7.21 ±1.78	6.71 ±1.96	1.00	< 0.10	NS
MEF 75(L/S)	6.42 ±1.94	5.86 ±1.74	1.22	< 0.10	NS
MEF 50(L/S)	5.44 ± 1.44	5.41 ± 1.63	0.08	< 0.10	NS
MEF 25(L/S)	3.46 ± 1.16	3.70 ± 1.47	0.75	< 0.10	NS

NS = Not Significant

P< 0.01 is considered significant

Degree of freedom =29.

Table No: 3 Comparison of Dynamic Lung functions of Athletes before exercise testing (BE) & after exercise testing (AE) with statistical analysis.

ATHLETES (n=30)

Parameter	BE	AE	T-value	P- value	Remarks
FVC (L)	3.31 ± 0.39	3.12 ± 0.30	2.50	< 0.05	NS
FEV1 (L)	3.27 ± 0.30	3.09 ± 0.30	2.57	< 0.05	NS
FEV1 /FVC	0.99	0.99			
MMEF (L/S)	6.02 ± 1.21	6.44 ± 1.07	1.66	< 0.1	NS
PEFR (L/S)	8.74 ±1.09	8.59 ± 0.84	0.77	< 0.1	NS
MEF 75(L/S)	8.27 ±1.28	8.13 ±1.13	0.46	< 0.1	NS
MEF 50(L/S)	6.39 ± 1.20	6.83 ± 0.92	0.76	< 0.1	NS
MEF 25(L/S)	4.34 ± 1.11	5.02 ± 1.05	2.51	< 0.05	NS

NS = Not Significant

P< 0.01 is considered significant

Degree of freedom =29.

Table No: 4 Comparison of Dynamic Lung function of Non-Athletes & Athletes before exercise testing with statistical analysis.

Parameter	Non Athletes	Athletes	T-value	P- value	Remarks
FVC (L)	3.59 ± 0.52	3.31 ± 0.39	2.45	< 0.05	NS
FEV1 (L)	3.52 ± 0.50	3.27 ± 0.30	2.30	< 0.05	NS
FEV1 /FVC	0.95	0.99			
MMEF (L/S)	4.94 ± 1.31	6.02 ± 1.21	11.66	< 0.001	HS
PEFR (L/S)	7.21 ±1.78	8.74 ± 1.09	11.76	< 0.001	HS
MEF 75(L/S)	6.42 ±1.94	8.27 ±1.28	4.53	< 0.001	HS
MEF 50(L/S)	5.44 ± 1.44	6.39 ± 1.20	3.00	< 0.01	S
MEF 25(L/S)	3.46 ± 1.16	4.34 ± 1.11	3.17	< 0.01	S

NS = Not Significant

S= Significa

HS= Highly significant P< 0.001

Degree of freedom =58.

Table No: 5 Comparison of Dynamic Lung function of Non-Athletes & Athletes after exercise testing with statistical analysis.

Parameter	Non Athletes	Athletes	Athletes	T-value	P-value	Remarks
FVC (L)	3.31 ± 0.56	3.12 ± 0.30	3.12 ± 0.30	2.09	< 0.05	NS
FEV1 (L)	3.27 ± 0.05	3.09 ± 0.30	3.09 ± 0.30	1.60	< 0.1	NS
FEV1 /FVC	0.96	0.99	0.99			
MMEF (L/S)	4.95 ± 1.46	6.44 ± 1.07	6.45 ± 1.07	4.80	< 0.001	HS
PEFR (L/S)	6.71 ±1.96	8.59 ± 0.84	8.59 ± 0.84	4.94	< 0.001	HS
MEF 75(L/S)	5.86 ±1.74	8.13 ±1.13	8.13 ±1.13	6.33	< 0.001	HS
MEF 50(L/S)	5.41 ± 1.63	6.83 ± 0.92	6.83 ± 0.92	14.30	< 0.001	HS
MEF 25(L/S)	3.70 ± 1.47	5.02 ± 1.05	5.02 ± 1.05	4.29	< 0.001	HS

NS = Not Significant

S= Significant P< 0.01

HS= Highly significant P< 0.001

Degree of freedom =58.

DISCUSSION

Considerable information can be obtained by studying the exercise response of dynamic lung functions in untrained and trained 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.

VO2 max values were higher in athletes and was statistically significant (P< 0.001).This observation is expected in view of the training stimulus and adaptability of both the pulmonary system and the cardio vascular system. VO2 max is an objective index of the functional capacity of the body's ability to generate power.

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.

On comparing dynamic lung functions in terms of the above flow rates of non-athletes & athletes before exercise [Table 4] it is seen that athletes have higher MMEF, PEFR, MEF 25% TO 75%. This suggests a higher adaptability of the respiratory system to the training stimulus.

These changes are consistently maintained after maximal exercise testing [Table 5] suggesting a higher elastic recoil pressure of the lungs and a lower resistance of medium to small airways in response to exercise as a result of adaptive mechanisms in the pulmonary system.

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A Physiological Study of Short Term Gutkha Chewing on Cardio-respiratory Fitness

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ABSTRACT

Smokeless tobacco has been advocated as a substitute for cigarette smoking. On the contrary, the use of smokeless tobacco is fraught with health risk and needs to be discouraged. Previous reports have described long term harmful effects of smokeless tobacco on various body parameters, little is known about short term effect of smokeless tobacco on cardio respiratory parameters. Very few studies have been undertaken on the effect of short term use of gutkha, a common form of smokeless tobacco in India on cardio respiratory parameters of youngsters. This aspect of use of smokeless tobacco needs to be attended to.

The present study has been undertaken to study the effect of short term [3-5 years] gutkha chewing on cardio respiratory fitness tests in young healthy gutkha chewers as compared to age and sex matched non gutkha chewing healthy controls.

Various cardio respiratory parameters like resting HR, delta HR, MVV, VE max, VO2 max were studied by using treadmill exercise testing and computerised spirometry.

In the present study no statistically significant difference was found in any parameter studied that can be attributed to the residual effect of short term use of gutkha. This is reason enough to discourage gutkha chewers from this unhealthy habit at this early stage itself before permanent residual effects on health is seen.

***Key words**: Smokeless tobacco, Gutkha, Cardio respiratory, VO2 max, Resting HR, Delta HR, MVV, VE max*

INTRODUCTION

Tobacco and traces of nicotine were discovered in human remains as early as the prehistoric era. During the 16th and 17th centuries, tobacco gained widespread popularity, especially in the form of snuffing tobacco. Snuff was considered a luxury; as tobacco became more readily available. Tobacco became even more popular and more affordable in the 19th century. The consumption of cigarettes had surpassed other forms, such as chew or snuff. Chewing is another mode of tobacco consumption, which is still widely used worldwide.

There has been resurgence of smokeless tobacco use since 1970[1]; its use is common in various parts of the world, including India and central Asia. An increase in consumption of smokeless tobacco has been noticed among high school, college students and sportspersons [2, 3, 4]. Use of smokeless tobacco indeed represents a health concern of growing magnitude among these groups. As a consequence of its addictive qualities, the consumption of smokeless tobacco often becomes a lifelong habit with cumulative and deleterious effects on health[5,6].Despite the known health consequences of tobacco, "chewing" is not viewed by users as particularly dangerous and is considered less of a "social evil" than smoking by much of the public[7,8].Smokeless tobacco has been advocated as a substitute for cigarette smoking. On the contrary, the use of smokeless tobacco is fraught with health risk and needs to be discouraged. Previous reports have described long term harmful effects of smokeless tobacco on various body parameters, little is known about short term effect of smokeless tobacco on cardio respiratory parameters [9]. The effect of tobacco smoking on aerobic capacity and their predisposition to various unfavourable risk factors for

disease is well studied. Very few studies have been undertaken on the effect of short term use of gutkha, a common form of smokeless tobacco in India on cardio respiratory parameters of youngsters. This aspect of use of smokeless tobacco needs to be attended to.

AIMS & OBJECTIVES

The present study has been undertaken to study the effect of short term [3-5 years] gutkha chewing on cardio respiratory fitness tests in young healthy gutkha chewers as compared to age and sex matched non gutkha chewing healthy controls.

MATERIAL & METHOD

Present study was conducted in the Exercise Physiology lab of KIMS, Hubli. 30 apparently healthy sedentary male gutkha chewers of age group 18-30 years were taken as subjects and equal number of age and sex matched healthy non gutkha chewers were taken as controls. Ethical clearance was obtained from institution ethical committee.

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

Inclusion criteria

1. Males between 18-30 years of age
2. Leading sedentary life
3. Chewing gutkha for 3-5 years duration of 5 or more packets per day

Exclusion criteria

1. Age more than 30 years
2. Leading physically active lifestyle
3. Suffering from cardio respiratory or systemic illness like diabetes, hypertension
4. Involved in any sports or exercise regimen
5. Addicted (dependence) to any drugs

The subjects for the control group were selected based on the following criteria:

Inclusion criteria

1. Males between 18-30 years of age
2. Leading sedentary life
3. Not chewed even a single packet of gutkha upto the time of study

Exclusion criteria

1. Age more than 30 years
2. Leading physically active lifestyle
3. Suffering from cardio respiratory or systemic illness like diabetes, hypertension
4. Involved in any sports or exercise regimen
5. Addicted (dependence) to any drugs

Before starting the actual study subjects were briefed about the protocol and informed consent was obtained. Thorough history regarding suitability as per the above inclusion and exclusion criteria was elicited. Basic clinical examination was done to rule out any cardio respiratory or other illness. Subjects were instructed to come to the lab after 2 to 3 hours of abstinence from gutkha chewing. Both controls and chewers were advised to refrain from consumption of coffee, tea and heavy meals at least 2 hours prior to the recordings.

I. Resting heart rate

Resting heart rate was measured in both non-athlete and athlete group, with the help of Cardiart 108T-mk-VI; ECG machine manufactured by BPL India Ltd. which is a single channel, 12 lead selection electrocardiograph, designed to record electrocardiograms.

Measurement was carried out only after the subjects were thoroughly acquainted with working of the corresponding instrument and the prescribed manoeuvre.

Special instructions

1. The subject was made to rest for fifteen minutes after the attachment of leads.
2. He was instructed to remain in sitting posture and completely relaxed.

The calibration (1mv = 10mm deflection height) and paper speed (25mm/sec) were checked. Lead selection was switched to LEAD-II and E.C.G. was taken. The resting heart rate was calculated and results were expressed as beats per minute.

$$\text{Heart rate} = \frac{1500}{\text{Distance between two consecutive R-R interval in mm.}}$$

II. Maximal voluntary ventilation (MVV)

MVV was measured in both the non-athlete and the athlete group with the help of computerised spirolyser.

Spirolyser

In this study, the instrument used to measure respiratory parameters was spirolyser model Spl –95 manufactured by FIM Company, which is an electronic spirometer.

The instrument has facility for calibration, and gives reliable values of tests, which are displayed on the screen along with its graphical interpretation. The instrument is standardised. The instrument has an in-built printer, which prints on special thermal paper. The instrument has memory for 2-3 tests, hence best of the 3 tests can be chosen.

Recording of MVV

The sensor was placed on the stand and then MVV key was pressed. The subject was instructed to keep the disposable mouthpiece attached to pneumotachograph half way in the mouth above the tongue. The nose clip was applied and the start button was pressed. The subject was asked to breathe as deeply and as quickly as possible for 12 seconds, at the end of which the test terminates automatically. Now the sensor is replaced back on the stand. The screen displays the values of MVV along with its graph. This test has no memory. The print key was pressed to obtain a print.

III. Maximal oxygen consumption (VO_2 max)

VO_2 max was indirectly assessed by the astrand-astrand nomogram method from sub maximal exercise data obtained while running on a treadmill.

In this study, the treadmill used was model GM1300 motorised treadmill manufactured by Afton company, with assembling size: 146 (L) X 66 (w) x 143 (H) cm and running surface of 360 x 1150 mm. It is driven by a 1.25 H.P. DC motor capable of 4000 r.p.m. The treadmill has a speed range of 1-11 km/hour with 3 levels of pre-set elevations which can be selected. The 3 possible elevations are 1^O (1.75 percent grade), 3^O (5.23 percent grade) and 7^O (12.28 percent grade). This tread mill has a polyster-backed belt and waxed deck for silent operation and 8 elastomer cushions for a low impact running surface.

The LCD monitor of the above treadmill has a 5 window display and displays time, distance travelled, speed, pulse rate and calories consumed. It also has an ear pulse sensor, magnetic safety key for emergency stop, ON/OFF and FAST/SLOW switches. In addition there are switches for mode, set & reset.

Sub maximal Exercise Testing

Subject preparation

1. Subjects had to appear for the test only after 2-3 hrs have lapsed after the last meal.
2. Contra-indications to testing are ruled out
3. A detailed explanation of the testing procedure was given outlining risks and possible complications. The subject was told how to perform the exercise test and the testing procedure was demonstrated.
4. All safety measures for the exercise testing were undertaken.

The treadmill was set to the elevation of 7^O. The safety key was put in place and the mains switched ON. The subject was made to stand on the belt and support his arms by the side in the arm support provided. ECG limb leads were connected and the cables were securely tied to the legs. The ear pulse sensor was connected.

The 'ON' Switch is pressed to start the motor. The 'FAST' Switch is pressed to increase the speed gradually upto 5km/hr and the subject is instructed to run at this speed. The running is continued till a heart rate between 125 and 170 beats per minute is obtained as shown on the LCD display. A steady heart rate for a given work load is indicated by a variation of not move than 5 beats per minute. On attaining this heart rate, the speed is gradually brought down by pressing the slow switch and the machine is switched OFF.

Lead II is selected in the E.C.G. machine and E.C.G. is recorded for a few complexes and sub maximal heart rate is calculated.

The distance travelled and time taken is noted down from the LCD display.

The power reached is calculated as follows:

X = sin á x B Where X = vertical distance travelled

á = elevation in degrees

B = Distance travelled on Treadmill (in km)

Work done = Weight of subject x (X)

Power = Work done / Time

The Astrand nomogram is used. The heart rate and the power reached are connected in the nomogram. VO_2 max (in Lit / min) is read from the VO_2 scale.

Corresponding values of VO_2 max in terms of body weight, height and surface area are calculated.

Since the subjects in this study did not exceed 25 years of age, age correction factor was not applied.

Maximal exercise testing

This is done after a rest period of 10 minutes. The L.C.D. display of the treadmill is reset to zero values.

The spirolyser is switched ON, subject's details entered and the VC key is pressed and kept ready. The ECG limb leads are connected and the cables secured as before. The subject was suitably instructed about the test manoeuvre. Elevation was continued at 7^{O}. The subject was asked to run till exhaustion and to stop only when he felt that he could no longer run.

With the subject on the belt, the treadmill was switched ON and the FAST key pressed. The speed was gradually raised to 10km/hr. When the subject could no longer continue running, the speed was gradually brought down and the treadmill switched OFF.

Lead II is selected in the E.C.G. machine and E.C.G. is recorded for a few complexes and Maximal Heart Rate is calculated.

(IV) Maximal Heart Rate.

Simultaneously, the nose clip is applied; the disposable mouth piece on the pneumotachograph of the ready spirolyser is placed on the subject's mouth over the tongue. The start switch is pressed in the VC Mode to record the respiration at VO_2max work load. After 50 seconds the test terminates automatically. The sensor is placed back in its place. A print is obtained.

(V) Delta Heart Rate (ä HR).

The ä HR was the calculated difference between the maximal HR and the resting HR.

(VI) Minute Volume at VO_2max (V_E max) is calculated from the respiratory rate and the tidal volume recorded

(VII) Breathing reserve (BR) at VO_2max is calculated using the formula.

$$BR_{\text{at VO2max}} = MVV - V_E \text{ max}$$

(VIII) Dyspnoeic Index (DI) at VO_2max is calculated using the formula

$$DI_{\text{at VO2max}} = BR_{\text{at VO2max}} / MVV$$

(IX) Recovery Heart Rate: This is recorded after a period of 1 minute from the cessation of maximal exercise. Lead II is selected in the E.C.G. machine and E.C.G. is recorded for 15 seconds.

Recovery heart rate is obtained by using the formula,

Recovery HR = 15 – sec HR x 4

(X) Maximum oxygen Pulse

This is calculated by using the formula,

$$\text{Maximum } O_2 \text{ pulse} = \frac{VO_2 \text{ max (ml/min)}}{\text{Max HR}}$$

All these set of recordings were done on both the non-athlete as well as the athlete groups

Statistical analysis was done by using un-paired student's test.

RESULTS

Table No. 1 Anthropometric data of controls & gutkha chewers (mean ±SD).

	No. of Cases	Age (yrs)	Height (cm)	Weight (kg)	BMI (kg/m^2)	Body surface area(m^2)
Controls	30	20.1 ±2.32	165.40 ±8.20	55.0 ±7.10	20.17 ±2.0	1.6 ±0.13
Gutkha Chewers	30	21.73 ± 2.28	165.30 ±6.80	53.0 ±4.40	19.23 ± 1.87	1.67 ± 0.59
P - Value		>0.05	>0.05	>0.05	>0.05	>0.05

Table No. 2 Various Heart Rates of controls & gutkha chewers (mean ±SD).

PARAMETER	Controls n = 30	Gutkha Chewers n = 30	P - Value
Resting Heart Rate[bpm]	75 ± 5.1	76 ± 4.7	>0.05
Sub-maximal Heart Rate[bpm]	151 ± 8.26	152.2 ± 5.46	>0.05
Maximal Heart Rate[bpm]	176 ± 8.01	178 ± 7.79	>0.05

Table No. 3 Comparison of the differences between

1. Maximum heart rate and Recovery heart rate (MHR-RHR)
2. Maximum heart rate and Resting heart rate (ä HR)
3. Maximum oxygen pulse of controls and gutkha chewers

PARAMETER	Controls n=30	Gutkha Chewers n=30	P - Value
MHR-RHR bpm	38.4 ± 8.57	39.1 ± 7.84	>0.05
5 HR bpm	101 ± 12.1	102 ± 8.5	>0.05
Maximum oxygen pulse	12.75 ± 1.2	12.53 ± 1.07	>0.05

Table No. 4 Comparison of Maximal Oxygen Consumption (VO2 max) of controls and gutkha chewers

PARAMETER	Controls n=30	Gutkha Chewers n=30	P - Value
VO2 max l/min	2.21 ± 0.19	2.23 ± 0.15	>0.05
VO2 max ml/kg/min	41.0 ± 5.56	42.63 ± 5.44	>0.05
VO2 max ml/cm/min	13.5 ± 1.31	13.4 ± 1.01	>0.05
VO2 max l/m2/min	1.39 ±0.14	1.43 ± 0.14	>0.05

Table No. 5 Comparison of the differences between

1. Maximum Voluntary Ventilation (MVV)
2. Maximum Minute Ventilation (VE max)
3. Dyspnoeic Index (DI) of controls and gutkha chewers

PARAMETER	Controls n=30	Gutkha Chewers n=30	P - Value
MVV l/min	100.1 ± 7.7	100.99 ±6.89	>0.05
VE max l/min	49.7 ± 4.32	50.0 ± 3.48	>0.05
BR litres	50.0 ± 5.8	50.8 ± 4.7	>0.05
DI %	49.8 ± 3.2	50.4 ± 2.5	>0.05

DISCUSSION

The greatest concern for nicotine related effects is acceleration or aggravation of cardiovascular disease[10]. In a study of the cardiovascular effects of daily smokeless tobacco use, the prominent effects of nicotine use viz., heart rate acceleration and increased urinary catecholamine excretion were similar throughout the day in people smoking cigarettes and those using smokeless tobacco [9]

In the present study no statistically significant difference was found in any parameter studied that can be attributed to the residual effect of short term use of Gutkha. This is reason enough to discourage gutkha chewers from this unhealthy habit at this early stage itself before permanent residual effects on health is seen.

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A Comparative Study of Serum Prolactin and Cortisol During Labour and After Delivery

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ABSTRACT

Objective: To study serum prolactin and Cortisol among primiparous and multiparous women during labour and after delivery.

Material and Method: Female patient of different parity attending Gauhati Medical College & Hospital were included in the study group. Sample were taken within 6 hrs of onset of labour and immediate postpartum (within 15minutes after delivery) and estimated by radio immune assay method.

Results: Serum cortisol in multi vs. primi statistically vary significantly ($p<0.05$) but the serum prolactin levels in multi vs. primi did not show statistical variation ($p>0.05$).

Key words: *Serum prolactin, Serum cortisol, Primigravida, Multigravida, First stage of labor, Immediate postpartum.*

INTRODUCTION

Prolactin is a protein hormone concerned with stimulation of breast development and milk production. Prolactin secretion increase steadily during pregnancy may be due to increase secretion of estrogen which stimulate hyperplasia of prolactin producing cells [1].Prolactin promotes mammary alveolar cells RNA synthesis , galactopoiesis , production of casein and lactalbumin ,lactose ,lipids (Andersen 1982) [2].Prolactin secretion increase throughout pregnancy but antagonized at receptor level by estrogen . Rapid fall in estrogen concentration in first 48 hrs after delivery removes inhibition and lactation begin[3]. The rise in prolactin is proportionate to the levels of estrogen and in the third trimester of pregnancy Prolactin concentration is 200ng/ml [4]. Maternal CRH and ACTH level increase during pregnancy [5].Maternal CRH rise sharply during labour, fetal cortisol production rises sharply during last few wks of gestation.[6]. There are 2 sources of cortisol in pregnant mother; one is from fetal hypothalamus and other from cytotrophoblast-syncytiocytotrophoblast complex of placenta. Serum concentration of cortisol is elevated because of estrogen induced cortisol binding proteins Transcortin Synthesis is more and metabolic clearance is lower during pregnancy because half life is nearly doubles than non pregnant women (Migeon and associates 1957). In early pregnancy level of circulating corticotrophin are reduced, as pregnancy progresses, the levels of ACTH and free cortisol rise. The cause is not understood. Notten and Rneckert (1981) give the evidence that the higher level is due to resetting of maternal feedback mechanism at higher levels. In late gestation cortisol level is increased 2-3 fold than non pregnant level. Peak CRH level is 48hrs before delivery [7].Serum CRH level 10 fold increases in labour than non pregnant level .Thus the progression of gestation is linked with the rise of Cortisol level for the timing of fetal development and born with appropriately mature organs. Placental regulation of its own metabolism through effect on the fetus with subsequent effect on maternal and uterine physiology and onset of labour is called placental clock theory.[8].Late gestational rise of cortisol is important for preparing the fetus for the abrupt change to extra uterine life [8].

Normal level

CORTISOL: 13.9microgm/dl, **PROLACTIN:** 10ng/ml

During normal labour, primiparous woman have

been observed to have higher antepartum and early post partum cortisol levels [9], whereas Prolactin level decrease during labour .[10]. There is a progressive rise in serum cortisol from the first trimester onwards along with an increase in serum prolactin level also.[11] Birth is a stressful event and there are significant changes in the hormonal profile associated with parturition, particularly in the stress-related hormones. The amount of stress experienced by both the mother and fetus during labor and delivery varies considerably and is likely to be different in primigravida and multigravida. [12]

MATERIAL AND METHOD

The study was carried out from March 2012 –May 2012 in Gauhati Medical College and Hospital. The patients were selected among the patients who were admitted to the labour room and in early stage of labour. Blood samples were collected under all aseptic and antiseptic measure and Maternal serum cortisol and prolactin levels were measured during first stage labour(within 6hrs in primi and 2hrs in multi) and 15minutes after delivery in both primi and multigravida,(immediate post partum) in 54 uncomplicated pregnancies at term (34 primi, 20multi).

Inclusion criteria

1. Patient delivered by spontaneous delivery were taken.
2. Without any induction of labour by oxytocin or artificial rupture of membrane or postagladine.
3. With out any pain relieving drugs.

Exclusion criteria

1. Patient undergone caesarian section.
2. Patient of induced labour.
3. Patient given pain relieving drugs.

METHOD

Under all aseptic and antiseptic measure blood sample were collected during first stage of labour and after spontaneous delivery .Serum Prolactin and Cortisol were estimated by radio immune assay (RIA). -: Serum cortisol was analyzed with commercial (RIA) radioimmunoassay kits (Beckman Coulter, IMMUNOTECH Prague).

Serum prolactin was analyzed with commercial immuno-radiometric assay kit (IRMA, Beckman Coulter); The samples were counted in a fully automatic Gamma Counter (Gamma -10 Version 2.0, Shin Jin Medics, and M.C.)

Findings

Serum cortisol level in multigravida before and after delivery did not statistically vary (p>0.05).However serum cortisol in primigravida showed statistical variation (p<0.05) before and after delivery. Serum prolactin levels in multi and primi, before and after delivery also varied significantly (p<0.05).Furthermore, serum cortisol in multi vs. primi statistically vary significantly (p<0.05) but the serum prolactin levels in multi vs. primi did not show statistical variation (p>0.05).

Table-1

1	BEFORE AND AFTER DELIVERY	MEAN	STD DEVIATION	STD ERROR	LEVEL OF SIGNI-FICANCE	95% CONFI DENCE INTERVAL OF THE DIFE. LOWER	UPPER
2	CORTISOL MULTIPARA	-108.1530	440.78150	139.38735	(>0.05) NS	-423.4691	207.1631
3	CORTISOL PRIMIPARA	413.0829	449.23821	108.95627	(<0.05)S	182.1060	644.0599
4	PROLACTIN MULTIPARA	-68.4057	62.67354	23.68837	(<0.05)S	-126.3691	-10.4424
5	PROLACTIN PRIMIPARA	-52.3559	72.01879	17.46712	(<0.05)S	-89.3845	-15.3272
6	MULTI VS PRIMI	MEAN DIFFE-RENCE	STD ERROR DIFFERENCE				
7	CORTISOL	-520.9848	177.95096		(<0.05)S	-887.48163	-154.48790
8	PROLACTIN	-16.0498	31.25417		(>0.05)NS	-80.86702	48.76735

Table-1 shows Mean, Standard Deviation and Level of Significance in 95% Confidence Interval of Serum Cortisol and Prolactin level during labour and after delivery in Multi and Primi gravida.

Conclusion

These changes in hormone levels during the first stage of labour and immediate post partum could be attributed to the emotional and physical stress of labour.

