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Editor

Dr. R.K. Sharma
Institute of Medico-legal Publications
501, Manisha Building, 75-76, Nehru Place,
New Delhi-110019

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Knowlegde, Attitude and Practices Regarding Family Planning Practices and Methods among Women of Urban Slums of Pondicherry City Chennai

Arjit Kumar[1], Pankaj Bhardwaj[2]

[1]Assssociate Professor, Department of Community Medicine, Sri Lakshmi Narayan Institute of Medical Sciences, Pondicherry, [2]Professor, Department of Community Medicine, All India Institute of Medical Sciences, Jodhpur

ABSTRACT

Background: Utilization of family planning methods, their side effects and the factors influencing their uses. Aims: To study the family planning practices methods among the married women of reproductive age (15-45 yrs). Study Design: Community based study. Study Subjects: The Women of reproductive age groups (15-45yrs) adopting family planning methods & those residing in urban slums of Puducherry. Sample Size: 540, Study Period: July 2009 to July 2011. Sampling Technique: Thirty cluster sampling. Result: The acceptance of family planning methods both temporary and permanent methods increased with level of literacy of women. About 53.40% adopted I.U.C.D, 38.83% O.C. pills & only 7.77% of their partners used condoms, 66.6% have undergone laparoscopic & 33.4% mini-lap sterilization. Vasectomy was not done for even a single partner. More number of illiterate and primary educated accepted permanent method after 3 or more children than higher educated who accepted it after 1 or 2 children. Among acceptors of permanent methods, total 70.27% were experiencing side effects and among temporary method users, it accounted 23.30%. Conclusions: Acceptance in family planning is associated with increasing age, nuclear family & level of literacy. IUCD is the most accepted one among all the temporary methods. Vasectomy and newer contraceptives were not at all used.

Keywords: *Contaceptives, IUCD, Contraception, need ,urban-slums, practices.*

INTRODUCTION

India is home for three in-famous problems and those pre-fix with letter "P". They are "population explosion", poverty and pollution. Population explosion is directly perpetuating the other two problems. India is among the few countries in the world to accept family planning as a national programme. Operationally Family Planning practices are women-centred and based on two methods/practices, they are permanent and temporary.[1]

In NRHM, the family planning programme is implemented on cafeteria approach and is client-centred, demand-driven and need-based. The need-based or client-centred approach starts from the bottom and the need is calculated from the population in sub-centre by the health workers.[2] So this is otherwise called bottom-up approach. In this present study an attempt has been made to assess the magnitude and distribution of the family planning practices/methods adopted or practiced.[3]

MATERIALS & METHOD

The Antenatal coverage amongst the recently delivered women was found to be 60%. Taking P as 60 as "Concurrent assessment of Health and Family Welfare Programmes and technical assistance to district of Uttar Pradesh" by the Department of Medical Health And Family Welfare, Uttar Pradesh reported the same prevalence and Q as 40 and absolute error (L) 6%, sample size was calculated using the formula.[4] Since respondents are chosen by cluster sampling design effect due to complex sample design comes into picture. Taking into account design effect of 2, the sample size was 532 # 540. The maternal care and other components of the Reproductive and Child Health programme were assessed using 30 cluster sampling technique. Thus for the present study, Probability Proportionate to Size (PPS) method was adopted as the sampling strategy. The study period was from July 2009 to July 2011. The desired number of women to be interviewed in each cluster was 18. In each cluster the first house was

chosen at random and from there on, the next nearest house was visited until the desired numbers of mothers were interviewed. If a household had more than one beneficiary, all were included in the survey. The basic questionnaire of "Concurrent assessment of Health and Family Welfare Programmes and technical assistance to district of Uttar Pradesh" by the Department of Medical Health And Family Welfare, Uttar Pradesh was adopted and reframed as per the requirement of the study.[5]

RESULTS

Socio demographic profile of the contraceptive users

More than half, 334 (61.9%) of the women were Hindu and 200 (37%) were Muslims. Two third of the women, 367 (68%) belonged to SC/ST caste and one third of the women 122 (22.6%) belonged to OBC. A small percentage i.e. only 51 (9.4%) belonged to general caste. About one third, 202 (37.4%) belonged to age group 31-35 years and 158 (29.3%) belonged to age group 20-25 years. About 89 (16.5%) belonged to 26-30 years of age. About half, 282 (52.2%) were illiterate and 153 (28.3%) were educated up to primary level.