Maternal stress leads to a reduced concentration of prolactin and increased concentration of cortisol whereas relief of pain and maternal anxiety lessens both effects.[13] Primiparous women had higher antepartum and early postpartum cortisol levels that were twice as high as those among multiparous women .Increased Cortisol level reduced concentration of prolactin leads to delayed onset of lactation.[14] In this study serum Cortisol and prolactin level in primigravida before and after delivery showed statistical variation but in multigravida only serum prolactin levels showed statistical variation before and after delivery. Induction of labour with oxytocin or other agents were excluded to maintain spontaneous course

of labour without any interference. Analgesics or sedatives were also not allowed to the patients during the labour and after delivery prior to collection of sample. The mind behind this study is that to see the effect of physical stress and pshycotraumatic factors on hormone levels which are necessary on maturation of fetus and on lactation .Relieving of anxiety and stress by drugs might interfere on the value of hormone levels. The prolactin levels showed a fall during labour where stress was evident. Glucocorticoides inhibits secretion of prolactin [15]. The concentrations of cortisol tended to increase during labour and reached a maximum at delivery but drugs for relive of pain and anxiety level significantly lower the hormone. These results give further support to the hypothesis that maternal stress leads to a reduced concentration of prolactin and increased concentration of cortisol whereas relief of pain and maternal anxiety with meperidine lessens both effects.[16] Multigravida are already experienced about the stressful situation of labour moreover the duration of labour is also shorter than primigravida therefore rise of Cortisol level was not significant and the inhibitory effect of Cortisol on prolactin is absent so the prolactin level increases though it is statistically not significant. Primigravida faced the stressful condition of labour for first time moreover the duration of labour is also long so secretion of stressful hormones take place which might have got some beneficial effects on the fetus and for the new born baby.

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Nil

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Effect of Six Weeks Yogasana Training on Selected Physiological Parameters

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ABSTRACT

There are number of reports on effect of yoga training on pulmonary functions, but very few studies have been undertaken on effect of yoga on Handgrip strength Handgrip endurance and Peak expiratory flow rate (PEFR). 34 volunteers subjects [15 Males and 19 Females] attending Pattanjali yoga training Institute at M.E.S high school, Davangere in the age group of 20-60 years were selected for the study. Subjects underwent Yogasana training for about 6 weeks. Yoga training produced statistically significant increase in Handgrip strength and PEFR. Handgrip Endurance though increased after yoga training was not statistically significant. Study shows that Yogasana practices for about 6 weeks has marked effect on Physiological functions and improves lung functions, strength of skeletal muscle, inspiratory and expiratory muscles and Endurance.

KEY WORDS: *Yogasana, Handgrip strength, Handgrip endurance, PEFR*

INTRODUCTION

Handgrip dynamometry is an indicator on muscle function and nutritional status. As an objective and accurate physiological test that is easy to perform, it can be used as a bedside test to predict pre-operative nutritional status and postoperative complications. [1] Studies have shown significant increase in handgrip strength [HGS] after yoga training .[2,3,4,5] However the effect of yoga training on handgrip endurance [HGE] has been studied by only a few workers. While Trans et al., have reported a significant increase in muscular endurance after 6 weeks of yoga training programme. Dash and Telles. [6] have concluded that yoga training does not increase muscle endurance. Availability of energy and oxidation of glucose is believed to influence the handgrip strength proportionately.[7]

Peak expiratory flow rate [PEFR] is an effective measure of effort dependent airflow. Yogic techniques are known to improve one's overall performance and work capacity. Yoga appears to provide a comparable improvement in stress, anxiety and health status. [8] Yogic practices can be used as a psycho physiologic stimuli to increase endogenous secretion of melatonin, which in turn might be responsible for improved sense of well being.[9] Training to yoga respiration selectively increases the respiratory sensation perhaps through its persistent conditioning of the breathing pattern.[10]

METHOD

Study was done on 34 volunteers subjects [15 Males and 19 Females] attending Pattanjali yoga training Institute at M.E.S high school,Davangere.Subjects were in the age group of 20-60 years. Subjects underwent yoga training for about 6 weeks. Training sessions were held regularly from Monday to Sunday between 5.30- 7.30 AM under supervision of a certified yogic trainee. Yogic postures practised during training were as follows:

1. Calmness and Prayer : Shanti Mantra 2. Breathing Exercises: Abdomen Breathing [Udar Swasha],Chest Breathing [Ura Swasha],Neck Breathing [Griva Swasha],Hand stretch Breathing [Purna Swasha],Cat/ Tiger Breathing [Murgala Swasha or Vaghra Swasha],Dog Breathing [Swana Swasha],Trunk Breathing [Kati Swasha] 3. Dyanamic Yoga Postures: Foot Finger Movement [Padanguli Chalana],Panda Chalana [Foot movement], Pada Pashrva Chalane , Pada Bhramana [Savya-Apasavya – Clockwise and Anticlockwise rotation], Knee joint movement [Janu Kilu Chalane], Knee joint rotation [Janu Kilu Bhramana],Uru Sandhi Chalane [Hip Joint Movement],Paripurna Pada Bhramana [Full leg Joint rotation] clock wise and anticlockwise 4. Agantilagi [Back Postures]:Urdwa Prasarita Pada Chalane [one

leg and two leg],Urdwa Prasarita Pada Chalane Urdwa Bhramana [one leg and two leg],Cycling [One leg, two leg], Sethu Bandha Kathichalane,Supthabadha Konasu Chalane, Ardha Jathara Parivarthanasana Chalane, Halasana-Shavasana-Paschimothasana-Shavasana-Chalane, Eka Padaprasaranasane Chalane, Ardha Sama Konasana Chalane,Prasarita Padosthasana Chalane,Uthirta Trikosana Chalane, Hastha Pasharva Chalane[4 Types], Ninthale Ota [Running on standing], Swana Swasa, Sira bhramana [Head rolling], Adomukha virasana. 5] Standing Postures: Tadasana. Type 1, Urdwha Hasthasana, Urdwabadaguli, Namaskarasana, Urdwha Namaskarasana,Tadasana [Gomukhasana- eka-dvi hasth],Gomukasana- Hasthamudra, Paschima Namaskara, Ardhakati Chakrasana, Adhomukha Swasana, Shasomkasana, Vajrasana, Virasana-Parvatasana, Svastikasana, Padmasana, Gomukhasana, Pashcimostasana, Namaskara, Pavanamuktasana, Savasana 6] 1. Ardhakati chakrasana 2. Uthita Tikrosana 3. Veerabhadrasana Type 2. 7] 1. Uthiti Parsvakonasana 2. Veerabhadrasana Type 1. 3. Ardhachandrasana-2. 4. Veerabhadrasana Type-3. 8] Parirutha Trikosana. 9] Paschothasana-Hasthapadagala Pakka.10] Prasarita Padosthasana 11] Sitting Postures. 1 .Dandasana 2. Urvadandasana 3. Badhakonasana (Butterfly) Janu sirsana, Veerasana 6 vidha 12] Sarvangasana : Ekapada Sarvagasana, Parsavakpada, Halasana, Karna Pidasana, Supta Konasana, Parsva Halasana, Viparita Karni

A day prior to pre-training recordings, the subjects were familiarized with the Laboratory environment and their anthropometric measurements were taken.

They were given instructions about the experimen tal procedures and practice trials were administrated until we were satisfied that subjects performed the test as required of them.

Handgrip strength [HGS] of both hands was assessed using a handgrip dyamomometer [Inco instrumentation].Subjects were tested in 6 trials, 3 for each hand alternatively with a gap of 10 seconds between the trials. During the assessment subjects were asked to keep their arm extended at shoulder level, horizontal to ground.[3] The maximal value obtained during the 3 trials was used for statistical analysis.

For determining Handgrip Endurance [HGE], the subject was asked to maintain 1/3 rd of HGS in a sustained squeeze for as possible and the time was noted.[2] Dominant hand was right hand in all the subjects.

Peak expiratory flow rate [PEFR] was measured using a Wright peak expiratory flow meter. The subject was asked to take a deep breath and then to blow hard into a mouthpiece of the flow meter with a sharp blast. The movement of needle on the dial indicated the peak expiratory flow rate in liters per minute. Three recordings were taken at one minute intervals and the highest of the 3 readings were noted.[11]

Study was approved by Institutional Ethical Committee and informed consent was taken from the subjects for participation in the study.

STATISTICAL ANALYSIS

The data was analyzed using student paired 't' test to compare the effect of yogasana before and after the training on Handgrip Strength [HGS],Handgrip endurance [HGE] and peak expiratory flow rate [PEFR] .P value less than 0.05 was accepted as indicating significant difference between the compared values.

RESULTS

Yoga training of 6 weeks produced a significant [$P<0.05$] increase in HGS in both right and left hands. But handgrip endurance [HGE] does not show any significant change. In the present study, significant improvement was observed in Peak expiratory flow rate [PEFR] before and after Yogasana training.

DISCUSSION

The Physiological responses to Physical training have been well studied by many investigators. The improvement in Handgrip strength after yoga practices is ascribed to oxygen requirement reducing effect of Yogasana, as the availability of energy and oxidation of glucose is believed to influence the handgrip strength proportionately.[7]

Present study has shown differences in improvement in Handgrip strength after yoga related to hand dominance. Right hand values were greater than left hand values both before and after the practise of yoga. Similar improvement in handgrip were noted in earlier study related to hand dominance, age and gender.[3]

Previous studies have shown that twelve weeks practise of selected asanas for 30 minutes daily causes 21 percent increase in handgrip strength. Significant increase in handgrip strength after 6 week yoga training is in agreement with other studies. However, 6 week yoga training does not significantly increase Handgrip endurance in this particular study. It supports the earlier findings of Dash and Telles on Handgrip endurance after yoga training.[6]

The increase in handgrip strength following other yoga practices could be due to different factors including cognitive components and non-specific arousal. [12]

HGS is influenced by effort, integrity of motor neuronal pathways, muscle bulk and contractility. HGE is influenced by strength, and metabolic capacity of exercising skeletal muscles. The difference in handgrip between the 2 hands are related to relative functioning of 2 cerebral hemisphere.[13]

Yoga theraphy re-adjusts the autonomic imbalance, controls the rate of breathing and relaxes the voluntary inspiratory and expiratory muscles, which results in decreased sympathetic reactivity. Yoga increases respiratory efficiency, balances activity of opposing muscle groups and slows dynamic and static movements. [14, 15] Peak expiratory flow rate (PEFR) is a simple test of ventilator function which is widely used in clinical practice with a normal value of 400-450 L/min in adults. Normal values are dependent on age, sex and body built. It is expiratory flow rate at the peak of Forced vital capacity (FVC) and its value falls in Obstructive lung diseases. In the present study, significant improvement was observed in Peak expiratory flow rate [PEFR]. It is an effort independent flow and is dependent on lung volume. Increase in PEFR could be due to small airway opening in the lungs.[12]

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CONFLICT OF INTEREST

This is to certify that contribution titled "Effect Of Six Weeks Yogasana Training On Selected Physiological Parameters" is an original work conducted by Dr.Chandrashekhar Karpoor with approval taken from Institutional Ethical Committee and hereby considered for publication in 'International Journal of Physiology'. This particular manuscript has not been sent to any other Journal for publication or already accepted for publication anywhere.

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Instruments used in this study were provided by Department of Physiology, S.S.Institute of Medical Sciences, Davangere and was assisted by Lab Technicians of the department. Financial expenses was met by the investigator in completing this study.

TABLE I: **Handgrip Strength [Hgs] ,Handgrip Endurance [Hge] and Peak Expiratory Flow Rate[Pefr] Before and after Six Week Yogasana Training.**

Parameters	Measurement	Before		After		Differences	Significance		
		Mean	S.D	Mean	S.D		t value	P value	
HGS	Rt	16.4	6.3	21.9	7.5	-5.5	7.16	0	HS
	Lt	13.8	5.9	20.8	7.4	-7	8.15	0	HS
HGE	Rt	58.1	32.9	54.9	29.9	3.1	0.59	0.56	NS
	Lt	59.1	28.4	50.5	23.4	8.6	1.65	0.11	NS
PEFR		365.3	108.1	394.7	85.9	-29.4	2.35	0.03	S

HS: Highly significant. NS: Not significant. S: Significant.

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Diagnostic Approach to Bleeding and Clotting Disorders - Review

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ABSTRACT

Bleeding is one of the most serious and significant of the cardinal manifestations of disease. It may occur from a local site or may be generalized. Bleeding associated with a local lesion may be superimposed on either a normal or a defective haemostatic mechanism. In contrast general bleeding is usually associated with a hemorrhagic diathesis. This article covers various investigations and protocol to accurately diagnose the defect in the hemostasis mechanism.

Keywords: *Bleeding disorder, Clotting disorder, Hemophilia, Thrombocytopenia*

INTRODUCTION

Evaluation of the bleeding and clotting disorders is commonly initiated when a patient or referring physician suspects a bleeding tendency, a bleeding tendency discovered in one or family members, abnormal coagulation assay result is obtained from an individual as a part of routine examination or during preparation for the surgery or patient has unexplained bleeding through during or after surgery or following trauma. So, the evaluation of the possible hemostatic disorder is a step wise procedure to arrive at a tentative diagnosis. For the final diagnosis of the hemostatic disorders, confirmatory tests are to be done. The necessary investigations that need to be carried out are listed below:

TEST FOR VASCULAR AND PLATELET PHASES

BLEEDING TIME

First described by Milian in 1901

- Introduced by Duke in 1910, who observed duration of bleeding from small incisions of the ear lobe
- Modified by Ivy in 1941
- Bleeding time is a crude test of hemostasis (the arrest or stopping of bleeding).[1]

Various Methods

1. Ivy method
2. Template method
3. Modified template
4. Duke method

Indications

- Diagnostic test for platelet related bleeding
- A measure of efficacy in various forms of therapy
- Prognosticator of abnormal bleeding[1]

1. DUKE METHOD

A Nick is made in an ear lobe or a fingertip is pricked to cause bleeding. As in the Ivy method, the test is timed from the start of bleeding until bleeding is completely stopped. The disadvantage to the Duke method is that the pressure on the blood veins in the stab area is not constant and the results achieved are less reliable. The advantage to the Duke method is that no scar remains after the test. The other methods may result in a tiny, hairline scar where the wound was made. However, this is largely a cosmetic concern.[2]

2. IVY METHOD

The Ivy method is the traditional format for this test. In the Ivy method, a blood pressure cuff is placed

on the upper arm and inflated to 40 mM Hg. A lancet or scalpel blade is used to make a stab wound on the underside of the forearm. The area stabbed is selected so that no superficial or visible veins are cut. These veins, because of their size, may have longer bleeding times, especially in people with bleeding defects. The time from when the stab wound is made until all bleeding has stopped is measured and is called the bleeding time. Every 30 seconds, filter paper or a paper towel is used to draw off the blood. The test is finished when bleeding has stopped completely.[2]

3. TEMPLATE METHOD

- **C.H.Meilke,** modified the traditional Ivy method. The template and modified template methods are variations of the Ivy method. A blood pressure cuff is used and the skin on the forearm prepared as in the Ivy method. A template containing standardized lancet is placed over the area to be stabbed and two incisions are made in the forearm using the template as a location guide. The main difference between the template and the modified method is the length of the cut made.[2]

4. MODIFIED TEMPLATE METHOD

NORMAL RESULTS

- **Ivy method:** less than **5 minutes** from the time of the stab until all bleeding from the wound stops. Some texts extend the normal range to **8 minutes**.
- **Template Method:** range up to **8 minutes**
- **Modified Template Methods:** up to **10 minutes**
- **Duke Method:** is **3 minutes**.

ABNORMAL RESULTS

- BT longer than normal: abnormal result
- The test should be stopped if the patient hasn't stopped bleeding by 20-30 minutes
- BT is longer when the normal function of platelets is impaired or if there are a lower-than-normal number of platelets in the blood.
- A longer-than-normal bleeding time can indicate that one of several defects in hemostasis is present, including:
  Severe Thrombocytopenia, Platelet dysfunction, Vascular defects, von Willebrand's disease, or other abnormalities.[3]

Increased Bleeding time is associated with

Congenital thrombocytopathies

- Bernard Soulier
- Thrombasthenia
- Storage Pool Disease
- Defective release
- Gray platelet syndrome

Acquired thrombocytopathy

- MPD
- Liver disease
- Uraemia

Auto immune disease

- Drugs
- Diet
- Anxiety
- Anaemia

Vascular defects

- Ehlers-Danlos syndrome
- Osteogenesis imperfecta

Coagulation defects

- Afibrinogenaemia
- Severe Factor V deficiency
- Von Willebrands disease
- 20% of severe FVIII dificiencies

Decreased platelet count[3]

MEAN PLATELET VOLUME (MPV)

- The mean platelet volume (MPV) is an indication of platelet size
- Normal MPV: ranges are app. 7 to 11 fL.
- MPV can be an indication of platelet turnover, because platelets newly released from the bone marrow are larger and tend to decrease in size with age in the circulation
- It increases in disorders associated with accelerated platelet turnover as a result of large no. of thrombocytes or Bernard Soulier Syndrome.
- Normal or decreased values are obtained in patients with deficient platelet production, in some patients with sepsis, and with big spleen syndromes.
- Microcytic platelets in patients with some inherited thrombocytopenia such as Wiskott Aldrich Syndrome is reliably reflected by MPV measurements.[2]

PLATELET COUNT

PC is difficult because of small size of platelets and their tendency to adhere to foreign surfaces and to aggregate when activated.

a. Tests platelet phase for adequate number of platelets
b. Normal (140,000 to 400,000/mm^3).
c. Clinical bleeding problem can occur if less than 50,000/mm^3

PLATELET AGGREGATION STUDY

- Remain the gold standard in detecting platelet function defects
- measures the ability of agonists to cause in-vitro platelet activation and platelet-platelet binding
- Detects platelet aggregation in response to a variety of agents tested including: ADP, Epinephrine, Collagen, Arachidonic acid, and Ristocetin
- important reagent used : Antibiotic Ristocetin, which facilitates the binding of VWF to the glycoprotein Ib/IX/V complex
- For a normal result, the patient requires the presence of both functional VWF and normal glycoprotein Ib/IX/V
- This dose response allows testing for both increased and decreased sensitivity to Ristocetin

Platelets of patients with Glanzmann's Thrombasthenia only aggregate with Ristocetin

while platelets of patients with Bernard Soulier syndrome have:

- absent aggregation with Ristocetin
- reduced aggregation with collagen
- normal aggregation with ADP, Arachidonic acid and epinephrine.[4]

PLATELET FUNCTION ASSAY

Platelet aggregation using platelet rich plasma is the standard method to assess platelet function. It permits measurement of changes in optical density of platelet suspension.

New automated whole blood platelet function screening assays such as:-

1. **Platelet function analyser-100**: analyses the ability of platelets to aggregate in two cartridges:
   - Collagen/ADP
   - Collagen/epinephrine
2. **Reptilase** Time: measures time to clot formation after adding reptilase (Thrombin like snake enzyme) to citrated blood. It is not affected by heparin.
3. **Ultegra**: it is a whole blood assay designed to assess platelet aggregation based on the ability of activated platelets to bind fibrinogen.

FLOW CYTOMETRY

This is to study platelet structure and function and is based on the detection of cell surface glycoproteins with fluorescent labeled antibodies. It is used to detect the absence of Gp IIb/IIIa – receptors in patients with Glanzmann Thrombasthenia; GpIa, Ib, IIb, IV, and IX.[4]

TOURNIQUET TEST OR HESS TEST OR CAPILLARY FRAGILITY TEST

It is based on the fact that platelets maintain the capillary integrity.

Procedure

1) Examine the forearm, hand and fingers to make certain that no petechiae are present. Apply a blood pressure cuff on the upper arm above the elbow, and take a blood pressure reading.
2) Inflate the cuff to a point halfway between the systolic and diastolic pressures. However it should never exceed 100mmof Hg. Maintain this pressure for 5mins and later remove the cuff.
3) After 5-10 mins examine the forearm, hands and fingers for petechiae. Disregard any petechiae within ½ inch of the blood pressure cuff, because this may be due to pinching of the skin by the cuff.

Test Results: may be graded as follows

GRADES

- 1+ = a few petechiae on the anterior part of the forearm
- 2+ =many petechiae on the anterior part of the forearm
- 3+ =many petechiae over the whole arm and back of hand
- 4+ =confluent petechiae on the arm and back of the hand[5]

INTERNATIONAL NORMALIZED RATIO

- ↑INR=↑ bleeding risks
- Normal INR: 1.0
- INR : >3.5 - 4.0 : no treatment, until the use of dicumorol is stopped.
- INR : <3.5 - 4.0 : minor surgical procedures
- INR : <2.0 - 3.0 : total extraction with local measures
- INR : <1.5 : extensive flap surgeries or multiple bony extractions

TESTS OF COAGULATION PHASE

PARTIAL THROMBOPLASTIN TIME (PTT)

- represents the time for clot formation after adding calcium, phospholipids, and kaolin to citrated blood.
- is prolonged by:
- Heparin
- direct thrombin inhibitors

- deficiency or inhibitor for factors in the intrinsic and common pathway (namely, factors ii, v, viii, ix, x, xi, xii)
- lupus anticoagulant
- Vitamin K deficiency
- Severe liver disease[5]

PROTHROMBIN TIME (PT)

- represents the time for clot formation after the addition of Thromboplastin (tissue factor) and calcium to citrated blood.
- is prolonged with:
- deficiencies of factors II, V, VII, X or fibrinogen
- liver disease
- vitamin K deficiency
- Warfarin use.[5]

THROMBIN TIME (TT)

- Time taken for clot formation after the addition of thrombin to citrated blood.
- TT is prolonged by
- Heparin
- Direct thrombin inhibitors
- Fibrin degradation products (fdps)
- Paraproteins
- Fibrinogen deficiency (both qualitative and quantitative)
- Addition of protamine to neutralize the heparin is done to interpret the TT without heparin interference.
- used to establish the presence of adequate fibrinogen[5]

TEST FOR FIBRIN DEGRADTION PRODUCTS

FDPs are the protein fragments of varying sizes that result from proteolytic action of plasmin on fibrin or fibrinogen. Increased levels are seen in DIC, Fibrinogenolysis.

DISORDERS OF INTRINSIC PATHWAY

Screening test

- Prolonged aPTT
- normal PT
- normal PC

Specific assay ----------> Specific missing factor

Screens/Mixing studies ----------> to exclude factor inhibitors[6]

DISORDERS OF EXTRINSIC PATHWAY

Screening test :

- Normal aPTT Factor VII Def or

- Prolong PTInhibitors of Factor VII

Factor VII Def ----------> Confirm by specific assay

Factor VII Inhibitors ----------> Mixing Studies[6]

Table 1. FINDINGS IN PLATELET DISORDERS

Disorder	Bleeding Time	Platelet count	Clot Retraction	Platelet Aggregation	Platelet FIII activity
Thrombocytopenia	↑	↓	↓	–	–
Thrombasthenia	↑	N	↓	↓	↓
Storage pool deficiency	↑	N	N	N or ↓	↓
Aspirin	↑	N	N	↓ (only with Ristocetin)	N
Von Willebrand's disease	↑	N	N	↓(only with Ristocetin)	N
Thrombocythaemia	↑	↑	N or ↓	↓	N or ↓

Table 2. LAB FINDINGS IN COAGULATION DISORDERS

Disorder	PT	APTT	TT	FL	FDP
Hemophilia A, Hemophilia B, von Willebrand's disease, deficiency of factor XI, XII	N	↑	N	N	N
Warfarin therapy, obstructive jaundice, deficiency of factor V or X	↑	↑	N	N	N
Heparin therapy, disseminated intravascular coagulation	↑	↑	N	N	N
Parenchymal liver disease	↑	↑	↑	↓	↑
Deficiency of factor VII	↑	N	N	N	N

PT - Prothrombin Time, APTT - Activate Partial Thromboplastin Time, TT - Thrombin Time
FL - Fibrinogen Level, FDP - Fibrin Degradation Products

Table 3. COMPARISON OF PLATELET AND COAGULATION DISORDERS

Features	Platelet Disorders	Clotting Disorders
Gender	Females > Males	Males
Family history	Rare	Positive history
Nature of bleed	Immediately after Trauma Short- lived	Delayed after trauma Persistent
Removal of applied pressure	Bleeding usually stops	Bleeding recurs
Spontaneous bleeding	Common	Uncommon
Bleeding from superficial injuries	Common	Uncommon
Deep Hemorrhages or Hemarthroses	Rare	Common
Bleeding Time	Prolonged	Normal
Hess test	Positive	Negative
Platelet count	Often Low	Normal
Clotting function	Normal	Abnormal

CONCLUSION

Patients with hemostatic disorders are the regular visitors to the dental clinics, so the knowledge about these disorders is must for a dental physician. These patients should be managed carefully in the dental clinics to prevent undue complications for these patients.

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Basic Principles & Interpretation of Nerve Conduction Study : A Short Review

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ABSTRACT

Nerve conduction studies (NCS) are done to diagnose peripheral nerve diseases. These studies are extension to clinical examination and provide useful tool in the evaluation of patients who have pain, numbness, tingling, and hypo or arefelxic weakness. Proper electrophysiological approach & Technique is used to carry out the test, but more important is to interpret the result. Certain standard nerve conduction study criteria's are used to diagnose the peripheral nerve diseases. Demylinating neuropathy is recognized by moderate to severe slowing of nerve conduction velocity, prolongation of distal and F-wave latencies. A drop of more than 20% of compound motor action potential (CMAP) is strongly suggestive of conduction block provided there is no abnormal temporal dispersion. Axonapthy is recognized by normal or mildly slowed conduction velocity, reduced CMAP amplitude and sensory nerve action potential (SNAP) amplitudes, normal or mildly prolonged distal motor & F- latencies. H-reflex is measure of the arc reflex integrity; it allows evaluation of small motor fibers in proximal locations like roots and plexus.

Key words *- Latency, Amplitude, Conduction Velocity, Compound Motor Action Potential (**CMAP**), Sensory nerve action potential (**SNAP**), **F- wave, H-reflex.***

INTRODUCTION

Nerve conduction studies are a useful tool in the evaluation of patients who have pain, numbness, tingling, and hypo-or areflexic weakness [(1,2)]. The extent of correlation between measured latencies & amplitudes & the clinical presentation depends on the selection of nerves and timing of nerve conduction study in relation to the onset of symptoms. There are, however, limitations to the ability of these measurements to predict specific pathologic abnormalities in nerves [(3)]. There is extensive normative data for values of NCS, but each laboratory should establish its own set of normative data. Nerve conduction study findings are carried out & expressed as Motor nerve conduction study (MNCS), Sensory nerve conduction study (SNCS) & Long latency response, F-wave & H-reflex [(4-9)].