Knowledge about contraception

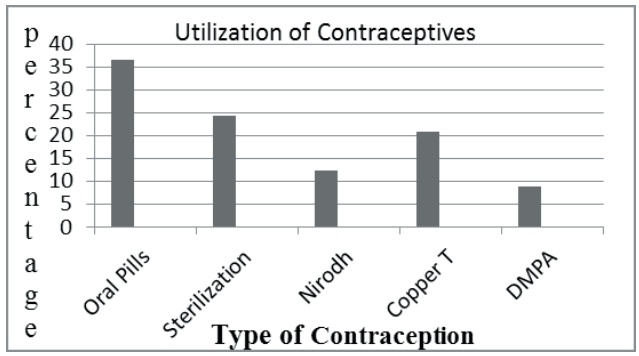
More than half (55.6%) of the women in the study were married before 18 years of age and 44.4% were married after 18 years of age. The distribution of the women according to knowledge of contraception is shown in table.

Table-1: Distribution of women according to Knowledge about contraceptive methods.

Knowledge	No.	%
Knowledge about any contraceptive method (n=540)		
Yes	340	63.0
No	200	37.0
Knowledge about type of contraceptive method (n=340)		
Oral Contraceptive Pills	331	95.7
Nirodh	116	34.1
Copper T	159	46.8
Male Sterilization	182	53.5
Female Sterilization	271	79.7
Injection	4	1.1

Use of contraception method

Figure depicts the distribution of women according to the type of contraceptive method. More than half 226 (66.5%) of the women were currently using contraception and 114 (33.5%) were not using any contraceptive technique even after having knowledge about them. More than half 54% of the women told that their husband were currently using oral pills as a method of contraception 12.2% of the women husband were using Nirodh whereas 24.3% of the women were sterilized and 20.8% were using Copper-T. Very few 8.8% women were using other method of contraception i.e. (DMPA/injections).



Unmet need of Contraception:

Table 2 depicts the distribution of unmet need of contraception of the women. More than one third 52 (45.6%) of the women were in unmet need of contraception. The unmet need was for pills as temporary method and rest of them were having the choice of other conventional contraceptives. Unmet need of family planning turns out to be 57%.

Table-2: Distribution of women according to their unmet need of contraception

Unmet need	**No.**	**%**
Need to use any contraceptive method in future (n=14)		
Yes	52	45.6
No	62	54.4
Preferred method of contraception (n=52)		
Temporary methods		
Oral Contraceptive Pill	18	34.6
Nirodh	8	15.4
Copper T	7	13.5
Injection	3	5.8
Permanent methods		
Female Sterilization	9	17.3
Male Sterilization	1	9.1

Source of Contraceptives :

The study shows the distribution of the source of availing contraceptives by the women. More than one third, 91 (40.3%) availed contraceptives from private health facility while, 55 (24.3%) availed if from government health facility and local shops, remaining 25 (11.1%) were not having any knowledge regarding source of contraceptives.

Reason for non use of contraceptives

Table 3 depicts the reasons for not using any contraceptive technique. About one third 35 (30.7%) opined that the use of contraception was against religion and 20 (17.5%) did not have much knowledge about the safe use of contraceptives. Similar number gave the reason as reluctance of the husband, other reasons were financial constraints, wish to extend family, some of them have no need for contraception and others were not able to give any cause.

Table-3: Distribution of women according to reasons for not using any method of contraception.

Reasons	No. (n=114)	%
Against religious belief	35	30.7
Less Knowledge	20	17.5
Opposition & reluctance of husband	20	17.5
Very costly	12	10.5
Wish to extend family	12	10.5
No need	12	10.5
No response	3	2.7

DISCUSSION

Similar findings were represented in the study done by, Agrawal Shraddha et al (2006). Dinesh and Kalia et al (2008) found the highest awareness ranging from 65-68% regarding contraceptive methods which is corresponding to our observation. The NFHS-3 data shows the findings differently. It shows that 38.4% had knowledge about any method of contraceptives.[6]

In the present study, 66.5% of the women were ever users of contraception where as 33.5% were the never users of contraception. Similar finding were shown by, Bhasin et al (2006), NFHS-3 India, Renjhen (2008). These studies show the usage of contraception between 50%-75%.[7] The findings of these studies match the findings of the present study. Bhasin et al in their study showed that 75% of the subjects were users of any contraceptive method. In the present study 54% of the women told that their husbands were currently using condoms for family planning and 36.6% of the women were using pills. It also shows that 24.3% of the women were sterilized and 20.8% were using copper-T. Very few were using other method of family planning.[8] Similar findings were shown by Bhasin et al (2005), Agrawal Shraddha et al (2006) Condom was the most common method which constituted about 33.4% of contraception followed by oral contraceptive pills, tubectomy and intrauterine device 15.7%. The percentage use of female sterilization was 37.8% followed by 9.8 for condoms, 3.8% for IUD and 3.2% for contraceptive pills. Non acceptors were more in Muslim community.[9] Khokkar and Gulati (2000), Banerjee et al in (2004) found in their studies that low usage of family planning methods is associated with low literacy rate and Muslim community and the present study shows the similar results.[10]

CONCLUSION

NGO involvement with active community participation has to be strengthened for effective implementation of RCH services. Health volunteers and workers under NHUM should be piloted in these urban slums to increase the utilization of maternal health services.[11]

Regular concurrent assessment of the client based perception of the programme to be done so as to improve the quality services provided to increase utilization of the programme.

Ethical Clearance- Taken from Sri Lakshmi Narayan Institute of Medical Sciences Ethical committee.

Source of Funding- Self

Conflict of Interest: Nil

REFERENCES

1. K. Park. Park's Text book of Preventive and Social Medicine, 18th edition, Bhanot publishers 2009.
2. RCH Training module for Medical Officers. Family Welfare Statistics (2006), Ministry Health & Family Welfare, Govt. of India, Reference table

C-21, page C-65, section-C.

3. S M Joshi, S B Patil, Knowledge & practices of family planning in an urban slum of Mumbai, Indian Journal, Preventive Social Medicine, volume 38, No. 1 & 2, Jan to June 2007.
4. Singh JV, Mishra P. Baseline Facts Uttar Pradesh RCH and Some Other Health Programmes, Feb 2007.pg 7-14.
5. Sen A K, Das K K, Mukerjee, Kriplani G. Study on measurement of the effects of factors influencing acceptance of family planning. The Indian Journal of Family Welfare, volume XXXVI, No. 2 June 1990.
6. Agrawal S, Sangar K. Need for Dedicated Focus on Urban Health within National Rural Health Mission. Indian Journal of Public Health, July-September 2005; Vol. XXXXIX No (3); 22-27.
7. National Family Health Survey (NFHS-3), Uttar Pradesh. International Institute of Population Sciences, Bombay 2006.
8. A.K. Biswas, A Roy, R. Biswas. Adoption of small family norms in a rural community of West Bengal. The Indian Journal of Community Medicine, volume XIX, page 68, 2-4 April-Dec 1994.
9. Khokhar A, Gulati N. A Study of Never Users of Contraception from an Urban Slum of Delhi: 2000 Vol: 25, 1, 26-26.
10. Banerjee et al : A comparative study of permanent contraceptives methods between rural & urban areas of Krishna District in July 2003, page 53
11. S K Bhasin, M Pant, M Metha, S Kumar, Prevalence of Usage of Different Contraceptive Methods in East Delhi. A Cross Sectional Study, IJCM, 30, 2, April to June 2005.

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The Role of Biofeedback Therapy as a Tool for Stress Reduction in Patients Suffering from Chronic Stress

Shweta Kanchan[1], Basu Dev Singh[2], Gautam Swaroop[3]

[1]Lecturer, Department of Physiology Govt. Medical College Ambedkar Nagar, [2]HOD Department of Physiology MLB Medical College Jhansi, [3] Consultant Cardiologist Vivekanand Polyclinic Lucknow

ABSTRACT

Modern day life is replete with stress, development and increased dependency on technology comes with a baggage of stress. Stress is the major factor responsible for lifestyle related disease. The below study was conducted to evaluate the extent to which stress management could be carried out in subjects of different age groups using biofeedback as a technique for stress management. Biofeedback therapy is a tool in which the subjects are trained how to relax using program generated audiovisual effects which monitor the parasympathetic response as the patient gets more and more relaxed. Biofeedback is a perfect example of mind body interface where the progress made by patient could be accessed by patient himself.