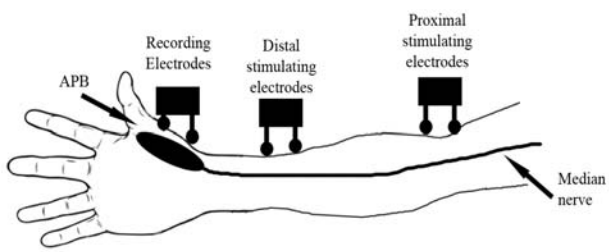
Motor nerve conduction study (MNCS)

The measurement of motor nerve's response, or M wave, is achieved by recording a compound muscle action potential (CMAP) from a surface electrode at the end-plate region of a muscle[(10,11)] .It represents the sum of the surface-recorded motor unit action potentials (MUAPs) and, therefore, is the sum of the action potentials generated by individual muscle fibers. The CMAP mainly is representative of those motor units lying close to the surface of muscle. Technical aspects of recording CMAPs are similar, but not identical.

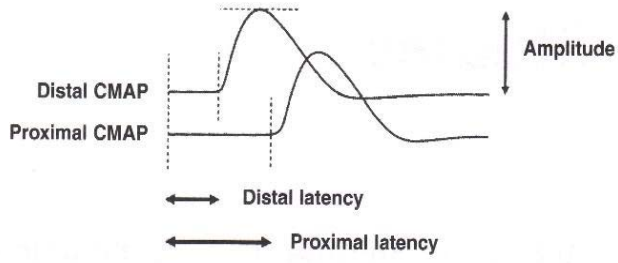
Fig. 1. A - Motor Nerve conduction study recording technique for Median nerve.

B – Compound Motor action potential waveforms (CMAP).

A



B



Technical considerations for proper motor nerve conduction study

Short stimulus duration, 10%-20% above threshold- supramaximal stimulus is used. A small preceding positive deflection at the distal stimulation site indicates that the active electrode is not over the end plate. This finding at a proximal site may the result of inadvertent stimulation of other muscles or anomalous innervations. Place reference electrode distal to the muscle being recorded. Ground electrode placement should be proper. Filter settings are kept at 2-10 KHz. Position of the limb influences length of the muscle or simply the muscles actual size. Smaller muscle causes decreased duration and increased amplitude of the CMAP compared to larger muscle because there is less opportunity for temporal dispersion of the muscle fiber action potentials. Anatomic anomalies will also influence CMAP measurements [4-5] .

Neurophysiologic interpretations of motor nerve conduction study parameters

Commonly measured parameters frequently are distal latency, amplitude & conduction velocity

CMAP Amplitude – It is affected by number of motor nerve fibers>9 um in diameter capable of being stimulated and to conduct impulses & conduction velocities of larger diameter axons (>9um). It is decreased in demylinating lesions (conduction block, slowing or temporal dispersion) with in the segment being studied & axonal loss with in the segment studied [12, 13].

Latency & conduction velocity- It is affected by conduction in primarily larger diameter axons between the stimulator and active electrode, relatively thicker myelin sheath & distance between stimulator & active recording electrode. It is slowed in demylinating lesions (slowing, temporal dispersion) with in the segment being studied & axonal loss in studied segment.

The shape of the CMAP & distal to proximal amplitude decay & duration changes (dispersion) are also recorded. Temporal dispersion of CMAPs is seen with increasing conduction distances & results in amplitude & area decay. Conduction velocity is faster over longer nerve segments because of faster velocities proximally [5].

Partial conduction block manifest if a significant number of axons have blocked conduction to result in weakness or sensory loss [14] . The concept of temporal dispersion commonly is used in the same settings of demylinating lesion & represents slowing of conduction along a segment without, however, producing clinical abnormalities [15] . The neurophysiology consultant has to interpret the findings suggestive of temporal dispersion in context of length of the nerve segment tested. The neurophysiological diagnosis of partial conduction block & temporal dispersion has to be firm, because it may help elucidate syndromes of acquired acute & demyelinating polyneuropathies & inherited polyneuropathies [16].

For patient seeking a second opinion, it is useful to allow for variability when comparing data from different laboratories. The variability for same-site velocity recordings is 2% to 10%. For amplitude measurements, 6%-25% variation has been cited. When comparing side to side, changes of 10-12 m/s in conduction velocity and more than 50% in amplitude are considered significant [5].

Sensory nerve conduction study (SNCS)

Sensory nerve conduction study represents evoked sensory nerve action potentials (SNAPs) of the fastest conducting sensory nerve fibers (as opposed to the smaller diameter nerve fibers mediating autonomic function & pain [17] . They assess the integrity of this population of sensory fibers from the dorsal root ganglion to periphery [2]. They can be performed either ortho- or antidromically as shown in fig. 2. Antidromically obtained SNAPs are deemed less uncomfortable, ring electrodes are used for the recording, it have higher amplitudes, thus facilitating measurement. Most neurophysiology laboratory use surface electrodes to stimulate & record SNAPs. SNAPs are demanding technically & can be influenced by various factors.

Technical considerations for proper sensory nerve conduction study

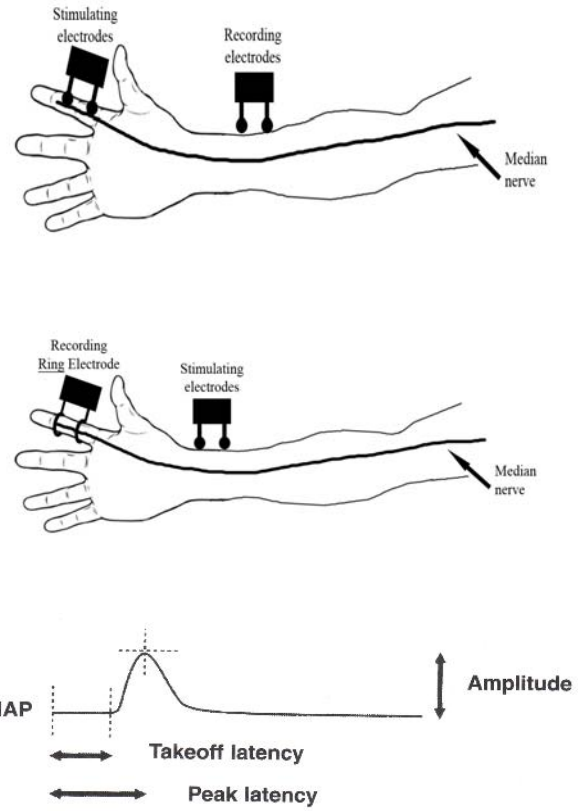
Limb temperature should be constant & above 28 degree centigrade. Inter electrode distance between the active & reference electrode should be 3-4 cm, with electrode secured to the skin surface, maintain low electrode impedance. Filter settings: low frequency 3-30 Hz, high frequency 2000-10000 Hz. Stimulus

strength is 10%-20% supramaximal to stimulate all myelinated fibers. SNAP amplitude is measured from maximal peak to the baseline immediately preceding it. Latency is measured from stimulus to the maximum negative SNAP amplitude. The onset latency of SNAP is used in calculating conduction velocities [4-5] .

Common pitfalls in recording SNAPs are suboptimal stimulating or recording electrode position relative to the nerve being studied. SNAPs may be altered or attenuated by edema or skin lesions, creating high impedance. When SNAPs are small or artifact is present, averaging may be necessary for optimal measure. SNAPs may be absent in sural nerves of individuals over age 60. However, more often a low amplitude response is found with advancing age [17] .

(Fig. 2). Sensory Nerve conduction study recording technique, A- Orthodromic recording, B- Antidromic recording & C- Sensory nerve action potentials waveforms (SNAP).

A



Neurophysiologic interpretations of sensory nerve conduction study parameters

Two primary measurements for SNAPs are latency & amplitude. The latencies provide almost no information regarding the number of functioning nerve fibers & should not be the only measurement, even in focal neuropathies, either demylinating or axonal [17]

Amplitude- Sensory nerve action potential amplitude is affected by sensory nerve fibers >9 um in diameter capable of being stimulated & conducting impulses. Conduction velocities of larger diameter axons (>9um) influenced by distance between the stimulator & active electrode. It is reduced in demylinating lesions with in the segment being studied & axonal loss with in the segment studied [13].

Latency & conduction velocity- It is affected by conduction in primarily larger diameter axons between the stimulator & active electrode, relatively thicker myelin sheath in large diameter axons & distance between stimulator & active recording electrode. Conduction velocity is reduced in demylinating lesion with in the segment being studied. Axonal loss in the segment studied may show mild slowing as reflected in axonopathies where axon diameter may be reduced as part of pathologic process [12-13] .

Evaluation of SNAPs is a sensitive measure of large myelinated nerve function if the process affects the segment of nerve being studied, even when clinical manifestations may be minor or absent. Conversely, if the process is early or mild affecting the sensory receptors or the distal axon, the SNAPs may be normal in the more proximal segments. Small fiber or autonomic neuropathies that spare large diameter nerve fibers likewise may show normal SNAP. If one encounter abnormal SNAPs it is good strategy to obtain other SNAPs appropriate for the clinical problem being studied- contra lateral or ipsilateral limb [4] .

In partial nerve lesions, SNAPs & motor response may be useful in diagnosis. In focal neuropathies & polyneuropathy, sensory nerve action potential abnormalities may be more sensitive than motor response [17]. This is because compensatory reinnervation of muscle fibers in chronic process may preserve muscle responses. Preservation of the SNAP in an area sensory loss suggests a lesion proximal to dorsal root ganglion or in a central sensory pathway [4] .

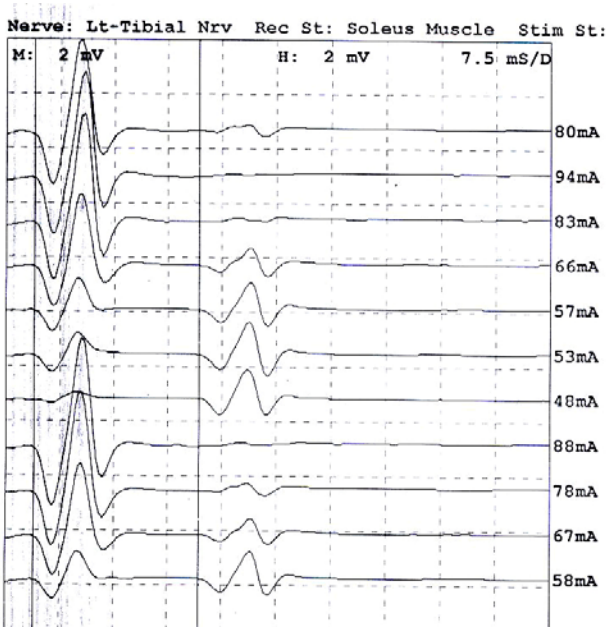
Long latency responses: H-reflexes & F-waves

H-reflex-

A short electrical stimulus applied transcutaneously to a mixed nerve may be able to stimulate only the lowest threshold Ia fibers. The ascending volley then can activate corresponding motor neurons for that nerve. The measured response is called the H-reflex & is considered a reflection of integrity of the reflex arc & excitability of the corresponding motor neurons [18] .

(Fig. 3) H-reflex waveforms.

M=CMAP response, H = H-reflex



Technical considerations for proper H-reflex testing

The optimal stimulus duration for Ia afferent activation is 0.5-1ms, H-reflexes are recorded more easily in flexors of the upper limb & extensors of lower limb.

Increasing stimulus intensity activates first the small motor neurons & later the larger motor neurons. This produces increasing H-reflex amplitude up to maximum. Increasing stimulus intensity above the M wave threshold decreases the H-reflex amplitude. For an individual H-reflex wave recording, allow 10 seconds between 5 &10 trials. Filter setting is kept 3-3000 Hz.

In clinical practice, H-reflex testing of the soleus, gastrocnemius & flexor carpi radialis frequently is used[4-5] .

Neurophysiologic interpretation of H-reflex parameters

H-reflex latency- It is measure of the arc reflex integrity, allows evaluation of small motor fibers in proximal locations (root & plexus). It depends on subject length & age.

Side to side differences of 1.5 ms for soleus & 1.0 ms for flexor carpi radialis are abnormal, although each laboratory should have its own criteria [4] .

H-reflex amplitude- Usually peak to peak measurements are used, it is influenced by synchrony & number of motor neurons activated. On average, increased in patients who have spasticity to reflect motor neurons hyper excitability.

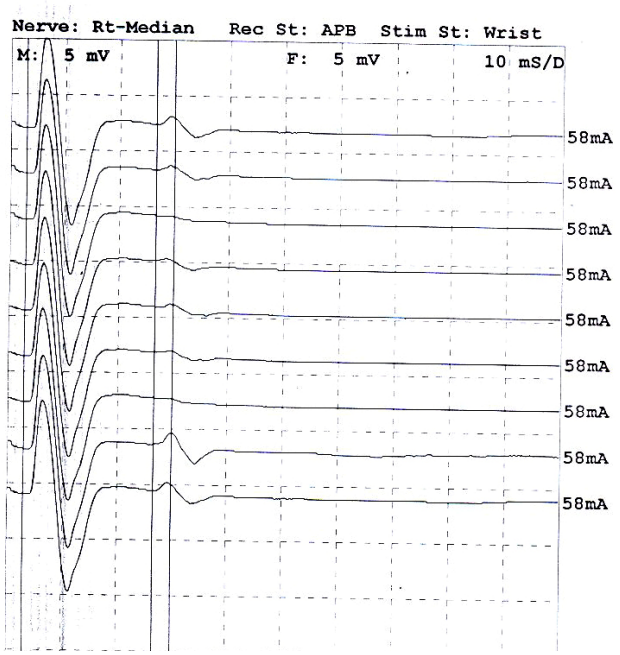
The clinical interpretation of the H-reflex depends on the presentation. Commonly this occurs in the neurophysiologic study of S1 radiculopathy. A mild & early proximal root lesion may produce asymmetric H-reflex abnormalities that support the clinical loss of an ankle reflex [18] .

F-waves

The F-wave is a long latency response produced by supramaximal, antidromic activation of a small portion of the corresponding motor neuron population & follows the M wave. It then is an orthodromic action potential generated by the motor neurons after they have recovered from applied antidromic stimulus [18].

Fig. 4 - F-Waves Waveforms;

M=CMAP response, F= f-wave



Technical considerations for proper F-wave testing

Supramaximal stimulation in a relaxed limb is optimal, the amplitude of the f-wave increases with stimulation intensity. The rate of stimulation is less than 0.5 Hz to avoid conditioning by a prior response. Because of small F-wave amplitudes (<5% of M amplitude) a smaller gain is used than for M wave recording. It should be differentiated from an axon reflex, which has more stable latency & morphology & can be blocked by increasing stimulus intensity. Since F-

waves are variable minimum 10 recordings should be taken & minimum F-wave latency is recorded. Mean latency, chronodispersion & persistence are recorded. F wave minimum latencies vary with limb length & normal data should be established by each laboratory[4-5] .

Clinical applications of F-wave

The F-wave latencies can be affected by lesions anywhere along the motor pathway. In diffuse demylinating proximal lesions, F-wave latencies become an important early measured abnormality, particularly with preserved M-waves. Muscles are supplied by multiple roots, whose motor neurons may generate independent normal F-wave latencies in a radiculopathy. F-wave latency may be normal in root lesions that leave most fast conducting fibers intact because minimum F-latency is a measure of these fibers [18] .

Ultimately, NCS together with long latency reflexes should help the examiner answer a few questions.

1. Is there axonal degeneration of large diameter fibers?

   The nerve conduction study of axonal polyneuropathy allows for differentiation of sensory & motor involvement. It helps in detection of early involvement of motor axons. Length dependant, axonal, sensory motor polyneuropathy can be classified further depending on the predominant involvement of sensory or motor fibers. In the case of focal nerve lesions, the presence, timing, & degree of axonal loss may be helpful in establishing severity & outcome [13-19] .
2. Is there focal or diffuse demylination?

   Symmetric, uniform involvement of sensory & motor fibers usually indicates the presence of an inherited polyneuropathy. Acquired demylinating polyneuropahties tend to have more asymmetric findings of conduction block, temporal dispersion, slowing, and F-wave prolongation [12,13,19] .
3. What are the severity & therefore prognosis?

   For axonal polyneuropahties, the amplitude of the nerve action potentials represents a good prognostic factor for axonal degeneration. In the case of demyelinating polyneuropahties, it is the secondary axonal loss that determines prognosis. This is true for acquired acute & chronic demylinating polyneuropahties. The abnormalities on nerve conduction study are not measurement of the level of pain & may not predict the disappearance thereof [4-5] .

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Comparative Analysis of Instructional Learning Preferences of Medical Students of First and Seventh Semester

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ABSTRACT

Learning style preferences can be based on personality models, information processing models, social interaction models and instructional preference model. The VARK inventory which gathers information according to instructional preference model is a widely accepted tool for assessing learning style.

Aim: Evaluation and comparison of instructional learning style preferences of first and seventh semester medical students.

Method: Study was conducted on first and seventh semester medical students (84 students each) of School of Medical Sciences and Research. VARK inventory (Version 7.1) was administered to determine the preferred instructional mode based upon the four sensory modalities- visual(V), auditory(A), read/write(R) and kinaesthetic(K).

Results : 75% of the first semester students had unimodal learning preference out of which 9%, 44%, 5% and 17% students preferred visual, auditory, read/write and kinaesthetic modes respectively. In comparison, significantly higher percentage (45%) of seventh semester students had multimodal learning preference and learning preference of unimodal students for visual, auditory, read/write and kinaesthetic modes was 6%, 13%, 12% and 24% respectively. The most preferred unimodal instructional style of the first semester students was auditory, and that of seventh semester students was kinaesthetic. However, in both semesters, significantly higher number of female students preferred auditory mode of learning style as compared to males whereas significantly higher number of male students preferred kinaesthetic mode. In contrast to the first semester students, the learning style preferences of final semester students were more varied, including all the bimodal (VA, VK, VR, AK AR, KR) and trimodal (VAK, VAR, AKR and VRK) learning styles.

Conclusion: In accordance with the principles of andragogy, teaching methodologies should be tailored to suit the learning preferences of learners. This can be aided by assessing the instructional preferences of medical students. Knowledge of their learning style preferences will also assist the students in incorporating appropriate learning strategies to enhance the process of self directed learning.

***Key words**: Instructional learning preference, Andragogy, Medical students, VARK*

INTRODUCTION

Educational researchers have reported that each individual has a specific learning style and if the method of information delivery conforms to their learning style, learning is more effective[1-3]. Learning styles may vary according to the sensory modality that one most prefers to use when internalizing information. To improve student motivation and performance we need to adapt our teaching approaches to

meet the different learning style preferences of our students.

Amongst the various tools used to determine learning preferences, VARK questionnaire is one of the most widely accepted and used for assessing instructional preferences. The latest VARK version 7.1 uses four major sensory modalities: visual, auditory, read/ write and kinesthetic for determining learning style preferences[4].

Students with visual preference use diagrams and pictures, symbolic devices such as graphs and flow charts .Auditory learners gather information best by hearing and enjoy discussions, lectures and tutorials. Read/write learners prefer printed material to gain knowledge .Kinaesthetic learners prefer simulations of real life experiences, field trips, demonstrations, workshops and hands on experiences[5].

Students who prefer a single method of information presentation are referred to as unimodal learners whereas others preferring more than one instructional mode are called as multimodal learners[6]. Various attempts have been made to identify learning style preferences in medical students of various countries using VARK Inventory method[7-10]. In the medical research arena, most of the previous studies have been conducted on first year medical students and the results obtained have shown vast variations. However, further studies need to be conducted to focus on identifying a variation in the pattern of learning styles of students in various stages of their medical curriculum.

This study aims at evaluating and comparing the instructional learning style preferences of first and seventh semester medical students using 7.1version of VARK questionnaire.

MATERIAL AND METHOD

The study was conducted on medical students studying in School of Medical Sciences and Research, Sharda University, Greater Noida. Ethical clearance for the study was obtained from the institutional human ethics committee. Students of first and seventh semester (n= 180) participated in the study. Purpose of study was explained and voluntary participation was seeked. Version 7.1 of the VARK questionnaire[4] was administered. The questionnaire consists of 16 multiple choice questions and it measures four perceptual learning preferences (visual, auditory, reading/writing and kinaesthetic). Each question carried four options. Participants were permitted to choose one or more than one option as found suitable. Out of the 180 questionnaires distributed to students of both the semesters, 12 questionnaires were found to be incompletely filled and were rejected. 168 respondents submitted the completed questionnaires. Both the study groups i.e. first and seventh semester students comprised of 84 students each. Male and female students in first and seventh semester were 24 and 60, and 26 and 58 respectively. Questionnaires were evaluated on the basis of previously validated scoring instructions available on the VARK website[4].

The data thus obtained was compiled using Microsoft excel spreadsheet and statistically analyzed for a. Percentage of students with unimodal and multimodal preference/s in both study groups b. Percentage of students in each category of learning style preference /s in both semesters. c. Dominant learning preference in each study group, and d. Statistical comparison of learning style preferences of first and seventh semester students using chi square test.

RESULTS

VARK inventory results for the first and seventh semester medical students are shown in Figure 1a, b and Table I. The data revealed that 75% of the first semester students had unimodal learning style and 25 % had multimodal preferences. Amongst the students with unimodal preference the percentage distribution was as follows: visual (9%), auditory (44%), read/ write (5%) and kinaesthetic (17%). As compared to first semester students, significantly higher number (45%) of seventh semester students had multimodal learning preference. Of the 55% of unimodal seventh semester students- 6%, 13%, 12% and 24% preferred visual, auditory, read/write and kinaesthetic modes respectively.

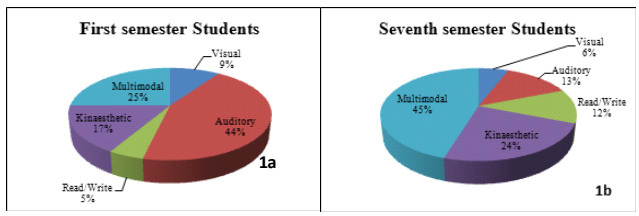

Fig. 1 – Percentage distribution of learning style preferences of (a) first semester and (b)seventh semester students.

	Visual	Auditory	Read/Write	Kinaesthetic	Multimodal
First semester students	8	37	4	14	21
Seventh semester students	5	11	10	20	38
P value	0.405	0.0001	0.108	0.303	0.026
x^2	0.692	14.083	2.57	1.06	4.89

Table 1 – Comparison of learning style preferences of first and seventh semester students

The most preferred unimodal instructional style of first semester was auditory and of seventh semester students was kinaesthetic. The number of seventh semester students preferring auditory way of learning was significantly lower than first semester students ($p < 0.05$) (Table I).

In both the semesters, significantly higher number of female students preferred auditory mode of learning style as compared to males; whereas significantly higher number of male students preferred kinaesthetic mode (Fig. 2).

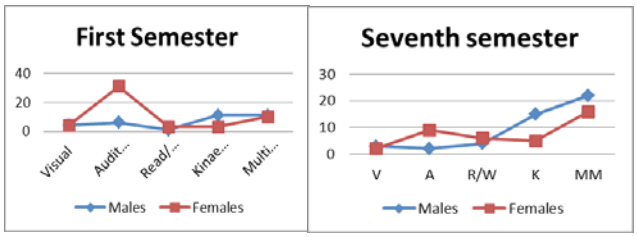

Fig. 2 – Comparison of learning style preferences of first and seventh semester male and female students.

Furthermore, the seventh semester medical student population tended to be more diverse than first semester medical students, encompassing a broader range of sensory modality combinations within their preference profiles (Fig. 3).

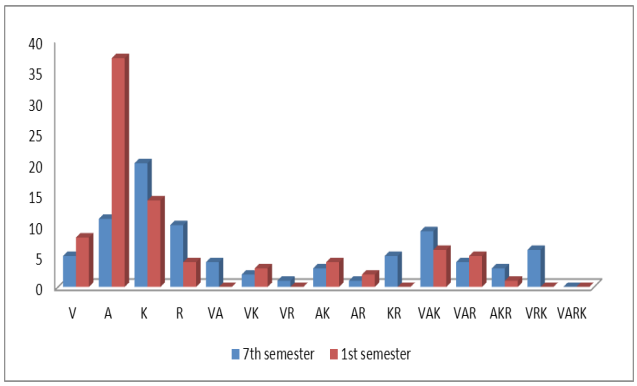

Fig. 3 – Distribution of various unimodal and multimodal learning preferences in first and seventh semester students.

The most preferred bimodal learning style in first semester students was AK (auditory and kinaesthetic) followed by VK (visual and kinaesthetic) and AR (auditory and reading). Three of the six bimodal styles (VA, VR, KR) were not represented in the first semester medical students. As compared to the first semester students, the learning style preferences of final semester students were far more wide ranging, encompassing all the varieties of bimodal learning styles. The pattern of preference of trimodal learning styles was similar in both first and seventh semester students, however, the number of students who preferred bimodal and trimodal learning styles was more in seventh semester as compared to first semester (Fig 3).

DISCUSSION

The present study was carried out with the objective of understanding the learning preferences of first and seventh semester medical students with an aim to gain an insight into the most preferred instructional style and whether or not learning preferences vary significantly in students of different stages of medical studies. Knowledge of learning style of students needs to be addressed so that it can help educators to ensure that their students become more effective learners [2,11]. The present study revealed that the most preferred unimodal learning style in first semester students was auditory followed by kinaesthetic, visual and read/write. These findings are comparable to the results of the study conducted by Shah et al[7] on first year Indian medical students. However, according to Lujan and DiCarlo[8] and Johnson[5], the most preferred learning style of first year medical students was read/write in students from Indiana, USA and kinaesthetic in students from Michigan, USA respectively. A study conducted in Malaysia also showed results similar to Michigan study[12]. The variation in learning preferences of medical students from different countries could be explained by the difference in teaching methodologies used at premedical level and exposure to hands on clinical experience in first year of medical curriculum[9].

The current study also reveals that the learning preferences are significantly different amongst male and female students, thereby indicating that gender influences learning style. This is highlighted by the observations of the present study that auditory mode of learning was the instructional preference of female students and kinaesthetic mode of male students in both the semesters. Shah et al[7] did not observe any significant gender difference in preference of different learning styles, however, they found that female students preferred auditory learning style slightly more than other unimodal learning styles and attributed this to males being more focussed externally and females being more introspective. According to the study conducted by Wehrwein et al[13] on undergraduate physiology students, female students preferred unimodal learning whereas male students preferred multimodal. Gender influence on learning style preferences was also studied by Slater et al[14] who reported that although the number and types of modality combinations were not significantly different between genders, the female student population encompasses a broader range of sensory modality combinations in

their learning preference profiles.

Another noteworthy observation from the present study was that the learning style preferences are significantly different in first and seventh semester medical students. The learning preference variation from predominantly unimodal in first semester students to a more diverse form in seventh semester students could be explained by the fact that premedical studies in India are primarily didactic in nature, whereas medical curriculum encompasses multiple modes of teaching methodologies like tutorials and problem based learning which inculcate self directed learning amongst students, hence multimodal learning styles. This suggests that students adapt to the various instructional strategies used and thereby learn to use different sensory modalities resulting in change of preferred learning style from unimodal to multimodal. Although no longitudinal study has been reported so far in medical students, a study conducted on dental students has also reported that learning preferences change over the four years of dental school as measured by the Gregorc learning style delineator[15]. Fleming et al[16] conducted longitudinal study on nursing students and reported that learning styles were significantly different in the two study groups i.e. first and final year students.