Keywords *: Stress,Biofeedback, Relaxation Therapy (BRT), EEG*

INTRODUCTION

STRESS AND MIND-BODY INTERPLAY

The commonsense notion that 'too much stress makes you sick' might hold more than a grain of truth in modern day lifestyle esp in workers in low key jobs , in which they have high stress and little autonomy, people today have more than twice the risk of developing metabolic syndrome —a precursor of heart disease and diabetes—compared with employees in higher-level jobs (Chandola et al, 2006), By measuring heart rate, and cortisol and adrenaline levels, researchers also found that stress affects the autonomic nervous system and neuroendocrine function (Chandola et al, 2006; Bjorntorp, 1991; Brunner et al, 2002). This aggregates (Brydon et al, 2006) the understanding that emotions affect physical health dates as far back as the second-century In the past 30 years, however, research into the link between health and emotions, behavior, social and economic status and personality has moved both research and treatment from the fringe of biomedical science into the mainstream. According to the mind–body paradigm, there is no real division between mind and body Chronic activation of stress responses by the hypothalamic–pituitary–adrenal axis and the sympathetic–adrenal–medullary axis leads to a permanent overproduction of glucocorticoid hormones and catecholamines (adrenaline and noradrenaline)[1]. Immune modulation by pituitary and adrenal hormones occurs through two pathways: directly by binding hormones to receptors, or indirectly by inducing the deregulation of cytokines, such as tumour necrosis factor (TNF) and interferon-γ (Glaser &Kiecolt-Glaser, 2005). This hormonal activation as well as production of several cytokines in turn lead to activation of the sympathetic nervous activity which produces the different manifestations of stress[2].

BIOFEEDBACK

Biofeedback is a self-regulation technique through which patients learns to voluntarily control what were once thought to be involuntary body processes. This intervention requires equipment to convert physiological signals into meaningful visual and auditory cues, as well as a trained biofeedback practitioner to guide the therapy. Using a screen such as a computer monitor, patients get feedback that helps them develop control

Corresponding author:
Dr. Basu Dev Singh
H.O.D Physiology Department
MLB Medical College Jhansi
Mob. +91 9450615845
Email: bdssagar@gmail.com

over their physiology.

Some of the other commonly monitored variables are used when the goal of biofeedback is to reduce sympathetic arousal. These include heart rate, respiration rate, skin surface temperature (at the fingertips), skin conductance and heart rate variability[3]. This physiological information is normally not viewed as being under conscious control, but biofeedback provides real-time data, helping to bring such physiological processes under the control of the patient. Common disorders treated in this way include hypertension, anxiety and medical conditions exacerbated by stress. Biofeedback also helps to make patients aware of the thoughts, feelings and behaviours related to their physiology. Over time, they can learn to self-regulate without feedback screens in front of them.

MATERIAL AND METHOD

The present study was conducted in the dept of psychiatry & physiology M.L.B Medical College ,Jhansi.The participants in the study were patients presenting in the Psychiatric O.P.D who were suffering from long term stress and were willing to participate in the study. At their arrival at the center, the authors, having informed the participants about the aim of the study, asked for their voluntary and anonymous participation, emphasizing that they could withdraw their consent at any time. Both oral and written instructions were given to ensure that the items were understood, and participants were reassured about the confidentiality of their responses.Concent was also obtained from hospital ethical committee

AIM

The aim of this study was to determine whether the use of a biofeedback-based stress management tool (consisting of rhythmic breathing, actively self-generated positive emotions and a portable biofeedback device) helps to reduce stress.

OBJECTIVES

- To study the effectivity of biofeedback in management of stress
- to study the effectivity of b.r.t in different age groups, sexes and education levels

INCLUSION CRITERIA:

- Subjects suffering from long term stress .
- Willing to participate in the study.

EXCLUSION CRITERIA:

- Subjects suffering from any comorbid psychiatric illness like depression,bpd,schizophreniaetc were not included.

PROCEDURE: Both the visual feedback received through a video game-like display portraying a animation and audio feedback with the inclusion of music with changes in frequency, volume, and rhythm enabled the individual to respond by moving toward a better, learned, and voluntary-controlled function as they consciously directed their brainwaves. For feedback control ,baseline alpha wave activity was set as the patient got more relaxed alpha activity increased and a bargraph turned green When subject to relax without falling asleep. In the training session they were first given progressive muscle relaxation exercises along with breath training and instructions to improve positive feedback. Subjects were also required to practice the relevant relaxation and breathing exercises that provided positive feedback daily, preferably at a fixed time of day. The perceived stress scale was administered at initial. Sujects were assigned in four groups according to their age group. Participants received instrument feedback training every week for 3 months.when the alpha activity was above threshold, the animation started and a song played,the animation became more vibrant as the patient relaxed. while the counter accumulated points.