Thus, it is important that the teaching and learning process should take cognizance of students' learning preferences. Knowledge of students' learning style preferences will not only help in the development of effective teaching methodologies by the educators but will also help students to recognize their own learning style preference/s thereby knowing their strengths and using appropriate strategies to enhance the process of learning.

CONCLUSION

Adult learning (Andragogy) based on Malcolm Knowles' theory[17] suggests that teaching learning should be learner centered. Hence, it is imperative that educators should have an idea of instructional learning preferences of their students. From the results of this study it can be concluded that the learning preferences of medical students are diverse and change from unimodal to multimodal as their studies advance. Therefore, it would be better to tailor the curriculum to incorporate different teaching learning methodologies suited to learning styles of all the students. Students' learning preference and their approach to study has a significant impact on both – academic as well as professional success.

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Conflict of interest

The authors declare that there is no conflict of interest.

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Koro - A Case Report and Review

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ABSTRACT

Koro is largely considered to be a culture-specific psychiatric disorder occurring primarily in Southeast Asian cultures though a large number of the cases has been reported beyond the cultural boundary as well, leading to a debate concerning the culture-specific nature of the syndrome. Classically it is manifested by acute anxiety associated with the fear of genital retraction, accompanied by fear of death induced by the thought that complete disappearance of the genital organ will result in death. Majority of the cases have been witnessed in male gender. Most of the female cases are from Koro epidemic. Sporadic individual case reports of Koro in female are very few.

Case report: Giving a psychopathological and nosological definition of this peculiar syndrome has also been problematic. In this paper, we report a case of koro in a young, Indian female patient. We briefly present the etiological factors related to the development of the syndrome, the most significant psychopathological characteristics and issues related to cultural specificity of the syndrome especially in a sporadic individual case.

Key words *- Koro*

INTRODUCTION

The term koro is thought to derive from the Malay word kura which means "tortoise" with symbolic meaning that the penile retraction is compared with the retraction of the head of the tortoise into its shell. In India it is known as Jhinjhinia Bemar especially in Assam and Wes Bengal where the Indian epidemic took place[1,2]. It is a psychogenic reactive state, which is intimately related with the socio-cultural construct of sexual somatization, does reflect varied types of illness beliefs prevailing in different cultural groups. When Van Brero first defined this disorder, he thought it was a peculiar manifestation of obsessional-compulsive illness. Subsequently, it has been classified under many categories, such as anxiety neurosis, conversion disorder, depersonalization disorder, atypical psychotic disorder, body-image disorder, etc.[3]. However, there is a general consensus that the syndrome is similar to panic attacks or other well-understood anxiety states[4].

All acute, subacute and chronic [5] form of Koro has been reported. The presentation may vary as retraction of penis in male, retraction of breast and labia in female or retraction of any protruded organ like nose & tongue [6,7] in either of them. Various medical hypotheses (etic explanation) of Koro (both sporadic and epidemic forms) e.g. premorbid sexual conflicts and guilt [8] morbid preoccupation with sexual functioning[3] heightened genital awareness and autonomic hyperarousal [2], learned phenomena [9] hypochondriacal genital concern [10]; cultural belief in ghost fox spirit [2,7], traditional Chinese Yang(male) and Yin (female) concepts have been proposed. Case reports of Koro in association with organic conditions such as substance abuse cannabis [11,12], alcohol[13], Steroid[14] and brain tumor [15] are also available. There is insufficient patient-reported (emic explanation) explanatory framework of Koro.

The Koro or koro like syndrome has occasionally been reported sporadically almost round the globe in people with various ethnic groups viz. Americans, British, Chinese, Canadians, Greeks, Indians, Jordanians [16], Jews and Nigerians besides the well known epidemic studies in Chinese and Indians. The presence of Koro outside the cultural boundary makes its cultural specificity apparently debatable. Berrios and Morley reviewed a total of 16 non Chinese sporadic cases and pointed out that most of the patients manifested incomplete Koro (as a Koro case is defined). Such Koro like states, as secondary symptoms, are usually observed as a part of the primary psychiatric condition, such as affective disorder or psychosis. Occasion-

ally, the syndrome may occur as forerunner of psychiatric illnesses viz. affective disorder [17] ; however in many cases it becomes difficult not only to draw a clear demarcation between Koro and Koro like states but also, to predict the course of illness.

Besides, all these most of the Koro cases have been observed in male gender. Most of the female cases are from Koro epidemic. There is dearth of literature on sporadic female cases of Koro especially in our part of the globe.

Keeping all these points in view we briefly present the etiological factors related to the development of the syndrome in a young Indian female patient focusing on emic explanations, the most significant psychopathological characteristics and issues related to cultural specificity of the syndrome especially in sporadic individual cases in the background of Indian culture.

CASE REPORT

Miss. J, a 21-year old Indian unmarried female student who visited the Psychiatry Department, SSL Hospital of our University in Nov. 2011 and reported that three days back while she was at her home, busy in study, she experienced a sudden feeling of breast and genitalia shrinking associated with the fear of loss of womanhood and death induced by the thought that complete disappearance of the genital organ may result in loss of her womanhood and death. She urgently went to her mother, showed her breast, complained about her retracting sexual organs and started crying and telling that with further retraction she will lose her womanhood and may die if it goes further inside the body. Despite her parents' reassurance that there is nothing like that and the size is as usual she could not be relieved. Besides, she also manifested symptoms of restlessness, brooding, guilt, palpitation, sweating, and inability to concentrate and to do anything of worth in life. She was hopeless and helpless but was eager and used to make repeated request to her parents to get her married, thinking that after marriage her active sexual life may help her in some way or other. She told that she could clearly appreciate the shrinkage of breast and vulva especially when she takes some juice and her waist used to broaden after

taking meal because of retraction of vagina inside the pelvic cavity. She was taken to a physician but did not get well. She was the oldest of four siblings (two brothers and one sister) in a middle class family living in Varanasi, India. The father, a police constable in UP police, was defined as caring with authoritarian attitude and had history of symptoms suggestive of a psychotic episode 15 year back which resolved after treatment by a psychiatrist and the mother was a home maker, modest Indian woman with puritanical attitude. She had less no. of friends as children especially female of the family were not allowed to go outside and mix-up with others. Being a leading child of the family she had to help her mother in various domestic chores. Though she had her admission in a college but she was not allowed to attend her classes as the college was reportedly distant and the family was more concerned about her security than her education amidst the fact that other female students from her neighborhood were attending the classes. She was neither provided any home tutor to help her in study. No psychiatric illness could be detected in blood relatives on both side of parental family tree, except for the father. She remembered that she experienced severe pain, was very anxious and a bit ashamed at the time of menarche when she was 13 year old. There was no history of any associated substance abuse or use of drugs like steroids known to be capable of inducing a similar clinical picture. At our hospital her physical examination and laboratory investigation results were within normal ranges, and she was fully oriented and cooperative during her psychiatric evaluation. She appeared somehow relaxed but slightly anxious with HARS [18] score 14 while being interviewed and she complained of insomnia and loss of appetite. She had continued worries about her fearful experiences related to her retracting sexual organs. Her Body Dysmorphic Disorder Examination (BDDE) [19] score was found to be 87 which reflect a significant degree of dissatisfaction with the appearance of the body parts concerned. There were no any obvious psychotic features in her thinking process or content. Her judgment and insight were intact. She had normal physical and neurological examinations and we decided that most probably she was suffering from Koro like culture bound syndrome. So, prescribed escitalopram-10mg and clonazepam (.25mg)-1/2-0-1 and was given psychoeducation sessions. One month later at her 2nd follow-up visit she reported that she used her medication regularly and felt relieved as far as her anxiety symptoms were concerned, but she insisted that her perceptions about her sexual organs are real. Thinking it to be a perceptual distortion 10 mg of olanzapine was added and on next follow-up after one month she was quite happy to realize that now she no longer experiences earlier problems and things got corrected with help of medicines. Though she was not experiencing those symptoms currently but still she was of the opinion that her earlier symptoms were real so she was given two more psychoeducation sessions targeting the status of her experiences which ended with desirable outcome.

DISCUSSION

Amidst the various form of presentation described in clinical cases of typical Koro this patient had acute form of anxiety symptoms. Several cultural and psychosocial stresses such as orthodox family, an authoritarian father with history of psychosis, strict mother with strong religious attitude towards sex, inadequate knowledge and misconcepts about sexual matters were present. Lin et al.1995[19] observed "Koro patients of southern China regard sexual taboos as more powerful conflict ". Added to this were pressures for domestic chores, as well as continuing study that too without attending college or having any tutor for academic help. The association of genital shrinkage and waist broadening with meal especially with liquid diet as explained by her was "whole of labia majora and minora starts shrinking inside the vaginal canal located in pelvis and the liquid being taken per oral also goes to intestines lodged in pelvic cavity thereby raising internal pressure of pelvic cavity and increasing the size of waist by pushing effect".

The pathological belief of retraction of nipple and labial shrinkage appears to be because of an underlying perceptual distortion. As mentioned studies have related body dysmorphic disorder as close a close differential diagnosis to an extent that this syndrome got even classified under the auspices of the body dysmorphic disorder. Koro patients don't show impairment of reality testing plus they are characterized by a false belief or exaggerated perception that a body part is defective. This case appears to be a unique example of a body dysmorphic disorder with a BDDE score of 87 and presenting as preoccupation with an imagined defect in appearance leading to clinically significant distress or impairment in social, occupational, or other important areas of functioning. But the acute onset, the severity of the symptoms, south-east Asian culture, part of perceived defect and the systematization of the conflict around genital make us think of Koro. The condition is probably a result of complex interaction of cultural, social and psychodynamic factors in predisposed personalities[5]. Culturally ingrained fears about the consequences of loss of womanhood what forced her to think and express her eagerness for marriage as a remedy for the same apparently has strong association with this syndrome. This is probably because of profound ignorance with resultant conflicts in sexual sphere. Unlike Khubalkar & Gupta[9] it doesn't appear to be a learned phenomenon as there is no history of reading, hearing or witnessing such case by this patient.

The cultural specificity of the syndrome has also been questioned by several studies. Given the questions surrounding the term koro, because of its specific cultural connotations, we may wonder whether genital retraction is one of many symptoms of anxiety rather than a specific symptom of the culture-bound koro syndrome[21]. Therefore, the term, anxiety disorder associated with genital retraction fear, would be a more appropriate term that reflects the universal nature of the disorder (Man-Lun, 1999; Bernstein and Gaw, 1991). According to Bracha (2006), maintaining the description of these syndromes as culture-bound may prevent science-based treatment and may be stigmatizing. As such, it is reasonable to think of the presented case while considering that koro-like symptoms are likely to be manifestations of a severe anxiety state (Bernstein and Gaw, 1990; Dzokoto and Adams. 2005; Cheng, 1996; Chiniwala et al., 1996).

The pathological belief in penile shrinkage is due to an underlying perceptual distortion. (Chakraborty, 1982). The perception of acute/subacute/chronic shrinkage of breast, labia, penis or even nose and tongue which leads to such a level of anxiety can be considered just one of the symptoms of an anxiety spectrum disorder where perceptual distortion occurs on already existing anxiety disorder. But when the anxiety symptoms start after these specific perceptual distortions at a place with specified cultural background then preferring Koro over any other diagnosis appears more reasonable. Again a typical intra cultural Koro patient (patient belonging to the culture which is supposedly predilected for Koro) in most of the cases would be able to recall that from where and how such idea came to their mind but in all cases it may not happen because that's what the culture may do to an individual's personality. It's not always possible to delineate the source of each behavioural component of an individual of a particular culture. An idea can enter the mind at any age in any of its states (conscious/subconscious/unconscious) and may come out with observable behavioural changes sooner or later subjected to the intensity, frequency & emphasis while delivering that idea to the individual via printed or any other audiovisual stimulus in a natural or controlled environment. Although the complete ruling out of possibility of other diagnosis is beyond the scope of these arguments yet giving priority to culture bound syndrome over any other diagnosis in such circumstances appears more practical and logical. However, understanding the complexity of culture-bound syndromes as expressions of distress requires comprehensive research, even though koro symptoms are manifestations of psychologically- based body dysmorphic disorder, anxiety states, such as panic disorder and other central nervous system insults viz. brain tumour(Durst,1988). Further research in this area can help to integrate cultural and clinical knowledge and provide insights into issues of etiopathogenesis, diag-

nostic universality and cultural specificity.

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Recent Concepts in Physiology of Deglutition - A Review

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ABSTRACT

Food is the necessity of life for which the man spends his livelihood. Enjoying good food gives pleasure to all. However there are many signs and symptoms of diseases which cause dysphagia. Thus it becomes very important for a physician to understand the physiology of deglutition.

Keywords : *Food, Deglutition, Swallowing*

INTRODUCTION

The process of chewing and deglutition taken together are often considered to represent the totality of feeding process. The details of the process of deglutition are still controversial. Parts of this complicated act are so rapid that it is impossible to follow with the eye all the movements. When observing radiologically the deglutition of radiopaque material, and even cinematography has not cleared a number of points.

PHYSIOLOGY OF DEGLUTITION

It is a reflex response triggered by Afferent impulses by Glossopharyngeal nerve, which is sensory to pharynx and Efferent impulses are carried by cranial accessory nerve which joins vagus to give motor supply to the constrictors. These impulses are integrated in Nucleus of Tractus Solitarius (taste sensation) and Nucleus ambiguous. Deglutition is initiated by a voluntary action of collecting the oral contents on the tongue and propelling them backwards into the pharynx. This starts a wave of involuntary contraction in the pharyngeal muscles that pushes the material in the oesophagus. Inhibition of respiration and closure of glottis are part of the reflex response. Deglutition is difficult if not impossible when the mouth is open. [1]

A normal adult swallows frequently by eating but deglutition continues between meals. The total number of swallows /day are:

- 600-200 While eating and drinking.
- 350 While awake without food.
- 50 While sleeping.[2]

Deglutition is a complicated mechanism because the pharynx most of the time serves several other functions besides deglutition and is converted only for a seconds at a time for the act of propulsion of food. It is important that respiration especially should not be compromised because of deglutition.[1]

In General 3 stages of deglutition are:

1. Oral Stage

This involves forces for propelling the bolus and tongue upliftement by mylohyoid muscle.

Safeguarding Factors which prevent the food from going to wrong place include Mouth closure (contraction of orbicularis oris). Elevators of mandible are raised, buccinator contracts to prevent food from going to vestibule. From here on deglutition becomes almost entirely automatic and ordinarily cannot be stopped.[2,3]

2. Pharyngeal stage

The posterior border of the soft palate is lifted, or pulled upwards to contact the passavant's ridge present over the superior constrictor of pharynx to prevent food from going to the nasopharynx. The palatopharyngeal folds on either side of the pharynx

are pulled medially to approximate each other. In this way these folds form a sagittal slit. Through this sagittal slit food must pass into the posterior pharynx. This slit performs a selective function, of allowing the food that has been masticated sufficiently to pass with ease while impeding the passage of large objects. Since this stage of swallowing lasts for less than a second any large object is usually impeded too much to pass through the pharynx into the oesophagus.[2,3]

The vocal cords of the larynx are closely approximated. Larynx is lifted and tongue pulled backwards. This action of larynx combined which the presence of ligaments which prevents the upward movement of the epiglottis causes the epiglottis to swing backward over the opening of the larynx. Both effects prevent the passage of food from going to trachea. Most essential is the close approximation of vocal cords. Destruction of the vocal cords of the muscles that approximate them can cause strangulation.

Constriction of Inferior constrictor (has two parts Thyropharyngeous and Cricopharyngeous) ie. Thyropharyngeous propels the food into the oeosphagus with relaxation of cricopharyngeous.

3. Oesophageal phase

Involuntary phase. The oesophagus functions primarily to conduct food from the pharynx to the stomach. The oesophagus normally exhibits 2 types of peristaltic movements: primary peristaltic movements and secondary peristaltic movements.[2,3]

INFANTILE SWALLOWING

The Infant is not an Anatomical Miniature of the Adult

Proportional differences exist between the young infant and the older infant, child, and adult. These include:

The oral cavity is small in the newborn and is totally filled by the tongue due to a small and slightly retracted lower jaw. The newborn has a set of sucking pads in the cheeks which provide stability during sucking. The soft palate and epiglottis are in contact at rest, providing an additional valve at the back of the oral cavity. The larynx and hyoid cartilage are higher in the neck and closer to the base of the epiglottis, providing added protection of the airway. The infant's eustachian tube runs horizontally from the middle ear into the nasopharynx, rather than its later vertical angle in the older child and adult.[4]

MECHANISM OF DEGLUTITION

Primary peristalsis is simply the continuation of the peristaltic wave that beings in the pharynx and spreads into the oesophagus during the 2nd stage of deglutition. This wave passes all the way from pharynx to the stomach in about 8-10secs. Food swallowed by a person who is in upright position is usually transmitted to the lower end of oesophagus even more rapidly than the peristaltic wave itself in about 5-8seconds. Because of the additional effect of gravity pulling the food downwards. If the primary peristaltic wave fails to move all the food that has entered the oesophagus into the stomach then the secondary peristalsis wave starts. These secondary waves are initiated partly by Intrinsic neural circuits in the oesophageal myenteric nervous system and partly by reflexes that are transmitted through vagal afferent fibers.[1,2,3]

The musculature of the pharynx and the upper third of the oesopahgus is striated muscle. Therefore the peristaltic waves in these regions are controlled only by skeletal nerve impulse in the Glossopharyngeal and Vagus nerves. In the lower two-thirds of the oesophagus, the musculature is smooth but this portion of oesophagus is also strongly controlled by the vagus nerve acting through their connections with the myenteric nervous system. [1,2,3]

THEORIES AND HYPOTHESIS

1. In 1880, the theory was proposed that fluids and semi fluids are propelled directly into the stomach by the contraction of the tongue and the mylohyoid mus0cles effecting a syringe like action to pressure the liquid downwards. The muscles of the pharynx proper came into play only for propulsion of solid food substances.
2. Another concept of the mechanism of deglutition was advanced as the results of the use of fluoroscopy. A radiolucent area in the laryngopharyngeal cavity was observed just prior to the propulsion of the bolus in to the pharynx. The radiolucent area disappeared immediately to provide space for the bolus. This concept gave rise to the theory of an instant negative pressure within the laryngopharyngeal cavity that pulled the bolus in by suction.
3. The concept that the process of deglutition is performed successively by contraction of the oral, pharyngeal, and oesophageal muscles has been confirmed by the roentogenographic studies by Bosma. He announced a new theory based on his roentgenographic studies which he called "motion in anticipation of the approaching bolus". He was impressed by a particular position or posture assumed by the upper part of the pharynx and the consecutive elveation of the

larynx and laryngopharyngeal area an instant prior to penetration by the bolus.[4]

CONCLUSION

All theorists agree that the pharynx is endowed with extreme rapidity and therefore all the structures involved in deglutition must be flexible and elastic. Correspondingly, these structures, while favoring the mobility of the pharynx, make it more vulnerable to impairment by various pathologic conditions such as peritonsilar, parapharyngeal and postparapharyngeal abscesses as well as by abscesses in the Thyroglossal duct of the tongue.[4]

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An Insight into Theories of Pain : A Review

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ABSTRACT

Pain is a common human complaint and can be alarming, especially when an individual cannot provide a proper explanation. It seriously impairs the lives of millions of individuals around the world and remains the main reason why a patient reports to the doctor. A lot of research has been done and is still going on to understand the physiology of pain and to invent ways and means to eliminate or control the intensity, duration and frequency of this factor which affects quality of life of individuals. Many theories have been proposed over the years and a knowledge of them will help us to understand the complexity of pain.

Keywords *– Pain, Theory.*

INTRODUCTION

International Association for the Study of Pain (IASP) has defined pain as "an unpleasant sensory and emotional experience associated with actual or potential tissue damage, or described in terms of such damage." [1]

The feeling that pain is inflicted from an outside source has been thought of since ancient times. It was Homer who initially thought that pain was the result of arrows shot by the Gods. Aristotle was the first to describe 5 physical senses and considered pain to be a "passion of the soul" which resulted due to intensification of the sensory experiences.[2]

It has been reported that women are at substantially greater risk for many clinical pain conditions than men.[3]Older age people are more sensitive to pain – due to a decline in the physiologic levels of estrogen with menopause.[4]Whites showed the highest average pain tolerance, blacks were second.[5]

Various theories have been proposed over the years to explain the complex mechanism of pain and some of them are discussed by us.

THEORIES OF PAIN

Intensity theory

Mumford and Newton in 1971 stated that "pain is a non-specific sensation produced when any sensory nerve is stimulated beyond a certain level (high intensity stimulation), i.e. pain results from excessive stimulation."Pain is felt when more impulses are conducted than usual, involves additional nerve fibres and the patterns of neural impulses reaching brain may be modified. The theory holds true for nerves mediating the sensation of touch temperature.

When stimulated to an excessive degree, more the stimulus, more the damage, more the pain

From this theory, it can be concluded that, intensity of stimulation is one of the factors in causing pain. But the same does not hold true for neuralgic pains.[6]

Specificity theory

This theory was given by Descartes 1664.It was proposed 300 years earlier that the pain system is a straight through channel from skin to brain. There is a direct line from receptor to brain and pain transmission is like pulling rope at one end and causing bell to ring at other end. When pain receptors located in the

skin are stimulated, impulses are transmitted to a pain center in the brain. There is a direct, invariant relationship between pain perception and intensity of the stimulus. Modern day specificity theory is also based on the same concept. This has dominated in the medical and dental speciality, where it is usually possible to relate the severity of pain to the noxious stimulus. The theory is based on "Muller's law of specific nerve energies" which states that a stimulus applied to a receptor produces the same sensation in the brain regardless of the type of stimulus.

Counterview: Pain can occur from non-noxious stimuli, Pain can occur spontaneously

e.g. phantom limb pain, causalgia, neuralgias, pain after surgical disruption of nerve

Pain from hyperalgesic skin areas often occurs after a long delay and continues long after the removal of the stimulus. Person who has suffered from an injury during an exciting game may not notice it until later. For the specificity theory to have been correct he would have had to feel considerable pain even though sufficiently interested in the game to carry on playing.[7]

Pattern theory

Wilhelm Erb in 1874 gave this theory. A pain signal can be generated by stimulation of any sensory receptor, provided the stimulation is intense enough. The pattern of stimulation intensity over time and area), not the receptor type, determines whether nociception occurs. Alfred Goldscheider (1894) proposed that over time, activity from many sensory fibres might accumulate in the dorsal horn of the spinal cord and begin to signal pain once a certain threshold of accumulated stimulation has been crossed. Fundamental assumption:

- All nerve endings are similar
- All cutaneous qualities are produced by spatial and temporal pattern of summation nerve impulses

Counterview: Fails to recognise the fact of physiological specialisation of nerve endings.[2]

Protopathic & Epicritic theory

This theory was proposed by Head & Rivers in 1908.This theory states the existence of 2 groups of cutaneous sensory nerve endings from periphery to CNS.

1. Protopathic , which is primitive, yields diffuse impression of pain including extremes of temperature.
2. Epicritic – these response to touch and small changes in temperature.

Counterview: Walshe stated that the presence of 2 systems is a fallacious notion.[8]

Chemical theory

The Chemical messengers in brain which modulate pain are Endorphins, Enkephalins, GABA which act as pain inhibiting substances and increase the patients' pain threshold. Substance P produced in the spinal cord and some parts of brain facilitate pain transmission and facilitate pain stimulation

Biochemical Theory

Lindahl stated that an alteration in the local pH in a nerve or in the vicinity of nerve is the cause for pain. The pain due to an abscess can be reduced by making the area alkaline. According to him acidity causes pain and alkalinity reduces pain.[9]

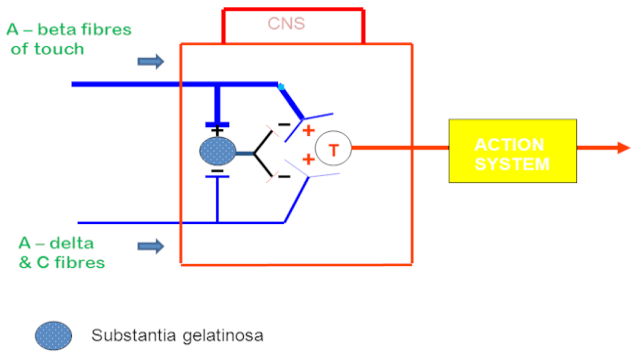
Gate control theory

Ronald Melzack and Patrick Wall in1960 proposed this theory which was modified by Noordenbos (1959) who postulated that the fast fibres exert an inhibiting influence on slowly conducting fibres.

Gate-control theory is based on the interaction among 3 systems:

1. Gate control system (substantia gelatinosa)
2. Central control trigger (Dorsal column fibres that project towards the brain)
3. Action system (First central transmission cells in the dorsal horn (T-cells)

In this system small fibres (A ä and C) facilitate pain transmission and open the gate, whereas large fibres (Aâ) inhibit pain transmission and close the gate.[10]



Neuromatrix theory

- Melzack and Wall in 1999 stated that each person has a genetically built-in network of neurons called the "body self neuromatrix". Each person's matrix of neurons is unique.[11]

Bio-psycho-social model

Two models have been proposed to understand pain mechanisms:

- Mechanistic model
- Bio-psycho-social model

According to mechanistic model, when pain is present, there is always something wrong with a part of the body and what the clinician needs to do is, just find out the offending part and then repair it. A more accurate way of understanding the disease is bio-psycho-social model which suggests that the person is a complex unit and the mind cannot be separated from the body. As an example, consider two individuals who awake one morning with identical pains in the masseter muscles secondary to bruxism. The first individual feels the pain, acknowledges it as from muscle overuse and carries on with the daily activities. The threat of pain in this case is minimal. The second patient however, correlates the pain with some disorder he might have heard of (like the cancer of jaws), stops all the daily activities and starts worrying about his pain. Though pain actually perceived is minimal, patient experiences enormous pain as the sick role dominates the situation.[2]

CONCLUSION

Pain is the most common reason for patients to consult physician, and to eliminate it always is a challenge. Understanding its physiology thus becomes very important in order to develop drugs targeting these regions. The following theories proposed give us an insight to the complexity associated with this phenomenon. Perhaps the capacity of the human brain falls short of the ability to understand its own complexity

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Evaluation of Factors Affecting Body Composition of Medical Students Residing at Hostel: A Cross Sectional Study

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ABSTRACT

Background: Obesity is one of the most visible yet neglected public health problems. With growing economy of India; lifestyle and dietary habits are changing at a rapid pace inviting obesity related diseases.