Perceived Stress Scale

The questions in this scale ask you about your feelings and thoughts **during the last month**. In each case, you will be asked to indicate by circling how often you felt or thought a certain way[4-7].

Name_____

Date _____Age_____

Gender (Circle): **M** **F**

Other _____

0 = Never 1 = Almost Never 2 = Sometimes 3 = Fairly Often 4 = Very Often

1. In the last month, how often have you been upset because of something that happened unexpectedly?..... ..... **0 1 2 3 4**

2. In the last month, how often have you felt that you were unable to control the important things in your life? **0 1 2 3 4**

3. In the last month, how often have you felt nervous and "stressed"? **0 1 2 3 4**

4. In the last month, how often have you felt confident about your abilityb to handle your personal problems? **0 1 2 3 4**

5. In the last month, how often have you felt that things were going your way?..... ..... **0 1 2 3 4**

6. In the last month, how often have you found that you could not cope with all the things that you had to do? **0 1 2 3 4**

7. In the last month, how often have you been able to control irritations in your life?..... ..... **0 1 2 3 4**

8. In the last month, how often have you felt that you were on top of things?.. **0 1 2 3 4**

9. In the last month, how often have you been angered because of things that were outside of your control?..... **0 1 2 3 4**

10. In the last month, how often have you felt difficulties were piling up so high that you could not overcome them? **0 1 2 3 4**

OBSERVATION

The present study entitled "role of biofeedback in stress management",was conducted in the Dept of psychiatry M.L.B Medical College Jhansi.All 100 subjects were accessed for stress level using perceived Stress scale and then biofeedback relaxation therapy was administered to them.

Mean time of completion for sessions was 20 min, with times ranging from 15 to 30 minutes. Forty-three percent of the sessions were completed within20 minutes, with 55% exceeding 20 minutes. Only 2 sessions were completed in less than 15 minutes.

Table No. 1 Reduction of stress in different age groups.

AGE	No. of Subjects	Overall Score SD 1st Session	Last Session	P Value
<30	25	28.2-7.6	19.2-7.6	.0001
31-40	27	30.4-7.7	20.2-7.6	.0001
41-50	26	33.4-8.5	24.2-8.1	.0001
>51	22	33.8-6.5	26.4-6.3	.0001

There was a gradual reduction in stress in all age groups which was significiant. Patient in the age group >50 years had the maximum stress level at the beginning of study ,but following b.r.t maximum stress reduction was found in younger age group 31-40 followed by >40 yr group ,which could be related to effect of aging on cognition and therby b.r.t was most effectively used by younger age group .

Table No. 2 Gender wise reduction of stress.

Gender	No. of Subjects	Overall Score SD 1st Session	Last Session	P Value
Women	56	32.4-7.7	25.2-7.2	.0001
Men	44	30.3-8.6	25.4-7.2	.001

A lowering in stress is seen in both sexes however females who had greater perceived stress at the beginning of study also showed a slightly greater reduction compared to there male counterparts.

Table No. 3 Lowering of stress in educated and uneducated subjects.

Education Level	No. of Subjects	Overall Score SD Ist Session	Last Session	P Value
10th and above	70	32.6-7.2	26.8-7.1	<.001
Uneducated	30	31-8.-7.4	27.6-6.8	<.001

Biofeedback relaxation therapy decreased stress to an equal extend in both educated and uneducated patients and no significiant change in level of stress reduction was found in different education level

DISCUSSION

The ability to generate alpha brainwaves has been associated with the self-regulation of stress (Wacker 1996). Previous studies specifically linked stress and relaxation with EEG recordings (Isotani et al 2001) and found that an increase in alpha frequencies in the frontal scalp area is an indication of positive relaxation training effects of audiovisual stimulation (Teplan et al 2003) and is neuroprotective (Sterman et al 1970). Our study suggests that EEG biofeedback can effectively lower stress, Inconsistencies in the different studies concerning stress reduction could be attributed to the way stress was assessed in individual patients and the actual length of treatment with longer periods of treatment reducing stress more effectively.

Detailed evaluation of each patient undergoing treatment would be a better evaluation of the characteristics and efficiency of the treatment. The Biograph program used for our study only required an electrode to be placed on only one active site in the scalp (C3) for EEG recordings. Most of the other similar studies recorded EEG from more than one active site according to the International 10–20 system. Furthermore, any increase in arousal affects the EEG frequencies in the entire region of the scalp and not just an isolated area (Barry et al 2004). Changes in arousal levels are linked with global activity while specific regional activity is linked with processing[3,8]. Our study of 5 sessions of operant training of EEG activity was sufficient to produce significant changes in stress scores.. A more detailed assessment would be to see the long-term effect of therapy, and evaluate whether a 3-month program could still have positive influence on stress 6months or one year after completion of treatment.

Although training involving EEG activation must be within a consistent therapy situation (Rosenfeld et al 1996), it is difficult to distinguish the effects of EEG training from confounding conditions like drowsiness, medications, caffeinated drinks, changes in emotional state/arousal, artifact from eye movements, time of day, and state of alertness. Therefore, these factors should be taken into consideration to eliminate the possibility of their influence on the positive effects resulting from intervention.

The open and uncontrolled nature of our study militates against firm conclusions. However, the significant reduction in stress scores could lead to a big improvement in the morbidity and mortality rate of these patients as a further reduction was seen even in those scoring normal level scores during initial recruitment.The study suggested a higher level of concentration and alertness for participants as they underwent their relaxation and biofeedback therapy.

EEG biofeedback provides accumulated benefits for some participants. The learning gained by the subjects during their training can be applied in their everyday life, as participants had their eyes open and learnt to stay relaxed while remaining alert and reducing their tendency to fall asleep. Biofeedback may also indirectly assist the participant to be better focused, more in control, and to feel clinically better.

CONCLUSION

The presentstudy titled “Role of Biofeedback Relaxation therapy in stress management”was conducted in the Dept of Psychiatry M.L.B MedicalCollege,Jhansi.

Subjects were taken from the psychiatryO.P.D ,50 consenting subjects were included in the study .The following conclusions were drawn from the study.

1. Following b.r.t maximum stress reduction was found in younger age group 31-40 followed by >40

yr group ,which could be related to effect of aging on cognition and therby b.r.t was most effectively used by younger age group .

2. A lowering in stress is seen in both sexes however females who had greater perceived stress at the beginning of study also showed a slightly greater reduction compared to there male counterparts.

3. Biofeedback relaxation therapy decreased stress to an equal extend in both educated and uneducated patients and no significiant change in level of stress reduction was found in different education level

Ethical Clearance: Present Sutdy was approved by institutional and review committee, MLB Medical College Jhansi, U.P India

Conflict of Interest- Nil

Source of Funding - Self

REFERENCES

1. Cohen S, Kamarck T, Mermelstein R. A Global Measure of Perceived Stress. J Health Soc Behav 1983.
2. Lazarus RA. Stress, appraisal, and coping. New York: Springer Publishing Company; 1984.
3. Cohen S, Spacapan S, Oskamp S. Perceived stress in a probability sample of the United States. The social psychology of health. Thousand Oaks, CA US: Sage Publications Inc.; 1988.
4. Remor E. Psychometric properties of a European Spanish version of the perceived stress scale (PSS). Span J Psychol 2006.
5. Ramirez MTG, Hernandez RL. Factor structure of the Perceived Stress Scale (PSS) in a sample from Mexico. Span J Psy.
6. Mimura C, Griffiths P. A Japanese version of the Perceived Stress Scale: translation and preliminary test. Int J Nurs Stud 2004;41:379–85.
7. Leung D, Lam T, S C. Three versions of Perceived Stress Scale: validation in a sample of Chinese cardiac patients who smoke. BMC Public Health 2010;10: 513.
8. Wongpakaran N, Wongpakaran T. The Thai version off the PSS–10: An investigation of its psychometrics properties. Biopsychosoc Med 2010;12:4–6. 9. Orucu M, Demir A. Psychometric evaluation of perceived stress scale for Turkish University student. Stress Health 2008 .