Objectives: To study the dietary habits of students, residing in the hostel, classified as per body mass index (BMI). To investigate relationship between the body composition and dietary habits and exercise level among college students.

Method: Study group comprised of medical undergraduate students (134 male, 66 female). History of diet, junk food intake and exercise was noted. Height, weight and percent body fat were measured. Total calorie intake (TCI), junk food (JF) intake, energy expenditure through exercise (EEE) and BMI were calculated. Intergroup and intragroup habits were compared by unpaired t test and one way ANOVA. Relationship between body composition and TCI, JF and EEE was obtained by Pearson coefficient of correlation.

Result: Proportion of underweight, normal BMI, overweight and obese was 28.36, 55.22, 10.45 and 5.97% in males and 18.18, 51.52, 18.18and 12.12% in females respectively. The intergroup differences in weight, body fat, JF intake were significant ($P<0.05$) in both groups. JF intake was significantly correlated with body fat. EEE had significant negative correlation with body fat in male subjects.

Conclusion: The major determinant of body fat was JF intake. For maintaining optimum body composition it is necessary to limit the amount of JF intake.

Key words: *Dietary habits, Body mass index, Body fat, Junk food*

INTRODUCTION

Economy of India is growing at a rapid pace which is reflected in changes in lifestyle and dietary habits.[1,2] Food choices and eating habits have become more westernized. With higher consumption of energy dense food, prevalence of overweight and obesity is rising in India. As Myung-Soo Ko quoted Kang WC, obesity begins to appear in the early years of school during puberty.[3] Dietary habits of adolescents and college students are highly influenced by fast-food market.[4] Also the students living away from home tend to develop unhealthy eating practices.[5] As a consequence, prevalence of overweight and obesity is increasing among adolescents.[6] Obesity is public health problem which invites diseases like diabetes, hypertension and coronary heart disease.[6] Unhealthy life style, such as physical inactivity, may further increase the risk of these diseases. Hence, the present study was undertaken to assess the dietary habits in medical college students residing in hostel and to find out possible relationship between the dietary habits and body composition.

MATERIAL AND METHOD

Design and sample

The study design was a cross-sectional survey conducted during September 2009 to January 2011. Two hundred medical undergraduate students (134

male and 66 female), residing in hostel were included in the study. Their age ranged between 17.5 and 21 (20 ± 1.9) years. Informed written consent was obtained from the students after explaining them the study protocol which was approved by the institutional ethics committee.

DATA COLLECTION

A standardized questionnaire based interview schedule was used to collect detailed dietary history. Three day diet recall method, which included one weekend, was used to assess the calorie intake per day. In addition, quantity and frequency of food items consumed apart from routine meals was noted. These items were divided into junk food (JF) and fruits. Calories obtained from these food items was averaged and added to the daily calorie intake. This was considered as subject's total calorie intake (TCI) per day. Calorie intake was calculated by referring the nutrient value of Indian Food.[7] Details of exercise performed by the subjects were noted. Daily energy expenditure through the exercise (EEE) was calculated. [8]

Anthropometric measurements included height, weight and percentage body fat. Height was measured to the nearest of 0.1 cm using stadiometer, without shoes. Weight was measured to the nearest of 0.5 kg, in light clothing using a beam balance. Body mass index (BMI) was calculated by using formula: BMI = Body weight (kg) / Height^2 (m^2). According to guidelines stated by the Indian Council for Medical Research, subjects were classified into: underweight (BMI d" 18.5), normal weight (BMI between 18.6-22.9), overweight (BMI between 23-24.9), and obese (BMI e" 25).[9] Percentage body fat was estimated by bioelectrical impedance analysis (Citizen body fat analyzer BM100, Citizen systems Japan, Co. Ltd., Tokyo).[10]

Statistical analysis was done by using NCSS97 statistical software and results were expressed as mean ± SD. Comparison of dietary habits and body composition between male and female groups was done by unpaired t test (alpha= 0.05 at 95% confidence interval with critical value of t being 1.972 for the equal variance). For unequal variance and skewed data, Aspin-Welch Unequal-Variance and Mann-Whitney U test was applied respectively. One way ANOVA and Bonferroni multiple comparison tests was used to compare various parameters among the BMI categories (alpha 0.05). If necessary, square root or logistic transformation was applied. Pearson's coefficient of correlation and Spearman's rho was used to find relationship between various parameters for normally distributed and skewed data respectively.

RESULTS

As indicated in table 1, overall BMI of females was significantly higher than male subjects (t=5.27, P<0.05) but was within normal range. Daily calorie intake from JF was significantly more in male subjects (t=1.806, P<0.05). EEE was less in females.

Table 1: Comparison of various parameters in male and female students residing in hostel.

Parameter	Male (n=134) (Mean ± SD)	Female (n=66) (Mean ± SD)	T value	P value
Height (cm)	169.67 ± 6.05	145.58 ± 4.45	18.42	0.0000
Weight (kg)	58.69 ± 8.63	51.73 ± 9.02	5.27	0.0000
BMI (kg/m^2)	20.36 ± 2.61	21.64 ± 3.63	2.49*	0.0145
Body fat (%)	16.71 ± 4.48	26.23 ± 4.44	14.17	0.0000
Total calorie intake (C/day)	1950.28 ± 427.06	1586.90 ± 304.88	6.18	0.0000
Junk food intake (C/day)	288.75 ± 169.21	239.36 ± 130.58	1.806	0.0378
Calorie from junk food (%)	14.31 ± 6.82	15.11 ± 7.75	0.74	0.46
Cal. utilized for Exercise (C/day)	39.07 ± 53.99	17.39 ± 53.09	4.50**	0.000007

*Aspin-Welch unequal variance test, **Mann-Whitney U test

As depicted in table 2 and 3, prevalence of overweight and obesity was 10.45 and 5.97% in males and 18.18% and 12.12% in females respectively. Prevalence of underweight was more in males (28.36%) than that of females (18.18%).

Table 2: Comparison of various parameters in males with different BMI groups

Parameter	Underweight	Normal	Overweight	Obese	Fratio	P value
(N)	38 (28.36%)	74 (55.22%)	14 (10.45%)	8 (5.97%)		
Weight (kg)	50.08 ± 4.12	59.47 ± 5.59	67.71 ± 3.66	76.5 ± 6.25	84.48	0.00000
BMI (kg/m^2)	17.52 ± 0.89	20.55 ± 1.39	24.01 ± 0.71	25.76 ± 0.68	107.42*	0.00000
Body fat (%)	12.98 ± 3.40	17. 03 ± 3.19	21.16 ± 3.40	24.0 ± 3.30	36.61	0.00000
Total calorie intake (C/day)	1936.87±400.60	1929.22±431.50	2052.43±527.36	2030.0 ±353.57	0.43	0.73
Junk food intake (C/day)	243.58 ± 157.98	283.19±148.21	334.29 ± 232.02	475.0 ± 166.91	4.43	0.0053
Calorie from junk food (%)	11.93 ± 6.10	14.38 ± 6.39	15.43 ± 7.94	23.0 ± 5.63	6.75	0.00028
Calorie for Exercise(C/day)	76.76 ± 74.32	22.45 ± 35.50	23.79 ± 22.14	40.5 ± 32.31	10.56*	0.012

*Kruskal Wallis one way ANOVA

Table 3: Comparison of various parameters in females with different BMI groups

Parameter	Underweight	Normal	Overweight	Obese	F ratio	P value
N	12 (18.18%)	34 (51.51%)	12 (18.18%)	8 (12.12%)		
Weight (kg)	41.53 ± 2.97	49.02 ± 4.62	58.38 ± 3.92	68.06 ± 6.10	64.27	0.00000
BMI (kg/m^2)	17.26 ± 0.75	20.60 ± 1.45	24.18 ± 0.61	28.63 ± 2.87	55.25*	0.00000
Body fat (%)	23.97 ± 5.60	24.74 ± 3.55	29.24 ± 2.58	31.71 ± 1.77	13.19	0.00001
Total calorie intake (C/day)	1628.11±337.90	1538.41±281.29	1659.25±405.89	1652.0±243.63	0.64	0.59
Junk food intake (C/day)	284. 11±136.76	205.5 ± 115.65	209.5 ± 76.03	420.63 ± 108.68	6.97	0.000407
Calorie from junk food (%)	17.19 ± 6.11	13.65 ± 7.99	12.9 ± 4.78	25.25 ± 4.50	5.50	0.00205
Calorie for Exercise (C/day)	5.00 ± 17.32	23.06 ± 70.89	25.33 ± 26.84	00	3.47	0.07

Percent body fat was significantly higher in overweight and obese when compared with underweight and normal-weight males. Calories from JF and percentage of total calories from JF were significantly more in obese males as compared with underweight and normal weight. Underweight males had more EEE than normal and overweight subjects.

Females showed similar findings for body fat and JF intake. None of the subject in obese category was performing exercise.

In both males and females, body fat was significantly related with JF intake in all the categories except in overweight subjects. JF intake was better correlated with body fat than TC intake in all the groups. Exercise showed a significant negative correlation with body fat in males.

DISCUSSION

In our study, prevalence of overweight and obesity was 10.45 and 5.97% in males whereas 18.18 and 12.12% in females respectively. In India, these values vary considerably from region to region due to wider food choices.[11] Combined prevalence of overweight and obesity among medical students was 21% which is comparable with findings from UAE (24%).[12]

As noted from tables 2 & 3, students in higher BMI category had more consumption of junk food. According to Lisa Langsetmo, the energy dense factor was associated with higher body mass index independent of other demographic and lifestyle factors.[13]

We also found that the percentage of females being overweight and obese was more than their male counterpart. Percentage of total calories obtained from JF was more in obese females than the obese males. Also none of the females in this category was performing any kind of exercise. Both these unhealthy habits are reflected in more percentage of body fat in this category. The physical activity guidelines recommend moderate physical activity for at least 30 minutes preferably daily.[14] Underweight male students had more daily calorie expenditure through exercise than other categories. This may be reflected in low body fat and low BMI even though TCI and JF intake is comparable with other categories. Obese male students also had more calorie expenditure through exercise compared to normal and overweight category which may be the reason for limiting the percentage of body fat in spite of high JF intake.

We could not find a statistically significant correlation between body fat and total calorie intake except in underweight male category. But there was a positive and statistically significant correlation between junk food intake and percentage of total calories obtained from junk food with body fat percent in all the categories except in overweight females. This suggests rather than total calories junk food intake plays an important role in the body fat percentage. As excess of calories are converted to storage fat, it leads to rapid gain in fat content of the body.[15] Brennan Davis showed more likelihood of overweight or obesity in students having fast-food restaurants near their.[16] Similar finding was given by Philip H Howard.[17] We have noted that daily intake of energy dense snacks apart from regular meals was common among the students. Easy availability, price and palatability were the major factors influencing this choice. In our sample, about 81.35% males and 72.72% of female students consume junk food daily which was comparable with the study by Frary CD.[18] Cause for higher JF was traced to the fact that the students feel hungry in the evening after the college hours. So they have no option but to eat the readily available food. Such consumption of easily available energy dense fast food in the vicinity of the institute allows students to prefer it as an evening snack leading to more prevalence of overweight and obesity. According to Cunha as quoted by Larissa da Cunha Feio Costa, the first year in higher education is a phase of challenge for students since it represents a period of development and academic adjustment, which demands adaptation and integration into the

new environment.[19] Frequent snacking may be viewed as a way to deal with this stress by some of the students.

CONCLUSION

Prevalence of overweight and obesity is more in female than male medical students residing in the hostel. Body fat percent was positively correlated with junk food intake and percentage of calories obtained from junk food per day. Decreased calorie expenditure due to lack of physical activity further add to the fat depot. Thus for optimum body composition one must limit the consumption of energy dense junk food and perform exercise daily. Institutions can help students by providing healthy food choices within the campus and conducting awareness programs.

Table 4: Relationship of percent body fat with dietary habits and exercise practices among male and female students as classified by BMI.

		Under-weight		Normal weight		Over-weight		Obese	
		Male	Female	Male	Female	Male	Female	Male	Female
N		(38)	(12)	(74)	(34)	(14)	(12)	(8)	(8)
BMI		17.52	17.26	20.55	20.60	24.01	24.18	25.76	28.63
TC	r	0.60	0.33	0.07	0.02	0.13	0.53	0.62	0.41
(C/day)	P	0.00006	0.29	0.57	0.93	0.65	0.07	0.10	0.31
JF	r	0.87	0.71	0.51	0.71	0.47	0.37	0.83	0.82
(C/day)	P	0.00000	0.01	0.000004	0.000002	0.08	0.23	0.01	0.01
JF (%)	r	0.78	0.69	0.52	0.72	0.56	0.05	0.75	0.82
	P	0.00000	0.01	0.000002	0.000002	0.03	0.88	0.03	0.01
Ex	r	-0.38*	-0.31*	-0.28*	-0.12	-0.63*	-0.26*	-0.80*	NA
(C/day)	P	0.01	0.33	0.01	0.5	0.01	0.41	0.01	NA

* Spearman rho

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Saliva: A Diagnostic Fluid

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ABSTRACT

As a diagnostic fluid, saliva offers distinctive advantages over serum because it can be collected non-invasively by individuals with modest training. Gland-specific saliva can be used for diagnosis of pathology specific to one of the major salivary glands. Whole saliva, however, is most frequently used for diagnosis of systemic diseases, since it is readily collected and contains serum constituents. Analysis of saliva may be useful for the diagnosis of hereditary disorders, autoimmune diseases, malignant and infectious diseases, and endocrine disorders, as well as in the assessment of therapeutic levels of drugs and the monitoring of illicit drug use.

Keywords: *Saliva, Salivary gland, Systemic disease.*

INTRODUCTION

Saliva has become an important resource for evaluating physiological and pathological conditions in humans. The use of saliva has many advantages, including the simple and non-invasive method of collection and its easy, low-cost storage. With the addition of modern techniques and chemical instrumentation equipment, there has been an increase in its use for laboratory investigations.[1]

Saliva is sterile when it leaves the salivary glands but ceases to be so as soon as it mixes with the crevicular fluid, remains of food, microorganisms, desquamated oral mucous cells, etc.[2]

Saliva is a good indicator of the plasma levels of various substances such as hormo-nes and drugs and can therefore be used as a non-invasive method for monitoring plasma concentrations of medicines or other substances.[4,5]

ANALYSIS OF SALIVA DONE FOR THE DIAGNOSIS:

1. Infectious diseases

Saliva contains immunoglobulins (IgA, IgM, IgG) that originate from two sources: the salivary glands and serum. Antibodies against viruses, bacteria, fungal and parasite can be detected in saliva and can aid in the diagnosis of infections.

Helicobacter pylori infection has been associated with peptic ulcer and chronic gastritis. Oral cavity may be the source of infection. There was considerable variation in the detection rate of H.pylori DNA in salivary samples. There is controversy whether saliva act as permanent reservoir for this bacterium and gastric and salivary specimen harbor identical or different strains. PCR cannot distinguish between living and dead organism.[6]

Pneumococcal pneumonia the detection of pneumococcal C polysaccharide in saliva by ELISA may offer a valuable complement to conventional diagnostic methods for pneumococcal pneumonia. Quantitative measurement of pneumococcal capsular antigen in the saliva may be valuable in helping to make an aetiological diagnosis in children with pneumonia.[7]

Lyme disease is caused by the spirochete *Borrelia burgdorferi* and is transmitted to humans by blood-feeding ticks. The detection of anti-tick antibody in saliva serves as a screening mechanism for individuals at risk for Lyme disease.[8]

Taenia solium Specific antibody to *Taenia solium* larvae in serum demonstrated greater sensitivity than antibody in saliva for identification of neurocysticercosis.[9]

Viral Diseases –HIV: Antibody to HIV in whole saliva of infected individuals was detected by ELISA and Western blot assay, correlated with serum antibody levels.[10] Salivary IgA levels to HIV decline as infected patients become symptomatic. It was suggested that detection of IgA antibody to HIV in saliva may, therefore, be a prognostic indicator for the progression of HIV infection . Analysis of antibody in saliva as a diagnostic test for HIV (or other infections) offers several distinctive advantages when compared with serum.

1. Saliva can be collected non-invasively, which eliminates the risk of infection for the health care worker who collects the blood sample.
2. Furthermore, viral transmission *via* saliva is unlikely, since infectious virus is rarely isolated from saliva.
3. Saliva collection also simplifies the diagnostic process in special populations in whom blood drawing is difficult, *i.e.*, individuals with compromised venous access (*e.g.*, injecting drug users), patients with hemophilia, and children.

Several salivary and oral fluid tests have been developed for HIV diagnosis. Orasure is the only FDA-approved, commercially available testing system. It detects antibodies against the p24 antigen of HIV. The applicator swab is gently rubbed along the outer gumsand inserted into a vial containing the developer solution that detects the antibody to p24 antigen of HIV.[11] In conclusion, collection and analysis of saliva offer a simple, safe, well-tolerated, and accurate method for the diagnosis of HIV infection. Applicable for both clinical use and epidemiological surveillance.

Measles, mumps, and rubella Saliva may also be used for determining immunization and detecting infection with measles, mumps, and rubella.[14]

Rotavirus For newborn infants, the salivary IgA response was found to be a better marker of rotavirus (RV) infection than the serum antibody response. Neonatal RV infection elicited specific mucosal antibody response which persisted for at least 3 months. However, a similar systemic immune response could not be observed, possibly due to interference by maternal antibody. Salivary antibodies could be used to monitor the immune response to vaccination and infection with RV.[15]

Reactivation of *herpes simplex* virus type-1 (HSV-1) is involved in the pathogenesis of Bell's palsy and PCRbased identification of virus DNA in saliva is a useful method for the early detection of HSV-1 reactivation in patients with Bell's palsy.[16]

Dengue is a mosquito-transmitted viral disease. Salivary levels of anti-dengue IgM and IgG demonstrated sensitivity of 92% and specificity of 100% in the diagnosis of infection. So, detection of dengue specific salivary IgG and IgM antibodies is useful markers for dengue infection.[17]

2. Hereditary diseases

Cystic fibrosis (CF) is a genetically transmitted disease of children and young adults, which is considered a generalized exocrinopathy. A defective electrolyte transport in epithelial cells and viscous mucus secretions from glands and epithelia characterize this disorder. The organs mostly affected in CF are: sweat glands, the lungs and the pancreas.

Elevations in electrolytes (sodium, chloride, calcium, and phosphorus), urea and uric acid, total protein and lipid were observed in the submandibuar saliva of CF patients.[18] Most of the studies concerning the diagnostic application of saliva for CF are relatively old, and saliva is not currently used for the diagnosis of this disorder.

21-Hydroxylase deficiency is an inherited disorder of steroidogenesis which leads to congenital adrenal hyperplasia. Early morning salivary levels of 17-hydroxyprogesterone (17-OHP) determined by ELISA is an excellent screening test for the diagnosis of non-classic 21-hydroxylase deficiency, since the salivary levels accurately reflected serum levels of 17-OHP.[19]

3. Autoimmune diseases

Sjögren's syndrome — Sjögren's syndrome (SS) is an autoimmune exocrinopathy of unknown etiology. Serum chemistry can demonstrate polyclonal hypergammaglobulinemia and elevated levels of rheumatoid factor, antinuclear antibody, anti-SS-A, and anti-SS-B antibody. In addition, increased concentrations of sodium and chloride, IgA, IgG, lacoferrin, and albumin, and a decreased concentration of phosphate were reported in saliva of patients with SS.[20]

4. Dental Caries and Periodontal Disease

Diagnostic kits for S. mutans and Lactobacillus counting are widely used in dental practice and can be conducted without laboratory facilities. In a healthy situation, there is no correlation between saliva secretion rate and dental caries.[21] However, when the salivary secretion rate drops below a certain minimum, the amount of dental caries increases dramatically; salivary secretion rate is easily measured by

weighing the saliva volume that is collected by expectoration divided by the collection time. Low salivary buffering capacity is a risk factor for dental caries and also is indicative for low saliva secretion. Commercial kits are available for determination of the salivary buffering capacity.[22]

Periodontal Disease -There is a large, genetically determined, variation in susceptibility for periodontal disease. [23] Mutations in the cathepsin C gene have been identified as causal for the Papillon-Lefèvre syndrome. In addition, multiple genes have been associated with less severe forms of periodontal disease. People at high risk for periodontal disease can be determined by genetic screening. DNA can easily be isolated from oral epithelial cells, collected by use of a buccal swab, one of the most common oral diagnostics. The loss of attachment and deepening of the periodontal pocket leads to increased leakage of a serum-like fluid designated gingival crevicular fluid, into the oral cavity. Since serum has a 50 to 70 fold higher protein concentration the average protein concentrations in saliva increases dramatically and the concentration of albumin shows an 8-fold increase**.** During active periods of the disease increased levels of inflammatory markers, like interleukins, can be demonstrated in saliva.

Several bacteria have been associated with periodontal disease these bacteria are susceptible to different antibiotics. Therefore, prior to antibiotic treatment pathogens should be determined by culturing or PCR techniques. Oral fluid may be used for that, or small methylcellulose paper strips can be used to collect fluid from the gingival crevice.

Nevertheless, the recent focuses on the potential role of periodontal disease as a risk factor for cardiovascular and cerebrovascular diseases bring new importance to this aspect of salivary analysis.[24]

5. Diagnosis of Oral Disease with Relevance for Systemic Diseases

Evaluation of whole saliva quantity may provide information which has systemic relevance. Quantitative alterations in saliva may be a result of medications. At least 400 drugs may induce xerostomia.[25] Reduced salivary flows may lead to progressive dental caries, fungal infection, oral pain, and dysphagia. The reasons for such clinical findings should be thoroughly investigated, since they may be signs of an underlying systemic problem.

Qualitative changes in salivary composition can also provide diagnostic information concerning oral problems. Increased levels of albumin in whole saliva were detected in patients who received chemotherapy and subsequently developed stomatitis. Monitoring of salivary albumin can assist in the identification of stomatitis at a pre-clinical stage and enable the treatment for the stomatitis to be initiated at an early stage. Similarly epidermal growth factor (EGF) in saliva is decreased during the course of radiotherapy and severity of mucositis is related to reduced EGF concentration in saliva.[26]

6. Malignancy

p53- p53 is a tumor suppressor protein which is produced in cells exposed to various types of DNA-damaging stress. Inactivation of this suppressor through mutation is considered a frequent occurrence in the development of human cancer. Accumulation of inactive p53 protein occur, which in turn lead to the production of antibodies directed against this p53 protein.The p53 antibodies can be detected in the saliva of patients diagnosed with oral squamous cell carcinoma (SCC), and can thus assist in the early detection and screening for, this tumor.

Defensins Elevated levels of salivary defensin-1 were found to be indicative of the presence of oral SCC. A high-positive correlation was observed between salivary defensin-1 levels and serum levels of SCC-related antigen .

CA15-3, c-erbB-2 Elevated levels of recognized tumor markers *c-erbB-2 (erb)* and cancer antigen *15-3 (CA15-3)* were found in the saliva of women diagnosed with breast cancer, as compared with patients with benign lesions and healthy controls. They appear to hold greater promise for the early screening and detection of breast cancer.[27]

7. Bone Turnover Marker in Saliva

Saliva can be used to measure bone turnover. Mcgehee and johnson used commercially available ELISA to test for the presence of osteocalcin (OC) and pyridinoline (PYD) in the whole human saliva of women. Level of OC and PYD in saliva correlated reasonably well with calcaneus bone mineral density BMD/t scores. Suggesting that saliva may be valuable tool for assessing human markers of bone turnover. Further research is necessary to determine whether salivary level of bone turnover marker correlate with serum.[27]

8. Detection of drugs

Saliva may be used for monitoring patient compliance with *psychiatric medications.* Saliva is also useful for the monitoring of *anti-epileptic drugs and* anti-cancer drugs. Estimation of salivary carbamazepine levels is predictable and convenient method of drug monitoring in epileptic patient, and a positive correlation (r =

0.659) between salivary and serum carbamazepine levels was observed.[28]

Other recreational drugs that can be identified in saliva are *amphetamines, barbiturates, benzodiazepines, cocaine, phencyclidine (PCP), and opioids).*

Nicotine saliva can be used to monitor tobacco smoking and exposure to tobacco smoke. The major nicotine metabolite cotinine was investigated as an indicator of exposure to tobacco smoking. Cotinine is tobacco-specific and has a relatively long half-life (17hours) compared with nicotine. Salivary cotinine levels were found to be indicative of active and passive smoking. Monitoring level of salivary cotinine has proven useful in monitoring compliance with smoking cessation programs.[27]

10. Forensic Evidence

During the biting process, saliva is deposited on the skin or object surface in enough amount to allow typing of the deoxyribonucleic acid (DNA). Polymerase chain reaction (PCR) allows replication of thousands of copies of a specific DNA sequence in vitro, enabling the study of small amounts of DNA.[27]

CONCLUSION

Saliva offers an alternative to serum as a biologic fluid that can be analyzed for diagnostic purposes. Whole saliva can be collected in a non-invasive manner by individuals with modest training, including patients. Analysis of saliva can offer a cost-effective approach for the screening of large populations, and may represent an alternative for patients in whom blood drawing is difficult, or when compliance is a problem.

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Influence of Refractory Error on the Pattern Reversal VEPs of Myopes and Hypermetropes

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ABSTRACT

Objective: Multiple factors including age, sex, habituation, refraction, cooperation and technical variables are associated with Visual evoked potential (VEP). We attempted to evaluate the influence of refractory error on the Pattern Reversal Visual Evoked Potential (PRVEP) recordings of a cohort of Indian subjects having myopia and hypermetropia.

Material: This rural hospital based study was conducted in the Neurophysiology unit of the Department of Physiology. The study comprised of pattern reversal visual evoked potential (PRVEP) recordings from 50 hypermetropes and 50 myopes with and without glasses having age in the range of 18-40 years. The recordings were compared with those of 50 age and sex matched controls.

Methods: One channel VEP recordings were performed with the stimulus configuration consisting of the transient pattern reversal method in which a black and white checker board was generated (full field) and displayed on VEP Monitor (colour 14") by an electronic pattern regenerator inbuilt in an Evoked Potential Recorder (RMS EMG EP MARK II). P100 latency and amplitude were measured from the averaged waveforms and analysed by student's "t" test.

Results: P100 latency was increased and amplitude decreased with and without correction of refractive error. The statistical analysis revealed a significant difference ($p<0.05$) in latency of P100 and amplitude of P100 between controls and myopics with glasses and highly significant difference ($p<0.001$) in latency and amplitude of P100 between controls and myopics without glasses. The difference in P100 latency and amplitude between controls and hyperopics with glasses and those without glasses were found to be non-significant.

Conclusion: VEPs are affected in subjects with refractive error irrespective of correction given. Among the refractory errors, the VEPs seem to be more affected by myopia than hypermetropia and the probable contributory cause may be the defocusing of the image.

Key words: *Refractive error,Hypermetropes, Myopes, P100 latency, P100 amplitude*

INTRODUCTION

Numerous techniques are available for the assessment of functional status of the visual system in human beings. One of the most valuable of these in current clinical use is the recording of the evoked potentials in response to a variety of visual stimuli. The visual evoked potential (VEP) is widely used to validate the complaints of reduced visual performance and to identify the site of the disorder.

VEP technique allows one to assess in real time the processing of sensory information in the human central nervous system (CNS). The VEP traces consist of a succession of waves or peaks which reflect the neuronal responses at the different levels of sensory pathways.

It is well recognized that that the technical and physiological factors such as pupil diameter, refractive

error, type of stimulus, age and sex, electrode position, and anatomical variations may affect VEP. [1]

In view of the increasing use of VEP technique in neuro-ophthalmological diagnosis, the effect of introduced refractive errors on the VEP was studied on five women and eight men aged 19 to 45 years.[2] Refractive errors were created by introducing the following combined standard lenses: (+2/+2 x 90°), (+- 11+1 x 90°), (-1/-1 x 90°), and (- 2/ -2 x 90°) dioptres. There was a pronounced effect on the P100 component of the VEP with these introduced refractive errors.

Pattern defocusing has also been used to evaluate the contribution of different spatial frequency components in checks to VEP latency. Latency shifts with increasing blur (-2.5 to + 2.5) were determined for sinusoidal grating and check patterns.[3] The effect of blur was found to be greater with the higher spatial frequency.

Large refractive errors, introduced by the use of ophthalmic lenses, can make the waves to approach zero amplitude. Refractive errors were induced in normal subjects by means of positive dioptre lenses to reduce visual acuity (VA) from an initial level of 20/20 to 20/100 and then to 20/200.[4] Pattern visual evoked potentials (PVEPs) were recorded at each of these 3 levels of VA using high contrast checkerboard stimuli subtending 11' and 42' of visual arc. Their findings further confirmed the need to take refractive errors into account because latencies fell outside normal limits with decreased visual acuity.

Most of these studies have been reported in western populations and no such comparative study is available in Indian population. Since there are differences as regards to the age of detection, accuracy of correction and regularity of usage of correcting glasses, we conducted this study to estimate the effect of refractive error on VEP recordings in Indian population. To test the hypothesis that the changes in VEP due to refractory errors in Indian population are different from western population, VEP recordings were done in myopic and hypermetropic subjects with and without glasses.

MATERIAL AND METHOD

Our study was conducted in the Neurophysiology unit of the Department of Physiology. A total of 50 hypermetropics and 50 myopics attending the ophthalmology OPD, having age in the range of 18-40 years were investigated for pattern reversal VEP recordings with and without glasses. Their results were compared with those of 50 age and sex matched controls.

One channel VEP recordings were performed in accordance to the standardized methodology of IFCN [5] and ISCEV [6] with the stimulus configuration consisting of the transient pattern reversal method in which a black and white checker board was generated (full field) and displayed on VEP Monitor (colour 14") by an electronic pattern regenerator inbuilt in an Evoked Potential Recorder (RMS EMG EP MARK II).

Subject Preparation

- Each subject was briefed previously about the procedure to alleviate any apprehension and to assure full relaxation during the test.
- The subject was seated comfortably at a distance of 1 meter away from the screen of the VEP monitor.

Electrode placement

- Standard silver-silver chloride disc EEG electrodes were placed on the scalp areas after preparing the skin by cleaning, degreasing and abrading with a conducting jelly or electrode paste (RMS recording paste) rubbed lightly into the area with a cotton swab to ensure good, stable electrical connection.
- The scalp electrodes were placed according to the 10-20 International System of EEG Electrode placements [7] as mentioned below-
  a) the reference electrode (Fz) was placed at the forehead,
  b) the ground electrode (Cz) at the vertex and
  c) the active electrode (Oz) at approximately 2 cm above the inion.

Since the P100 latency is one chief discriminator between normality and abnormality of the visual pathways [8] so major emphasis was laid upon P100 wave and its latency and amplitude were measured from the averaged waveforms.

Ethical clearance was obtained from Institutional Ethics Committee for the present study. Informed consent was obtained from all the participants. All subjects underwent a complete ophthalmologic examination.

Inclusion criteria: Subjects having age in the range of 18-40 years and Refractory error of more than 2 years after diagnosis

Exclusion criteria: Subjects with abnormalities in the retina or optic nerve or with any other visual defects were excluded.

Statistical analysis

Student "t" test for independent samples was car-

ried out to find the significance of mean difference between normals and study groups. A p value of <0.05 was considered to be significant and that of <0.001 was considered to be highly significant. The statistical software namely SPSS version 10.0 was used for the analysis.

RESULTS

In this study the subjects were categorized into five groups-

Group A – Emmetropics

Group B - Myopics with glasses

Group C - Myopics without glasses

Group D - Hyperopics with glasses

Group E - Hyperopics without glasses

The effect of refractive error on P100 latency of PRVEP of subjects in various study groups and controls has been illustrated in Table 1. It is evident from the table that the latency of P100 was increased in groups B, C, D and E. The statistical analysis revealed a significant difference (p<0.05) in latency of P100 between Group A and B and highly significant difference (p<0.001) in latency of P100 between Group A and C. The difference in P100 latency between groups A and D and Group A and E were found to be non-significant (p>0.05).

Table 1: Effect of Refractive error on P100 latency of PRVEP

Groups	LEFT EYE P100 latency (msec)	RIGHT EYE P100 latency (msec)
Normal (A)	98.16 ± 4.51	98.45 ± 4.31
Myopic with glasses (B)	100.42 ± 7.38	100.88 ± 7.51
Myopic without glasses (C)	103.34 ± 9.22	102.69 ± 8.34
Hyperopic with glasses (D)	101.39 ± 9.70	101.22 ± 6.27
Hyperopic without glasses (E)	101.78 ± 10.22	101.61 ± 8.13
Significance with unpaired "t" test	A-B 0.014*	0.042*
	A-C 0.000**	0.000**
	A-D 0.305	0.460
	A-E 0.645	0.687

*p<0.05=significant **p<0.001=highly significant

Similarly the effect of refractive error on N70-P100 amplitude of PRVEP of subjects in various study groups and controls has been illustrated in Table 2.The amplitude of N70-P100 was decreased in groups B, C, D and E as compared to Group A. The analysis revealed a significant difference (p<0.05) in amplitude of P100 between Group A and B and highly significant difference (p<0.001) in amplitude of P100 between Group A and C. The difference in P100 amplitude between groups A and D and Group A and E were found to be non-significant.

Table 2: Effect of Refractive error on P100 Amplitude of PRVEP

Groups	LEFT EYEP100 Amplitude (μV)	RIGHT EYEP100 Amplitude (μV)
Normal (A)	6.17 ± 3.02	6.20 ± 3.09
Myopic with glasses (B)	4.65 ± 2.72	4.75 ± 2.98
Myopic without glasses (C)	4.12 ± 1.35	3.99 ± 2.02
Hyperopic with glasses (D)	5.50 ± 1.98	5.66 ± 2.06
Hyperopic without glasses (E)	5.24 ± 2.21	5.38 ± 2.13
Significance with unpaired "t" test	A-B 0.034*	0.029*
	A-C 0.000**	0.000**
	A-D 0.392	0.423
	A-E 0.565	0.652

* p<0.05 = significant ** p<0.001 = highly significant

DISCUSSION

Refractive errors cause defocus. Defocusing affects the VEP and the VEPs are found to be affected by refractory errors more so without correction. Among the refractory errors, the VEPs seem to be more affected by myopia than hypermetropia and the changes persisted even after application of correction.

The prolongation of P100 latency found in our subjects having either type of refractory error is in accordance with the findings of previous studies. [2,4,9,10] Similar results of significant changes in absolute and relative latency of P100 component were obtained in an earlier study. [11]

Our observation of more pronounced effect seen in myopes is in contrast with the effect observed by **Collins et al (1979)** [2] who obtained abnormally prolonged P100 latency in 87.5% (14/16) with the +2/+2 x 90°dioptre lens as compared to 31% (5/16) with -2/-2 x 90°dioptre lens.

However a negative correlation between refraction and P100 latency in myopia has been reported by **Lee et al (1997)** [12] which is in consonance with our findings. There is one more study in support of our findings which has shown significant deviations from reference of component P100 in subjects with congenital myopia. [13] On the other hand a similar incidence of associated ocular abnormalities has been reported in high hyperopia has as high myopia. [10]

The amplitude of the response in a pattern reversal VEP is dependent on the visual system's ability to resolve the pattern. The refractive errors blur the stimulus and blurred vision also has been shown to

decrease the amplitude of the conventional pattern reversal VEP**.** Even small errors of refraction act to reduce the average amplitude of the waves of VEPs.

In our study significant reduction in P100 amplitude was obtained in subjects having refractive error, which corroborates with the observations of previous workers**.** [11,14,15] In particular one of these studies [11] showed that there is consistently greater reduction in VEP amplitude for small amounts of plus lens defocus than for minus and it was believed that subjects partially accommodated for minus lens. It was found that the decrease in amplitude in non-cycloplegic refraction measurements seem to occur more rapidly for plus lens than for minus and it is thought to be due to partial correction of defocus brought about by accommodative effort of the subject.

On the contrary in our study more significant reduction in P100 amplitude was observed in cases of myopia as opposed to hypermetropia.

The probable reason for the difference in findings between myopes and hyperopes of western countries and those of Indian scenario may be that among the population studied in a developing country like India, there is lack of early diagnosis of refractive error and accurateness of correction is not precise. However, the primary cause of alterations seen in VEP components remains as the extent of defocusing of the image.

Overall our results corroborate with a very recent study [16] conducted to examine the effects of uncorrected refractive errors (RE) in a short-duration transient visual evoked potential (SD t-VEP) system. They induced refractive errors means of trial lenses in 35 emmetropic subjects and found that induced hypermetropia and myopia correlated strongly with both P100 amplitude and latency.

CONCLUSION

VEPs are affected in subjects with refractive error irrespective of correction given. Among the refractory errors, the VEPs seem to be more affected by myopia than hypermetropia and the probable contributory cause may be the defocusing of the image.

IMPLICATION

Our results suggested that there were significant changes in VEP (P100 latency & amplitude) with respect to the presence of refractory error. While performing the VEP investigation, one should take into account the refraction and visual acuity.

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Masticatory Performance and Chewing Cycle Kinematics : An Overview

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ABSTRACT

The mastication is the most important function of this morphofunctional system, since its contribution to growth, development and maintenance of osteodental arcs and the craniofacial complex. Masticatory movements in man are almost cyclic and mainly vertical. The precise movements depend on many factors, such as the amount of food, its consistency and the morphology of the occlusal planes. . Chewing movements and chewing forces result from a coordinated pattern of muscle activities. The basic pattern results from a central pattern generator in the brain stem. To understand aspects of physiology of masticatory function contributes to the use of therapeutic strategies in diseases that affect the stomatognathic system. The aim of this paper is to review the current concepts in the physiology of mastication.

Keywords: *Mastication, Muscles of mastication, Pattern generator*

INTRODUCTION

The human masticatory motor system is a remarkable machine. While people may think of it mainly in relation to the chewing of food, it also carries out many different functions under a wide range of different condition. At one extreme the masticatory system is capable of exerting huge forces. Most people are able to exert more force with their muscles of mastication than with any other muscle system. Many people can bite with a force equivalent to lifting their own weight. These high forces are usually required only for very brief periods to break down touch food and to perform such tasks as cracking nutshells. The existence of these high forces, and the fact that they are applied through the teeth which are specifically adapted for breaking down tissue, gives the masticatory system a significant potential for self injury. For this reason, it is obviously essential that the activity of the jaw closing muscles is very tightly controlled.

CONTROL OF MASTICATION

Voluntary movements are those which are carried out as the result of a delibrate effort or will. These are primarily result of the execution of a well formed movement plan by the brain, although most voluntary movements are fine tuned as they are carried out through the action of reflexes. The final common output pathway from the brain for the execution of the plan for a voluntary movement is the motor cortex. Speech is perhaps the most refined example of voluntary movement, in which all of the components required to utter a series of complex sounds are read out by the motor cortex to a large number of muscles in a most complex sequence.[1]

At the other extreme, some movements are purely reflex. That is, a given sensory input evokes a rather stereotyped motor response. Reflexes range from the very simple to the very complex. There are many examples of reflexes in and around the mouth. For example, tapping teeth briskly together activates a simple reflex that quickly stops the activity in the jaw closing muscles, but only transiently. At the other extreme, swallowing is an extremely complex reflex response involving coordination of many muscles that is triggered by stimulation of the mucosa in the pharynx.[1]

There is, however another general class of move-

ments. These are cyclical movements, like breathing or walking. Chewing is an excellent example of a cyclical movement involving the trigeminal system. The basic rhythm of cyclical movements is driven by a program that is hard wired in the brain, and cyclical movements can continue without feedback. However, like voluntary movements, cyclical movements are normally fine tunned by sensory signals acting through the action of reflexes.[2]

All of the jaw closing muscles on the both sides is activated at about the same time during the closing movement. During opening, only the jaw openers are active. The activity of the left masseter during the chewing stroke is less than the activity in the right masseter because most of the work is being done by the muscles on the right hand side.[2]

CONTROL OF MANDIBULAR REST POSITION

The occlusal surfaces of the teeth are separated by a distance of 3-8 mm when the jaw is in its rest position. The actual position can vary somewhat as the result of factors such as head posture, pain, and stress. The vertical position of the mandible is maintained by the continuous action of a stretch reflex that moves down a little under the influence of gravity. Despite the attractiveness of the notion, recent research has shown that stretch reflexes do not act in this way to maintain the posture of the mandible when the head is stationary. Rather, the mandible is held passively in place in this situation by elastic forces from the perioral soft tissues. These forces are viscoelastic. These forces are sufficient to maintain the mandible in or near its rest position even when the head moves up and down during walking. However, during more vigorous movements such as running or jumping on a hard surface, the brisker up and down movements of the head cause the mandible to move further and faster relative to the maxilla and, in this more challenging situation, the stretch reflex has recently been shown to play an important role in maintaining jaw posture. Consider a subject who is running. When he lands in each step, the mandible continues to move briskly downwards relative to the maxilla under its own momentum. This downward movement of the mandible relative to the maxilla stretches the muscle spindles in the jaw closing movement.[3]

MUSCLE SPINDLE REFLEXES

During any normal muscle contraction, the brain sends signals along the motor neurons that innervate the normal muscle fibres (they are called "alpha" motor neurons) to make the muscle fibres contract. At the same time the brain also sends similar signals along the gamma motor neurons. The coactivation of alpha and gamma motor neurons normally maintains a steady level of tension on the sensory receptor of muscle spindles even when the muscle changes length during a normal contraction, which keeps the receptor ready to respond to small stretches.[2]

During any normal muscle contraction the brain sends a stream of signal along the motor neurons that innervate the normal muscle fibres to make the muscle fibre contract: at the same time the brain also sends similar signals along the gamma motor neurons. These signals cause the ends of the spindle to contract too, thereby preventing the muscle spindle from becoming slack.[3]

PERIODONTAL REFLEXES

The stretch reflexes whose receptor lies around the teeth are known as periodontal reflexes. The receptors themselves are located in the periodontal ligament and are oriented in directions that cause them to respond to any forces applied to the crown of the teeth. Other receptors are located in the bony socket. The receptors are directionally sensitive. Those around the anterior teeth are particularly sensitive to forces applied horizontally to these teeth.[3]

The periodontal receptors play several functional roles. They give rise to subjective sensation about pressure on the teeth. They signal only relatively small forces, and saturate when larger forces are applied. The signals from these receptors also contribute to the reflex control of mastication. They also contribute in a more complex manner to the control of the masticatory muscles. Pressing weakly on a tooth activates a different population of receptors in the periodontal ligament. When the signals from these receptors reach the trigeminal motor nucleus, the response is quite the opposite of that caused by the tap. Weak pressure reflexly excites the jaw closing motor neurons and therefore increases the biting force.[4]

THE CHEWING CYCLE

Chewing is cyclical, occurring at a rate determined by the central pattern generator. This is divided into the following phases:

A. Preparatory Phase

The chewing movement begins when the pattern generator causes the jaw opening muscles to pull the mandible downwards from the rest or intercuspal position at about 7-8 $cm.s^{-1}$. This movement involves both the translation of the condyles primarily as the result of the activity in the lateral pterygoid muscle pulling the non working condyle forward and a hinge or rotary movement. When the jaw is open, the pattern generator ceases to activate the opening muscles, and activates the tongue and cheek muscles to posi-

tion the food between the teeth. This cycle of the movement then continues without pause into the next phase.[4]

B. Food Contact Phase

As the pattern generator switches off the activation of the jaw opening muscles, it almost immediately switches on the activity of the jaw closing muscles to produce the initial closing movement that traps the food between the teeth. It is in this phase of the cycle that the periodontal reflexes may assist in grasping the food in the correct position between the teeth, ready to be bitten through.[4]

C. Food Crushing Phase

In this phase, the output from the pattern generator to the closing muscles forces the teeth through the food bolus with the assistance of the load compensation reflex from the muscle spindle reflex system. For most western diet, the peak bite force during chewing is about 50 – 100 N, although tough food like nuts may involve much higher force levels transiently.[4]

D. Tooth Contact Phase

Activation of the jaw closing muscles continues as the opposing teeth come into contact, and while they slide from the working side into the intercuspal position. Such tooth contacts occur in 30 – 90 % of chews. During this phase, the output from the periodontal ligament receptors reflexly control the jaw closing muscles to ensure that the teeth slide in the correct direction towards the intercuspal position, thereby grinding the food into a paste. At the end of this slide, the pattern generator switches off the jaw closers, and reactivates the jaw opening muscles to move into the next chewing cycle.[4]

ROLE OF INDIVIDUAL MUSCLES IN CHEWING

The role of the major jaw closing muscles masseter and temporalis during chewing is for the most part fairly obvious. The direction in which the muscle fibres run in these muscles indicates the direction in which they apply force of the mandible. The temporalis muscle fibres converge in a fan like manner on the anterior ramus of the mandible, so that the most posterior fibres pull posteriorly, and the most anterior fibres pull upwards and anteriorly.[5]

The lateral pterygoid muscle plays an important role in several phases of the chewing cycle. It not only pulls the mandible forward during jaw opening, but also controls the rate at which the condyle returns to its fossa during haw closing. The jaw opening muscles are not normally required to exert much force during chewing because there is rarely much resistance to opening. Hence the role of the fast muscle fibres in lateral pterygoid is probably to help change the position of the mandible quickly during speech. In jaw opening, contraction of the digastric muscles is not in itself sufficient to pull the mandible downwards. It is necessary that the hyoid bone is held in a stable vertical position so that the digastric has a stable platform against which it can pull, and this is achieved by contraction of the infrahyoid muscles.[5]

CONCLUSION

Chewing is the first step in the digestion of food. It is a complex process that involves the precise control of a number of muscles including those in the tongue, and is integrated with swallowing. Mastication is a semi-automatic, cyclical process in which a basic rhythmical signal originating in a pattern generator in the brainstem alternately activate the jaw opening and jaw closing muscles. This basic opening and closing movement is fine tuned by a number of complementary reflexes which automatically adjust the activity of the motor neurons controlling the muscles to compensate for unexpected changes in the texture of the food, and to ensure that the teeth come correctly into occlusion in each closing movement.

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Cold Stress Response Variations in Lateral Positions of Body

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ABSTRACT

Aim of this study was to assess the cold stress response variations in lateral positions of body. A total of 100 healthy male subjects were chosen for the study. Blood pressure and heart rate were recorded at baseline and after Cold pressor test (CPT). Basal blood pressure and heart rate were significantly higher in left lateral position while all the parameters were significantly lower in right lateral position. After cold stress test, there was significant increase in all the parameters in both the lateral positions, but incremental change in all parameters was significantly higher in left lateral position in comparison to right lateral position. The results reveal greater response to cold stress in left lateral position in comparison to right lateral position, indicating that response to cold stress varies with body posture.

Key words: *Heart rate, Blood pressure, Cold Pressor test*

INTRODUCTION

Cold pressor test is widely used as test for autonomic functions. It has been used as diagnostic test for diseases like hypertension and other cardiac autonomic disorders. During cold pressor test , the hand or foot is immersed in cold water bath held at a constant temperature at 8^0 C. Cold water immersion activates afferent pain and temperature neurons, resulting in a centrally mediated stimulation of sympathetic efferent neurons. In healthy subjects , the CPT causes increase in blood pressure , heart rate and toatal peripheral resistance [1]. Use of cold pressor test was reported by Leblank (1960) in fishermen [2]. Following this, the response to cold pressor test has been reported in healthy subjects and in different disease states specially hypertension.

.Studies have shown that cold pressor test represents a wide spread neurogenic stimulation of multiple components of cardiovascular system. Major cardiodynamic changes during this stimulus , in addition to the pressor response ,include increased peripheral arterial resistance , increased cardiac output due to increased heart rate and increased pulmonary artery pressures [3].

Autonomic nervous system controls various visceral activities of body including blood pressure and heart rate [4]. It is influenced by many factors like orthostatic stress, cold shower, body posture etc [5-7]. In hypertensive patients and their siblings response to cold stress is greater in comparison to normal subjects. While studies have shown that yoga practices like shavasan can enhance one's ability to withstand stress induced by CPT, as shavasan reduces the load on heart by blunting the sympathetic response [8]. Postural stress in form of head-up tilt produces sustained increase in heart rate and rate pressure product so tilting can be used for assessing the integrity of autonomic cardiovascular regulatory mechanisms in physiological as well as clinical situations [9].

From physiological point of view, the response of autonomic nervous system can vary with the change in body posture including standing, sitting, supine and lateral decubitus positions. Response to cold stress would be greater in body postures influencing the sympathetic nervous system, while diminished response is expected in body postures associated with vagal influence. Present study has been done to explore the possibility of these variations in response to cold stress.

MATERIAL AND METHOD

One hundred asymptomatic healthy male subjects, aged 20-30 years, participated voluntarily in the present study, undertaken, to assess the cold stress

response variations in lateral positions of body.

Experiment procedures were in accordance with the ethical committee on human experimentation and was carried out at ambient temperature with minimal external or internal sound disturbances in the room. Subjects reported to laboratory 2 hours after light lunch. They were explained in detail about the experimental procedure. Informed consent was taken from all subjects. Systolic blood pressure (SBP), diastolic blood pressure (DBP) and heart rate (HR) were recorded by using automatic sphygmomanometer (National). Study was done in 2 steps. Each subject lied in left lateral position (step-1) posture for 10 minutes. SBP, DBP and HR were recorded from left arm. Then the subject was asked to dip his right hand in cold water at 8^{O}c for two min and above parameters were recorded again from left arm immediately and after 5 minutes of removal of right hand from cold water. The above tests were repeated with subjects in right lateral position (step-2). The parameters were recorded from right arm in step-2. Statistical analysis was done by paired t- test using the window SPSS Statistics 17.0 version.

Findings

Table-1: Comparison of Cold Pressor Test Response In Left And Right Lateral Positions of Body

		Left lateral	Right lateral
Basal	SBP	120.88 ± 8.50	115.42 ± 8.29*
	DBP	76.62 ± 7.17	71.44 ± 7.29*
	HR	79.38 ± 8.24	74.14 ± 6.53 *
Immediately after CPT	SBP	141.23 ± 9.62	130.65 ± 8.18
	DBP	95.77 ± 9.02	81.52 ± 8.65
	HR	99.76 ± 12.76	89.91 ± 11.3
after 5 min	SBP	121 ± 7.69	116 ± 7.71
	DBP	77.04 ± 6.51	71.44 ± 7.17
	HR	80.08 ± 9.84	74.64 ± 7.39

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

* compared between left and right lateral position * p<0.05

Table- 2: Comparison of Incremental Change After Cpt In Left And Right Lateral Positions Of Body

	Left lateral	Right lateral
SBP	20.35	15.23*
DBP	19.15	10.08 *
HR	20.38	15.77 *

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

* compared between left and right lateral position * p<0.05

Table – 1 shows that basal systolic blood pressure, diastolic blood pressure and heart rate (p<0.05) were significantly higher in left lateral position as compared to right lateral position. Immediately after CPT, there was a rise in all the parameters in both lateral positions, but, the increment in measured parameters was significantly higher in left lateral position (Table-2).

CONCLUSION

Cold pressor test is an autonomic function test in which cold stimulus causes intense stimulation of sympathetic nervous system [1]. Immersion of hand in cold water produced marked increase in heart rate. This increase in heart rate has been attributed to an increase in sympathetic activity with release of Norepinephrine and epinephrine [8].

Heart rate is controlled by the SA node of heart which has sympathetic as well as parasympathetic nerve supply. Stimulation of this sympathetic nervous system increases the heart rate. While parasympathetic stimulation decreases it. The stroke volume is also determined in neural input as well as on preload and afterload on cardiac muscle. Increase in venous return to heart increases it , while increase in peripheral resistance in arterial tree increase the after load and vice versa. In resting state, venous return to heart is affected by gravity. The peripheral resistance in the body in man is primarily controlled by the arterioles which are richly supplied with sympathetic fibers, but sparse parasympathetic innervation [10].

Table – 1 shows that basal systolic blood pressure, diastolic blood pressure and heart rate (p<0.05) were significantly higher in left lateral position as compared to right lateral position. Immediately after CPT, there was a rise in all the parameters in both lateral positions, but, the increment in measured parameters was significantly higher in left lateral position (Table-2).

Human S-A node receives its vagal innervation mainly from right vagus nerve. The right vagus nerve in the neck might be stimulated by periodic massage from the pulsation of the carotid artery in the right lateral decubitus position leading to higher parasympathetic activity. The position of the heart is lower in the left lateral decubitus than in the right lateral decubitus position. Gravity might exert an increased workload on cardiac function when the left lateral decubitus is assumed. A larger workload required in left lateral decubitus, as compared with the right lateral decubitus position, will produce more sympathetic and less vagal activity. While reduction in this workload in right lateral decubitus position will lead to an enhancement of vagal activity. Because of right sided anatomical position of right atrium, the venous

return from the venous system via inferior and superior vena cavae to the right atrium is more favorable when assuming the right lateral decubitus position, which may increase vagal activity. While in left lateral position, venous return is less in comparison to supine and right lateral decubitus. To compensate for decrease in venous return and cardiac output, sympathetic tone is enhanced and vagal tone is suppressed in left lateral position [11,12]. Therefore there is possibility of, higher vagal activity and lower sympathetic activity in right lateral position with reversal of autonomic activity in left lateral position. And because of this variation in resting autonomic status of an individual, cold pressor response varies with alteration in body posture.

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Electroencephalographic Pattern and Galvanic Skin Resistance Levels During Short Duration of "aum" Mantra Chanting

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ABSTRACT

Introduction: "AUM" or "Om" is the name or symbol of God which is the combination of three letters, namely, A, U, and M. It is found that previous studies have evaluated only the long term effects of mantra chanting on experienced meditators. There is lacunae in evaluating the immediate effect of short duration of "aum" chanting in untrained subjects which will evaluate the strong potency of "aum" mantra chanting on mind relaxing physiological mechanisms to prevent and counteract the effects of stress related disorders.

Objective: The objective of this study was to evaluate the electroencephalographic pattern, galvanic skin resistance levels and heart rate during 5 minutes of "aum" mantra chanting in untrained subjects.

Methodology: The recordings of electroencephalogram, electrocardiogram and values of galvanic skin resistance levels were taken during the control period of rest before "aum" chanting for 5 minutes immediately followed by the test period which was during 5 minutes of "aum" chanting and the recordings continued for 5 minutes after the chanting procedure.

Results: Beta wave electroencephalographic pattern of 18-30 Hz. were recorded before chanting. During 5 minutes of "aum" chanting the subjects showed slow wave electroencephalographic patterns of theta and delta waves suggestive of mental relaxation and simultaneously there was a significant decrease in galvanic skin resistance values and an increase in heart rate ($p< 0.05$) which are suggestive of activation. Thus it is concluded that there is a combination of physiological relaxation and mental alertness even during short duration of "aum" mantra chanting.

***Key words**: "aum" mantra, Electroencephalogram patterns, Galvanic skin resistance, Meditation.*

INTRODUCTION

Aum or Om is the name or symbol of God (*Ishwara, Brahman*)[1] . *Aum* covers the whole threefold experience of man. It is the combination of three letters, namely, A, U, and M. "A" represents the physical plane. "U" represents the mental and astral plane, "M" represents the whole deep-sleep state, which is unknown even in our wakeful state. From the original sound, *Aum*, all things become manifest as its extension embodiments[1].

Previous research studies were conducted on experienced *Om* meditators on autonomic and respiratory variables[2]**.**

There was statistically significant reduction in the heart rate during meditation compared to the control period. There was also a comparable increase in the cutaneous peripheral vascular resistance. This was interpreted as a sign of increased mental alertness even while being physiologically relaxed. Subsequently, a comparison study was done to see the physiological effects which reported that when repetition of *Om* was compared with the repetition of *One* in 12 meditators, there was a difference in the autonomic and respiratory responses [3] . Both types of sessions resulted in a decrease in the heart and breath rates, but the repetition of *Aum* alone reduced the skin resistance, as a sign of increased mental alertness related to the significance of the syllable [3].

It is found that previous studies have evaluated only the long term effects of mantra chanting on experienced meditators. There is lacunae in evaluating the immediate effect of short duration of "aum" chanting in untrained subjects which will evaluate the strong potency of "aum" mantra chanting on mind relaxing physiological mechanisms to prevent and reduce the effects of stress related disorders. Previous studies have shown that slow wave electroencephalographic patterns indicate deep relaxation and occur more frequently in highly experienced meditation practitioners [4]. The source is probably frontal parts of the brain, which are associated with monitoring of other mental processes. These types of waves likely originate from a relaxed attention that monitors our inner experiences [4]. It is also known that states of deep relaxation can prevent and reduce the effects of stress related health disorders [5].

Therefore this study proposes to evaluate the electroencephalographic pattern, galvanic skin resistance levels and heart rate during 5 minutes of "aum" mantra chanting in untrained subjects not experienced in any chanting procedure in the past. Galvanic skin resistance reflects central sympathetic stimulation [5] and is a sign of mental alertness [3].

It is hypothesized that "aum" mantra chanting for very short time of even 5 minutes in untrained subjects would produce slow wave electroencephalographic patterns and mind relaxing effects.

METHOD

Subjects: 15 medical students (10 males and 5 females) of average age group 18 volunteered for this study. None had previous exposure to any techniques of yoga or meditation. None had a psychiatric illness, neurologic illness, and none of the subjects were on chronic medications. All the subjects were asked not to take any central nervous system stimulants/ caffeine prior to the test. Written informed consent was taken from all the subjects and permission was obtained from institution's research and ethics committee. The procedures followed were in accordance with the World Medical Association declaration of Helsinki-ethical principles for medical research involving human subjects.

Procedure: The experiment was conducted in a closed room without any sound or light disturbance at constant temperature and at the same time of the day in the mornings. The procedure of chanting of "aum" was demonstrated and explained to the subject before the recordings. The leads of the electroencephalogram (e.e.g) and electrocardiogam of digital E.E.G machine were placed on the scalp and the limbs respectively before the chanting procedure. The electrode for galvanic skin resistance of polygraph (Rolex scientific engineers) was placed on the subject's index finger before the chanting procedure. Then the subject was instructed to rest with eyes closed in supine position. The recordings of electroencephalogram, electrocardiogram and values of galvanic skin resistance levels were taken during the control period of rest before "aum" chanting for 5 minutes immediately followed by the test period which was during 5 minutes of "aum" chanting and the recordings continued for 5 minutes after the chanting procedure. After the control period of rest for 5 minutes the subjects were instructed to chant the mantra "aum" repeatedly for 5 minutes of test period during which all the recordings continued. The recordings continued for 5 minutes after the chanting procedure during which the subjects were instructed to pay all their attention to the body vibrations produced with eyes closed.. It was a single session for each subject during the same time of the day.

Electroencephalogram (E.E.G) : Electroencephalographic recordings during control periods of rest were recorded for 05 minutes with eyes closed before the starting of the "aum" chanting, in 18 leads by digital E.E.G machine, Neuro-Page software (Medicaid, Chandigarh) . The electrodes were placed on the scalp. The recordings were also taken during entire test period of 5 minutes of "aum" chanting with eyes closed and continued for 5 minutes after "aum" chanting with eyes closed. The frequency of the wave pattern per second was calculated by counting the number of waves on the time scale of the electroencephalogram tracings (fig.1).

Heart rate: Heart rate was calculated using the number of cardiac cycle per minute by counting it on the time scale of the electrocardiogram tracings of the Neuro-Page software (Medicaid, Chandigarh) with the corresponding electrocardiogram limb leads (fig.1).

Galvanic skin resistance: The average value of each period was taken. Galvanic skin resistance electrodes of polygraph (Rolex scientific engineers) with the suitable all purpose amplifier model: 904, which was calibrated before the procedure was used.

STATISTICAL ANALYSIS

Statistical significance of difference in mean values between groups was assessed using sample t-test and significance of the results were calculated. P value of less than 0.05 was considered as significant for the statistical tests.

RESULTS

Electroencephalographic pattern during control period of rest with eyes closed:

All the subjects showed a basal beta wave pattern of 18-30 Hz. per second (fig.1,a).

Electroencephalographic pattern during test period of "aum" chanting for 5 minutes with eyes closed:

1. All the subjects showed slow wave electroencephalographic patterns. Patterns produced were short bursts of high voltage theta waves (in 8 subjects) (100- 300 microvolts) at 5-7 cycles per second (fig.1, b) and short bursts of large amplitude delta waves at less than 4 cycles per second (in 7 subjects) during 5 minutes of "aum" chanting which were typically seen in the occipito parietal regions of both the sides (fig.1, c). The slow wave patterns continued for 2-3 minutes after the end of chanting and was followed by beta wave pattern of 18-30 Hz.
2. There was a constant tendency of synchronisation of anterior and posterior channels during slow wave pattern (fig.1,b).
3. There were periods of uniformity of wave pattern, amplitude and frequency of wave form in all channels during the chanting procedure (fig. 1, b).

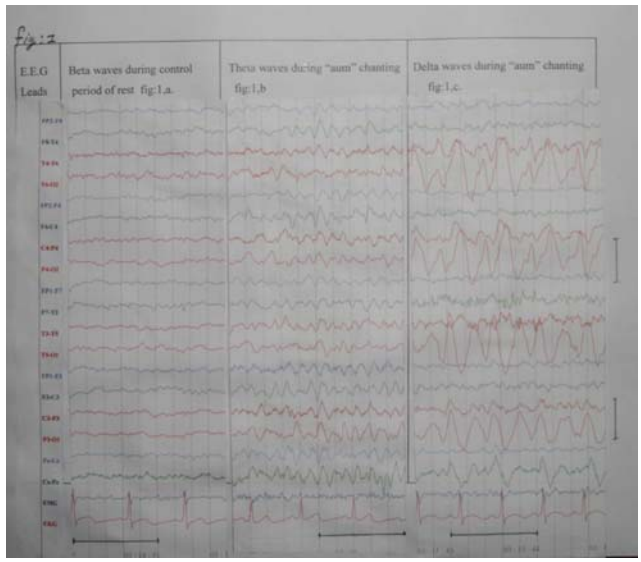
Galvanic skin resistance (GSR): There was a decrease in GSR values during 5 minutes of chanting compared to the resting control values ($P < 0.05$) and the values continued for 3-4 minutes after the end of chanting.. Statistical significance of difference in mean values between groups were assessed using students t-test and significance of the results were calculated (Table-1).

Heart rate: There was an increase in the heart rate during 5 minutes of chanting compared to the resting control values (Table-1).

TABLE – 1

PARAMETERS	BEFORE "AUM" CHANTING (Control period)	DURING 5 MINUTES OF "AUM" CHANTING (Test period)
GSR VALUES (ohms) (Mean± S.D)	1028.2 ± 0.77	1024.033* ± 1.099
HEART RATE (b/minute) (Mean ± S.D)	84.26667± 9.49	99.2±* 10.604

* Significance set at $P < 0.05$



Legend fig:1

The E.E.G leads in fig. 1 from top to bottom are FP2-F8, F8-T4, T4-T6, T6-O2, FP2-F4, F4-C4, C4-P4, P4-O2, FP1-F7, F7-T3, T3-T5, T5-O1, FP1-F3, F3-C3, C3-P3, P3-O1, Fz-Cz and Cz-Pz. Horizontal calibration at the bottom end of the figure shows duration of 1 second using the time scale at the bottom. Vertical calibration at the right end of the figure (15mm) = 100 μV at sensitivity of 7μV /mm. Fig.1, b and 1, c show slow wave theta pattern (100- 300 microvolts) at 5-7 cycles per second and delta wave pattern at less than 4 cycles per second respectively at a recording speed of 30mm/sec. at sensitivity of 7μV (7μV /mm) at awake state.

DISCUSSION

The significant findings of this study are the appearance of slow wave electroencephalographic patterns of theta and delta waves during the very short period of 5 minutes of "aum" chanting and a simultaneous decrease in galvanic skin resistance levels during the chanting procedure.

Beta waves occur when the brain is working on goal-oriented tasks, such as planning or reflecting actively over a particular issue [6]. In this study beta waves were seen in all subjects during the control period of rest in supine position with eyes closed in awake state before the chanting procedure (fig:1, a).

There was appearance of slow wave delta pattern during the very short period of 5 minutes of "aum" chanting (fig:1, c). Previous studies show that delta waves seen during slow wave sleep can arise either in the thalamus or in the cortex. When associated with the thalamus, they likely arise in coordination with the reticular formation[7,8]. In the cortex, the

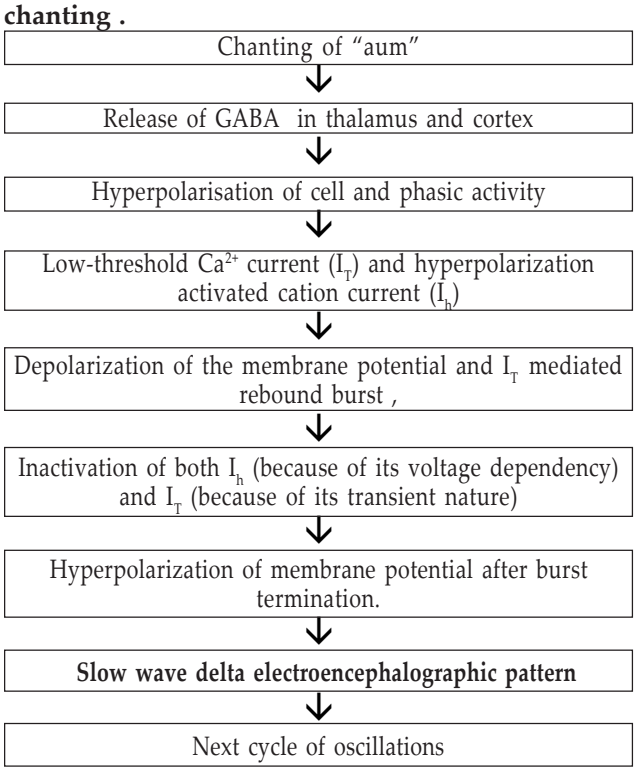
suprachiasmatic nuclei has been shown to regulate delta waves and show a lateralization, with right hemisphere dominance during sleep [9,10]. Delta waves have been shown to be mediated in part by T-type calcium channels [11]. It is known that during slow wave sleep with delta pattern, neurons are globally inhibited by gamma-aminobutyric acid (GABA) [12].

Thalamic delta (1-4 Hz) is a well known example of rhythmic activity generated intrinsically by thalamic relay neurons as a result of the interplay between their low-threshold Ca^{2+} current (I_T) and hyperpolarization activated cation current (I_h). As such, the delta oscillation may be observed during deep sleep when thalamic relay neurons are hyperpolarized sufficiently to deinactivate I_T [13].

Subcortical regions of slow wave sleep stimulated by pathways ascending from the thalamus are the diencephalic sleep zone in the posterior hypothalamus, the medullary synchronizing zone in the reticular formation of medulla oblongata and the basal forebrain sleep zone which includes the preoptic area and the Diagonal band of Broca [6].

Based on the above mentioned previous studies on the origin and formation of delta waves during slow wave sleep and finding of delta waves during "aum" chanting in the present study we propose the following mechanism as hypothesis for "aum" chanting to produce slow wave delta electroencephalographic pattern.

Proposed hypothesis for production of slow wave delta electroencephalographic pattern during "aum" chanting .



In the present study "aum" chanting has also produced short bursts of slow wave high voltage theta waves (100- 300 microvolts) at 5-7 cycles per second. Previous studies have shown that theta waves indicate deep relaxation and occur more frequently in highly experienced meditation practitioners [4]. The source is probably frontal parts of the brain, which are associated with monitoring of other mental processes. These types of waves likely originate from a relaxed attention that monitors our inner experiences [4].

The most widely accepted hypothesis for theta wave production proposes that the "pacemaker" for the theta rhythm is determined by a feedback loop involving the medial septal area and hippocampus [14]. These regions signal to lower parts of the brain, inducing the physical relaxation response that occurs during meditation. Several types of hippocampal and entorhinal neurons are capable of generating theta-frequency membrane potential oscillations when stimulated which are sodium-dependent voltage-sensitive oscillations in membrane potential at near-action potential voltages [15]. Specifically, it appears that in neurons of the dentate gyrus, these oscillations result from an interplay of dendritic excitation via a persistent sodium current (I_{NaP}) with perisomatic inhibition [16]. Therefore it is proposed in the present study that " aum" chanting probably triggers these sodium-dependent voltage-sensitive oscillations in membrane potential at near-action potential voltages in hippocampal and entorhinal neurons and thereby produces the slow wave theta electroencephalographic pattern.

Previous studies on functional role and purpose of electroencephalographic slow waves, have found that slow wave delta is associated with synaptic plasticity and could contribute to the consolidation of memory traces acquired during wakefulness [17]. Theta waves are believed to be vital to the induction of long-term potentiation, a potential cellular mechanism of learning and memory [18,19]. It is therefore proposed that even short duration of "aum" chanting on a regular basis can be beneficial for mental alertness while being physiologically relaxed and can be a potential mechanism to improve learning and memory process.

A significant decrease in GSR values ($p < 0.05$) during "aum" chanting is similar to the previous study on experienced "om" meditators [3]. It reflects central sympathetic stimulation [5] and is a sign of mental alertness [3]. The increase in heart rate could be due to the voluntary activity of chanting itself.

Conclusion: Based on the results obtained in this study, it is concluded that "aum" chanting produces physiological relaxation and mental alertness. It is therefore proposed that even short duration of "aum"

chanting on a regular basis can be beneficial for mental alertness while being physiologically relaxed and can be a potential mechanism to improve learning and memory process [18,19].

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Hypothesis Formulation for Integrated Neuroendocrinal Mechanisms for Pair Bonding, Romantic Love, Maternal and Paternal Love.

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ABSTRACT

Affiliation, pair bonding and love are important for survival, health and happiness. On the basis of various studies on neural mechanisms, endocrinal and genetic factors involved in various kinds of love, the purpose of this article is to hypothesize comprehensive, integrated neuroendocrinal mechanisms involved in pair bonding, romantic love, maternal and paternal love. The postulation depicted as flow charts at the end of this article seems to be triggered by various factors involving multiple neuroendocrinal mechanisms. It is concluded that the physiological mechanisms involved and the brain areas activated in each of these differ and the representation of postulated comprehensive mechanism in this article is an attempt to add a new dimension to understand the science of a very basic human quality of love.

Key words: *Pair bonding, Maternal love, Paternal care, Oxytocin, ArginineVasopressin (AVP)*

INTRODUCTION

Affiliation or love which is a basic instinct includes social bonding between individuals, sexual partner relationships and parent-infant relationships[1]. The ways in which social bonds are formed are species-specific and show high individual variability[1]. As there is lacunae in a concrete integrated physiological mechanism for various kinds of love in previous studies the purpose of this article is to hypothesize comprehensive, integrated neuroendocrinal mechanisms involved in pair bonding, romantic love, maternal and paternal love which have been depicted as flow charts at the end of this article.

Oxytocin (OT) and Prosocial behaviour

Previous studies have shown that brain OT influences the formation of social bonds [2]. The process was studied by means of autoradiographic receptor binding in prairie and montane voles, two closely related species with dichotomous systems of social organization [3]. OT receptors were found to be distributed in complementary patterns in the two species. In the highly socially affiliative prairie vole, receptors were most evident in the Bed nucleus of stria terminalis (BNST) and one of its primary afferents, the lateral amygdale. Studies have evaluated the role of Oxytocin in social relationships among humans and have confirmed the dependence of affective experiences of others which highly and critically affect human prosocial behavior [4]. The researchers tested whether oxytocin influences affective ratings, and examined the underlying brain activity for faces that have been aversively conditioned [4]. It was found that the differential negative evaluative effect was abolished by treatment with Oxytocin. This effect was found to be associated with an attenuation of activity in anterior medial temporal and anterior cingulate cortices. The results of this study suggest that Oxytocin modulates the expression of evaluative conditioning for socially relevant faces via influences on amygdala and fusiform gyrus, an effect that explains its prosocial effects. The results of studies for attachment behaviors suggest that OT has "prosocial" effects.

Dopamine and courtship attraction

Various neurochemical mechanisms have been associated with courtship attraction. Supporting Beach's hypothesis that the monoamines were involved in mate preference [5], it was found that when a female laboratory-maintained prairie vole is mated with a male, she forms a distinct preference for him associated with a 50% increase in dopamine in the

nucleus accumbens [6]. It has been shown that Oxytocin and Vasopressin facilitate social recognition in mammalian species and that all of these peptides facilitate monoamine release [7]. Therefore these peptides have been implicated to have more potent effects on monoamine release, particularly release of dopamine in brain reward centers by rewiring brain circuits [7]. It is believed that Oxytocin and Vasopressin interfere with the dopamine and norepinephrine pathways, which might explain why passionate love fades as attachment grows[8].

Serotonin and romantic love

Researchers have explored the possibility that romantic love like obsessive-compulsive disorder (OCD) might share alterations at the level of the serotonin (5-HT) transporter. The results of study by Marazziti et al [9] have shown that subjects who were in the early romantic phase of a love relationship were not different from OCD patients in terms of the density of the platelet 5-HT transporter, which proved to be significantly lower in both the groups than in the normal controls.

Nerve growth factors (NGF) and romantic love

A recent study by Emanuele et al [10] examined whether the early romantic phase of a loving relationship could be associated with alterations in circulating levels of neurotrophins (NTs) and found a significant positive correlation between levels of NGF and the intensity of romantic love as assessed with the passionate love scale. In 39 subjects in love who-after 12-24 months-maintained the same relationship but were no longer in the same mental state to which they had referred during the initial evaluation, plasma NGF levels decreased and became indistinguishable from those of the control groups. The results of this study suggest that some behavioural and/or psychological features associated with falling in love could be related to raised NGF levels in the bloodstream.

Neural correlates associated with romantic love

It is interesting to note that apart from the neurochemical mechanisms, areas activated in the brain in pair bonding and love has also been extensively studied.

In a study by Fisher and colleagues [11], the brain canning of men and women who were intensely in love after eliciting feelings of intense romantic love using photograph of the beloved as an effective stimulus showed that group activation specific to the beloved occurred in several regions, including the right ventral tegmental area (VTA) localized in the region of dopamine cells. Group activations were also found in Caudate nucleus specifically in the right medial and postero-dorsal body that received projections from VTA [11, 12]. The caudate nucleus plays a role in reward detection and expectation, the representation of goals and the integration of sensory inputs to prepare for action [13]. Dopamine was found to be released in the medial caudate body in response to predictable monetary reward presentation where group activation specific to the beloved was also found [14]. In another study using functional magnetic resonance imaging (fMRI), Bartels & Zeki[15] also investigated brain activity in 17 men and women who reported of being 'truly, deeply and madly in love' and found activity in regions of the ventral tegmental area and caudate nucleus. These datas suggest that mesolimbic dopamine pathways in the reward system of the brain play a role in the pleasurable feelings, focussed attention, motivation and goal-oriented behaviours associated with romantic love.

Gender differences in romantic love

Interesting findings highlighting the gender differences in romantic love is that men tended to show more activity than women in a region of the right posterior dorsal insula that has been correlated with penile turgidity [16] and male viewing of beautiful faces [17]. Men also showed more activity in parietal part of temporal lobe regions associated with the integration of visual stimuli [18]. Women tended to show more activity than men in regions associated with attention, memory and emotion [19].

Arginine Vasopressin (AVP) and Pair bonding (Attachment behaviours)

Found in fewer than 5% of mammalian species, monogamy with attachment is defined as an exclusive, long-lasting sexual relationship between partners [20]. The study by Winslow et al [21] determined the chemical make up of monogamous relationship or pairbonding which involved administering with AVP and AVP receptor1a (AVPr1a) antagonists in prairie voles which form "family" relationships like human beings. It was found that intracerebrovascular administration of AVP antagonists prior to mating , inhibit partner preference whereas AVP infusions facilitate partner preference [22].

Research on the genetic basis of pair bonding have found that structural differences in the V1 receptor gene of socially monogamous male voles (as opposed to asocial promiscuous voles) increased the levels of the expression of this receptor in the ventral pallidum [23]. Scientists report that when they transfected this genetic variant (the monogamous version) into the ventral pallidum of meadow voles, an asocial promiscu-

ous species, Vasopressin receptors were upregulated and showed monogamous behaviour [24].

It was also found that affiliative behavior also increased through additional AVP receptor1a (AVPr1a) expression delivered to the ventral forebrain via a viral vector [24]. Therefore activities of central oxytocin and vasopressin have been associated with both partner preference and attachment behaviours (pair bonding).

Neural correlates associated with pair bonding in humans

The study using neural imaging techniques showed activations, including the right anterior and posterior cingulate cortex, and right mid-insular cortex in individuals in longer relationship [25].This study confirmed Bartels & Zeki's [15] findings that the anterior cingulate and insular cortex are involved in longer term love relationships. Neural activation was also found in the ventral putamen/pallidum [25]. Activity in ventral pallidum, combined with a specific distribution pattern of Vasopressin (V1a) receptors, has been associated with pair bonding and attachment behaviours in monogamous prairie voles [24]. Hence, activity in the ventral pallidum is greater in long term human relationships than in shorter ones and in other pair bonding/attaching mammals.

MATERNAL LOVE

Studies have shown that AVP aids in maternal care of offspring. It was found that in rats during late pregnancy, parturition and lactation, AVP levels and/or release increase in various brain regions, including the septum [26], superior olivary nucleus (SON) [27], paraventricular nucleus (PVN) and hippocampus [26]. Similar results were found in rabbits where the size and number of AVPir (Arginine-Vasopressin immunoreactive) neurons significantly increased in hypothalamic nuclei from late pregnancy through parturition[28].

Among humans several research studies also emphasise the role of skin-skin contact between the child and the parent and increased release of oxytocin for attachment of parent to child [29].

Neural Correlates of maternal love

Among human beings, brain areas activated during maternal love has been studied by Bartels & Zeki[30] where they measured brain activity in mothers while each looked at a photo of her own infant, a photo of an infant with whom she was acquainted, an adult best friend's photo and photo of an adult acquaintance. It was found that maternal love activated several specific brain regions including the lateral orbitofrontal cortex and the periaquiductal grey area (PAG) that differed from those associated with romantic love.

Comparison of romantic and maternal love

Thus comparing romantic and maternal love it has been found that they share the same pattern of cortical de-activation, particularly in the frontal cortex. It was found that in maternal love there is a strong activation of parts of the brain that are specific for faces. This is for the importance of reading children's facial expressions, to ensure their well being, and therefore the constant attention of the mother for the face of the child [30]. Another difference is the involvement of the hypothalamus only in romantic love and not in maternal love.

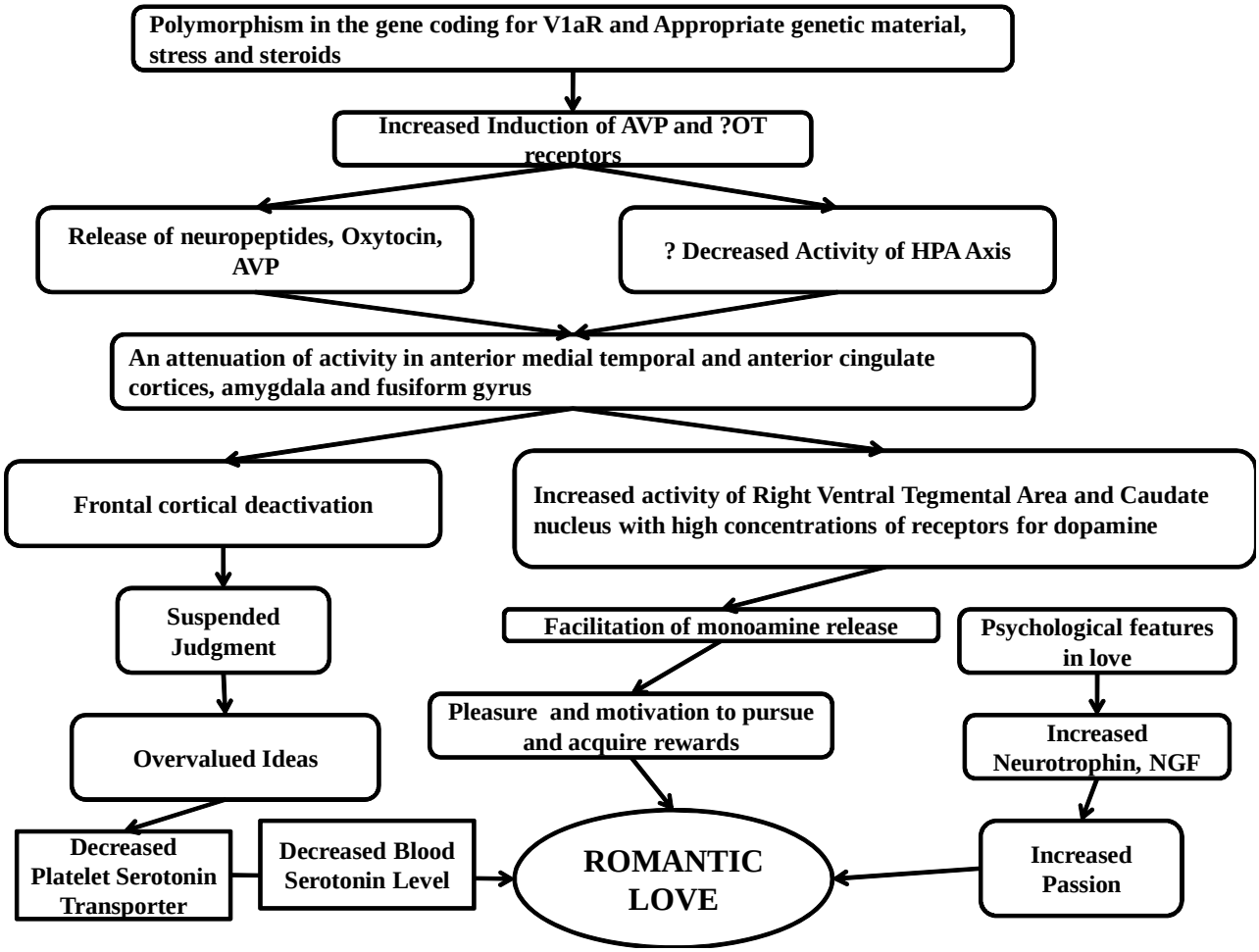
PATERNAL LOVE

Several studies have evaluated the role of OT and Arginine Vasopressin (AVP) in paternal behaviour on monogamous rodent species, particularly the prairie vole and California mouse. Male prairie voles express greater AVP-ir (Arginine-Vasopressin immunoreactive) fibers and neurons in lateral septum (LS) and BNST as compared to females [31]. Studies have found that AVP-ir fibers increase naturally in male prairie voles just prior to parturition, suggesting these fibers are involved in paternal behavior [32]. Intra-septal AVP increases and AVP receptor 1a (AVPr1a) antagonist decreases paternal behavior in sexually naïve male prairie voles directly implicating the role of AVP on paternal behavior [32]. Among humans several research studies also emphasise the role of skin-skin contact between the child and the parent and increased release of oxytocin for attachment of parent to child [29]. These results suggest that paternal behavior appears to be modulated by AVP in the BNST, hypothalamus and oxytocin.

CONCLUSION

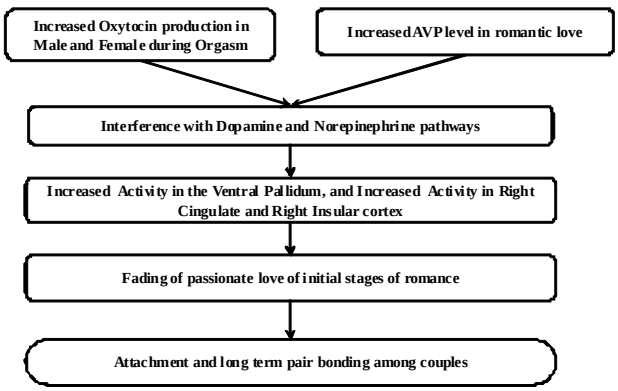
Based on the results of various previous studies we have formulated comprehensive hypothesis for integrated neuroendocrinal mechanisms for various kinds of love depicted as following flow charts and have concluded that the mechanisms, the factors involved and the brain area activated in each are different.

I) **HYPOTHESIS FOR NEUROENDOCRINAL MECHANISM OF ROMANTIC LOVE**

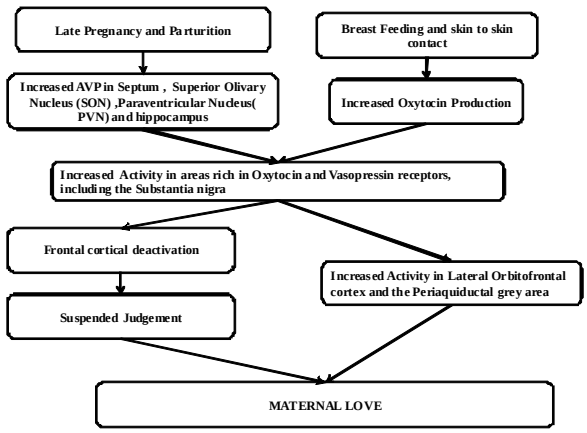


AVP- Arginine vasopressin, OT- Oxytocin, HPA axis- Hypothalamo-pituitary adrenal axis NGF- Nerve growtfactor

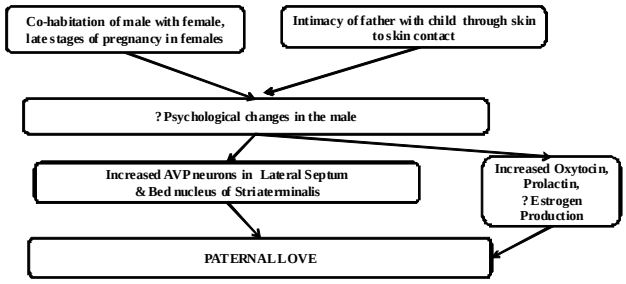
II) HYPOTHESIS FOR NEUROENDOCRINAL MECHANISM OF PAIR BONDING



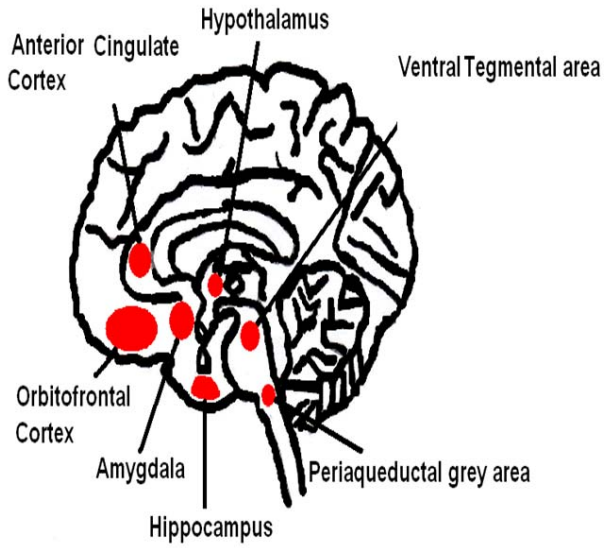
III) HYPOTHESIS FOR NEUROENDOCRINAL MECHANISM FOR MATERNAL LOVE



IV) HYPOTHESIS FOR NEUROENDOCRINAL MECHANISM FOR PATERNAL LOVE



Representation of brain areas activated during pair bonding, romantic love, maternal and paternal love.



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Thermosensation of the Orofacial Region

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ABSTRACT

Orofacial thermoreception results in qualitatively diverse percepts of temperature as the result of complicated central neural mechanisms along the thermosensory pathways to the cortex. Foods that enter the mouth and objects that touch the face often have temperatures that differ from the orofacial tissues. The resulting transfer of thermal energy evokes discharges in, or alters the ongoing discharge activity if different classes of thermoreceptors supplying the epithelia. The different classes of thermoreceptors differ in their response properties and explain human's capacity to distinguish between thermal stimuli at very high to very low temperatures.

Introduction : A cool drink of water, a hot cup of coffee, a warm glass of flavored milk. Qualitatively different adjectives such as hot, cool, warm describe our perception of a single dimension of stimulation that of temperature or thermal energy. Signal from temperature sensitive receptors or thermoceptors in the orofacial region contribute greatly to the enjoyment of foods. Foods that enter the mouth and objects that touch the face often have temperatures that differ from the orofacial tissues.

Key words: *Thermosensation, Thermoreceptors, Orofacial thermosensitivity*

STIMULATION OF THERMOCEPTORS

At rest and under normal conditions depending on the ambient temperature, the resting baseline temperature of the skin averages about 33-34^0 c. The skin overlying the lateral chin and of the scalp in the warmer than other facial areas, and temperatures intraorally are higher than those extraorally. The mucosal surface of the lips approximates 34-35^0 c and the tongue 36-37^0 c with all intraoral tissues becoming warmer when the mouth is closed. When an external object such as food is brought into contact with the soft tissues of the mouth or face, thermal energy is transferred between the object and tissue, causing the temperature of the tissue either to increase or decrease. The changes in the tissue temperature if sufficient in magnitude and rate of change evoke or alter activity in the different types of thermoreceptors. [1]

The transfer of energy to their receptor terminals depends on the thickness of the epithelium, degree of keratinization and the present amount of saliva. For example heat is transferred less effectively, in turn to receptors in the hairy skin of the lips, the vermillion, and the inner mucosal surfaces of the lips due to increase in the thickness of the epithelium. The relatively poor thermal conductivity of the thicker mucosa, however is offset in part by the presence of saliva which increases sensitivity to changes in temperature. Due to the higher degree of keratinization, the mid dorsal surface of the tongue is less sensitive to thermal changes than is the tip of the tongue.[1, 2]

The terminal endings of thermoreceptors are characterised by receptor channels that respond to thermal energies of specific magnitudes. These channels control the passage of ions across the cell membranes and thereby the development of depolarizing

receptor potentials. When the receptor potentials are large enough to exceed the axon's firing threshold, they initiate action potentials that are conducted to the brain. To date, channels that respond to temperatures above 41^0 c (the vallinoid receptor subtype 1, VR1), to temperatures above 50^0 c (vanilloid receptor subtype 1) and to temperatures in the range of about 8 to 28^0 c (the cold menthol receptor type 1, CMR 1) have been discovered. [1,2]

The channels are opened not only by thermal energy associated with the specified temperature ranges, but also by chemical compounds. Vanilloid compounds such as capsaicin, the hot component of chilli peppers, are highly effective in activating the high temperature channels and in decreasing the threshold temperature at which heat pain is first felt, from about 43^0 c to 33^0 c in the extreme case. Similarly, menthol and related "minty tasting" compounds increase sensitivity to cold. The development of highly specific agonist and antagonist of the receptor channels should enable control of temperature perception purely by chemical means.

Orofacial thermoreceptors

The afferents are classified as low threshold thermoreceptors (including warm and cold fibres) or high threshold thermoreceptors (including thermonociceptors and high threshold cold receptors).

The low threshold thermoreceptors signal information about temperature and changes in temperature that possess little, if any, potential for tissue damage, i.e. temperatures in the range of 15-45^0 c. High threshold thermoreceptors signal information about temperatures and changes in temperature that have potential for tissue damage. Although they sometimes respond to temperature within the low threshold range of 15 to 45^0 c, high threshold thermoreceptors respond maximally to higher and /or lower temperatures.

Recordings from neurons in the infraorbital nerve in monkeys and from nerves supplying the hand/arm and leg in animals and humans provide evidence for at least 2 different types of low threshold thermoreceptors and 3 types of high threshold thermoreceptors. All of these thermally sensitive afferents are thinly myelinated Aä fibres or unmyelinated C fibres. [1]

Receptive fields: Orofacial thermoreceptors are found to have small receptive fields, which are often single spots on the skin or mucosa of about 300ìm in diameter. The receptive fields of thermo-nociceptors tend to be larger (2-4 mm^2) than those of warm and cool fibres.

Low threshold thermoreceptors: The orofacial region is better equipped to process information about cooling than information about warming. The tissues are supplied with a notably higher density of cold fibres than of warm fibres. In addition cold fibres conduct action potentials about 3 times faster than warm fibres. In addition to their sensitivity to thermal energy, warm fibres discharge in response to mechanical stimuli that ally about 0.01 N of more to the receptive fields. The threshold forces are 10 to 100 times greater in magnitude than the force required to stimulate low threshold mechanoreceptors in the same skin areas. To activate the cold fibres by mechanical stimulation requires even greater forces that risk tissue damage.

These findings particularly for the warm fibres suggest that the texture of food interacts with the encoding of information about temperature at the most peripheral level of the thermosensory system. They may explain why temperature differences are more difficult to discern for some foods than others. It has been shown that cooling of the skin alters the response of slowly adapting low threshold mechanoreceptors that encode information about texture.

Warm fibres: Above 37^0 c, the discharge activity of warm fibres increases in proportion to temperature while the activity of cold fibres increases in the similar fashion. One subgroup of warm fibres reaches maximum firing rates at temperatures at temperatures of about of about 40 to 45^0 c. The second group of warm fibres reaches maximum firing rates for temperatures in the noxious range about 50^0 c.

Cold fibres: They are also known as low threshold cold receptors (LCR), are maximally active at about 30^0 c. They signal information about increasing intensities of coolness down to about 20^0 c.

High threshold thermoreceptors: In contrast to low threshold thermoreceptors, high threshold thermoreceptors do not exhibit on-going activity at the normal temperatures of the orofacial region. However, the more sensitive high threshold thermoreceptors begin to discharge at hot and cold temperatures that are not injurious to tissues or painful to most individuals.

Perception of temperature

Our sense of temperature completely adapts over

the range of normal resting temperatures of the skin and the oral mucosa, i.e. from about 29 to 37^0 c. A change in temperature within this range, results in different baseline or adapting temperatures that ceases to be perceived within a minute or so. For example, when an initially cool object is held against the skin of the face, it will soon cease to feel cool. This adaptation occurs within the central nervous system as the thermoreceptors respond to the new temperature within the range of 29 to 37^0 c, decrements in temperature below 29^0 c evoke persisting sensations of cool, cold and cold pain depending on the final temperature of the tissues. Similarly, increments in temperature above 37^0 c evoke persisting sensations of warmth, heat and heat pain. [3]

As the temperatures become more extreme, heat sensations in turn assume sharp/ pricking/ stinging and burning/ throbbing qualities. Cold sensations often assume tickling, painful pricking and aching/ burning/ numbing qualities. Temperatures that possess potential for tissue damage occur above about 45^0 c and below 15^0 c where these noxious sensations are first felt. Intense aching and burning pain is often felt at about 50^0 c and 0^0 c, temperatures that destroy soft tissues if maintained for more than short periods of time.

High temperatures and heat pain

The most prevalent high threshold thermoreceptor is the C-fibre polymodal nociceptor (CPN). These afferents are responsible for the burning, often intolerable, quality of noxious hot and cold stimuli. These receptive fields tend to be single spots on the skin about 2-4 mm^2 in area. CPN's also respond to strong mechanical stimuli, having thresholds that are 10 to 1000 times higher than those of low threshold mechanoreceptors supplying the same areas of skin or mucosa. Many CPN's respond to endogenous mediators of inflammation and noxious chemical agents.[4]

Cold and pain

Although HCRs respond to temperatures that are close to freezing, their discharge does not result in pain, so they are not considered to be nociceptors. However, decrements in temperature from baseline skin temperatures as high as 20-25^0 c activate nociceptors and HCRs. Thus cold pain is blended percept of cold and pain: cold from the activation of cold thermoreceptors and pain from the activation of nociceptors. [5]

Orofacial thermosensitivity [6,7]

The orofacial region is covered by epithelial tissue that varies notably in thickness, degree of keratinization, and level of hydration. These biophysical factors affect the thermal conductivities of the epithelia and the ease with which thermal energy is transferred to the molecular receptor channels on the underlying terminal endings of the thermoreceptors.

The density of innervations by the nerve endings also varies considerably in different orofacial structures. As a result of variations in the thermal conductivities of the tissues, their baseline resting temperatures and their innervations, the sensitivity to thermal challenges differs substantially in different sites in the mouth and on the face. Thermal sensitivity of the lower lip studies carried out to detect the thermal sensitivity of the tip and dorsum of the tongue revealed that increments in temperature on the tip felt twice as warm as the same increments on the dorsum of the tongue. Dorsum of the tongue was as sensitive as the tip to cold. Whole mouth thermal sensitivity testing discovered that mouth was more sensitive to differences in increments in temperature than to differences in decrements in temperature.

Burning mouth syndrome

It is characterised by a painful, burning sensation of the oral mucosa in the absence of any implicating pathology or relevant laboratory findings. Most commonly affected sites are the anterior tongue, hard palate and the lower lip. The pain is constant throughout the waking hours or slowly redevelops during the course of each day. The condition is most frequently found in postmenopausal women with an increased prevalence of personality disorders. Many patients with burning mouth syndrome also have distortions and persistence of taste sensations. It has been recently hypothesized that these patients have defective central nervous system regulation of pathways that process nociceptive and gustatory information from the mouth.

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Heart Rate Variability During Examination Stress in Medical Students

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ABSTRACT

Stress has been investigated as a risk factor for cardiovascular disease and for reduced human performances. This study investigates the variations of Heart Rate Variability (HRV) due to a real-life situation of examination stress which is a known stressor to examination going students. Sixteen first year MBBS students were selected randomly to participate in the study to know heart rate variability (HRV) during the examination period. After noting all the anthropometric parameters, three recordings were performed for each student: the first assessment was done during college cultural week and it served as control, the second reading was taken on the day of their second terminal viva voce examination and the final reading was taken on the viva voce examination during professional examination. Nonlinear analysis of HRV was performed using mean RR interval, Heart rate, RMSSD, NN50, pNN50, VLF, LF, HF and LF/HF ratio. Almost all HRV features measuring heart rate complexity were decreased in the stress period results indicating a decline in HRV during stress. It is also established that non parametric HRV analysis using short term ECG recording could be effective in detecting real-life stressful conditions.

Keywords*: Heart Rate Variability, LF/HF Ratio, Examination stress, RMSSD*

INTRODUCTION

Stress has been investigated as a risk factor for cardiovascular disease[1] and for reduced human performances which in some situation may results in negative consequences. Stress is reported to influence the balance between two limbs of Autonomous Nervous System [2]. Heart rate variability is a non-invasive measure reflecting the variation over time of the period between consecutive heartbeats (RR intervals) and has been proved to be a reliable marker of ANS activity[3]. For this reason, several studies investigated cardiovascular reaction induced by stress using Heart Rate Variability (HRV) focussing on acute, laboratory stressors: cognitive (e.g., mental arithmetic) [4-6], psychomotor (e.g., mirror tracing) challenges and physical stressors[7-9]. Moreover, as standard laboratory stressors do not always engage subject's affective response, real life stressors e.g. precompetitive anxiety[10] or social interaction stressors [11] are often applied to provide a more appropriate social context in which negative emotions [12] might be elicited. Some studies investigated HRV variations in the case of university exams as it is a real-life stressor[13-16]. These studies included only linear HRV measurement only due to stress of university examinations. Therefore HRV analysis is one of the objective parameter available today for evaluation of stress. The literature shows conflicting reports about the autonomic variability during mental stress. Therefore the present study is aimed to observe the autonomic variability by measuring their heart rate variability during examination stress in medical students.

MATERIAL AND METHOD

The data was acquired from 16 first years male MBBS Students of LLRM Medical College, Meerut, who volunteered to take part in the study. This study was performed in compliance with guidelines of College Ethical Committee. Each student was asked for detailed personal and family history including intake of any medication which might influence the autonomic activity. All the students were explained about the procedure and written consent was also taken from them. Each student was subjected for HRV analysis on three occasions: the first record was performed col-

lege cultural week when the students were in relaxed atmosphere with no stress and it served as control data. The second observation was recorded during second terminal viva voce examination about 30 minutes prior to their viva. The final HRV analysis was done during viva voce examination in first professional examination, again 30 minutes prior to their viva. All the recordings were taken under similar conditions such as time and body position after an adaptation time of at least 15 minutes. As examination is a known real life stressor for the students, thus last two observations were taken as record of stressful period.

After noting the anthropometric parameters a short-term 5-minute, three lead ECG recording using Biomed polygraph was taken and HRV analysis was done according to International Guidelines[3]. The RR interval time series were extracted from ECG records using Biomed HRV analysis software. Two type parameters were analysed. Time domain parameters like mean RR interval, Heart rate, RMSSD, NN50, pNN50 and frequency domain parameters VLF, LF, HF, LF/HF ratio.

RMSSD (ms): The Square root of the mean of the sum of the squares of differences between adjacent NN intervals. It gives information regarding HRV in short time interval.

NN50 (count): Number of pairs of adjacent NN intervals differing by more than 50 ms in the entire recording.

pNN50 (%): NN50 count divided by the total number of all NN intervals.

VLF (ms^2): Power in very low frequency range (< 0.04 Hz)

LF (ms^2): Power in low frequency range (< 0.04-0.15 Hz)

HF (ms^2): Power in high frequency range (< 0.15-0.4 Hz)

LF/HF Ratio LF [ms2]/HF [ms2]

The fraction of total RR intervals labelled as normal-to-normal (NN) intervals was computed as NN/RR ratio. This ratio has been used as a measure of data reliability [17- 19] with the purpose to exclude records with a ratio less than 90% of threshold. None of the records in this study was excluded as NN/RR ratio was greater than 90% on all occasions.

Statistical Analysis

HRV features were depicted as Mean ± SD during rest and stressful conditions. Nonlinear properties of HRV were analyzed by the following methods: Time domain parameters— mean RR, mean HR, RMSSD, NN50, pNN50 and frequency domain parameters— VLF, LF, HF and LF/HF were compared using paired t-test.

RESULTS

Sixteen males were enrolled in the study with mean age of 22.1±2.53 years, height 160.9±0.08 cm, weight 58.94±9.5 kg and BMI index 22.7±2.94. Both the HRV parameters—time and frequency domain, showed decrease value during terminal and professional examinations as compared to control reading though the decrease is much more during terminal than professional examination. Statistically significant decrease is observed in mean RR interval, Heart Rate, VLF and LF only when controls are compared with terminal examination but when controls and professional examination were compared significant decrease was found in mean RR interval and Heart rate only. LF/HF ratio was increased in terminal and professional examination but this increase was not statistically significant.

DISCUSSION

In the present work, short-term HRV measures computed during supine rest in the presence and absence of mental stress were compared. The anxiety associated with examinations is a source of mental stress that stimulates the sympathetic system of students and produces a state of cardiac sympatho-excitation. This is reflected in a significant decrease in the mean RR interval. The lowered mean RR interval denotes a higher resting heart rate during examinations. The mean RR interval is an indicator of the ratio of the cardiac sympathetic to parasympathetic tones (sympatho-vagal balance). The results suggest a tilt of the overall cardiac sympatho-vagal balance of the students towards the sympathetic side during examinations. In the supine position at rest during college cultural week, when the students are mentally relaxed, the sympathetic activity is expected to be least, and the ratio of cardiac sympatho-vagal tone the lowest. The significant decrease ($p<0.001$) mean RR interval and increase in mean heart rate ($p<0.008$) during the terminal examinations reflects a decreased total HRV in the presence of mental stress. The mean value of the HF power is of lower magnitude during examinations, but the decrease is not statistically significant except in the case of VLF and LF power. However the combined decrease in spectral power of all 3 bands contributes to the significant decrease in the total power during examinations. It is noteworthy that the time of underlying mental stress is associated with a significantly lower total HRV. Reduced HRV indicates di-

minished responsiveness of the cardiac autonomic system to normal physiological stimuli. Changes in the pNN50 and RMSSD are both reported in the literature to reflect HF changes in heart rate and therefore parasympathetic modulation (9,10). This study also shows that when comparison is done between control and professional examination various HRV parameters showed a decline but significant fall was observed only in mean RR interval and heart rate. Significant decrease in VLF power and LF power during terminal but not during professional examination is somewhat unexpected, but it may be possible that students feel maximum stress during first major examination and thereafter they get used to this kind of stress and stimulation of sympathetic system is not much in subsequent examinations. The frequency and time domain parameters were showing no change between terminal and professional examination. Though the stress level is expected to be more, the HRV was unchanged. It might be due to having full stress in these subjects at the time of terminal examination and later some adaptative mechanisms might have developed to counteract the effect of stress. Such mechanisms cannot be explained. There is need for further research including large number of students of both sexes from different professional batches to eliminate the shortcoming in the present study.

Table1.

Variables	Control		Term Examination		Professional Examination			
	Mean	SD	Mean	SD	Mean	SD	P value	
RR interval (s)	0.781	0.133	0.718	0.12	0.698	0.11	.0148*	£
							0.003**	¥
							0.316	•
Mean HR (s)	78.2	11.3	85.51	11.65	88.08	12.79	0.008*	£
							0.003**	¥
							0.301	•
RMSSD (ms)	22.57	8.82	21.03	8.52	21.26	12.35	0.59	£
							0.63	¥
							0.94	•
NN50 (count)	7.56	4.87	7.63	5.24	7.63	7.2	0.96	£
							0.97	¥
							1	•
pNN50 (%)	5.02	3.14	5.01	3.45	5.06	4.75	0.10	£
							0.97	¥
							0.97	•

£ = Control vs terminal ¥ = Control vs professional

•= term vs professional

Mean and SD along with p value of various time domain parameters during control, terminal & professional examination.

Table2

Variables	Without Stress		Term Examination		Professional Examination			
	Mean	SD	Mean	SD	Mean	SD	P value	
VLF (Power %)	36.97	16.11	24.02	12.3	29.33	17.93	0.03*	£
							0.24	¥
							0.31	•
LF (Power %)	46.05	13.18	54.61	12.49	53.3	15.51	0.03*	£
							0.76	¥
							0.77	•
HF (Power %)	16.96	11.93	21.35	9.14	17.37	5.88	0.20	£
							0.90	¥
							0.19	•
LF/HF (Power %)	2.75	1.17	3.22	1.94	3.60	1.19	0.36	£
							0.07	¥
							0.49	•

£ = Control vs terminal ¥ = Control vs professional

•= term vs professional

Mean and SD along with p value of various frequency domain parameters in three different conditions.

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