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Impact of BMI on Visual Reaction Time in Individuals with BMI in Normal Range

Christina Sudheer[1], Shivakumar Jagadeesan[2], Kararshah F Kammar[3]

[1]Associate Professor, Department of Physiology, Koppal Institute of Medical Sciences, Koppal, [2]Associate Professor, [3]Professor and Head, Department of Physiology, Karnataka Institute of Medical Sciences, Hubli

ABSTRACT

Background – Reaction time provides an opportunity to assess the processing capabilities of the nervous system. It is affected by several factors, some of which are related to the stimuli, while others to various aspects about the subject itself.

Methodology – This study was done on healthy females in the age group of 20-25 years with normal BMI and in the proliferative phase of the menstrual cycle. VRT was done using the response analyser and the results of VRT were correlated with various anthropometric parameters using Pearson's correlation analysis.

Results – Visual reaction time showed a positive correlation with various anthropometric parameters (height, weight, BSA and BMI), but was not statistically significant.

Conclusion – Visual reaction time is prolonged to some extent with increasing BMI, even though the BMI is within the normal range.

Keywords – *Visual reaction time, Anthropometric variables, BMI, Females.*

INTRODUCTION

Reaction time is the elapsed time between the onset of a stimulus and an individual's response.[1] It is affected by multiple factors related to the nature of the stimulus as well as to various aspects of the subject itself. Some of the subject factors that affect the reaction time to a stimulus includes age, physical condition of the subject, practice, attitude and attention, to name a few.[2] Anthropometry is the measurement of size and proportions of the body. These measurements include individual measurements like height and weight, as well as various ratios and indices like BSA (body surface area) and BMI (body mass index).[3]

Obesity (BMI > 25.0 kg/m^2) has been shown to be associated with poorer cognitive performance resulting in longer reaction times.[4] The aim of the present study was to elucidate whether reaction time to a visual stimulus is affected by BMI within the normal range (i.e. 18.5-24.9 kg/m^2)

Corresponding author:
Dr Christina Sudheer
Associate Professor, Department of Physiology, Koppal Institute of Medical Sciences
Email id – christina.sudheer@gmail.com

MATERIALS AND METHOD

The subjects for this study were selected from normal healthy unmarried females in the age group of 20-25 years. The study was duly approved by the institutional ethical clearance committee. 50 subjects who satisfied the inclusion and exclusion criteria were selected, and informed consent was obtained from them. The exclusion criteria applied were as follows: Those taking any medication or hormonal preparations (that could alter the menstrual hormonal milieu), those having any physical illness or endocrinological disorders, smokers, alcoholics, athletes/ those involved in excessive physical activity. The subjects were instructed to visit the department during the proliferative phase i.e. 9-12th day of their menstrual cycle. Daily basal body temperature recordings formed the basis for this judgment. Height and weight were recorded

using standard methodologies. The BMI (body mass index) of each subject was calculated by dividing her body weight in kilograms by the square of her height in metres (Quetelet's index), whereas BSA (body surface area) was calculated using a standard nomograph. Response times measurements (VRT) were carried out after the subjects were thoroughly acquainted with working of "response analyzer" (YSRT – 0101 – Pune). It was ensured that no subject consumed any caffeinated products 6 h before the testing. The time displayed in milliseconds was noted and taken down as the response time for that stimulus. 10 readings were taken, the lowest readings were used for computation. The procedure room was a quiet and secluded room, whose ambient temperature was about 27°C. All tests were done between 10.00 am and 1.00 pm. The results of VRT were expressed as mean ± standard deviation and its relationship with anthropometric data were analysed using Pearson's correlation coefficient. P value < 0.05 was considered as significant. Statistical analysis was done using Microsoft Excel.

RESULTS

The average values and standard deviations of VRT and various anthropometric parameters like height, weight, BSA (body surface area) and BMI (body mass index) during the proliferative phase of menstrual cycle of the study subjects are provided in Table 1. Whereas the results of the Pearson's correlational analysis of VRT with various anthropometric parameters like height, weight, BSA (body surface area) and BMI (body mass index are represented in Table 2. VRT showed a general positive correlation with all the assessed anthropometric variables, but were statistically not significant.

Table 1: Mean values and standard deviation of Anthropometric parameters and Visual reaction time (N=50)

	Height(cms)	Weight (kgs)	BSA	BMI	VRT (msec)
Mean ± SD	161.02 ± 6.41	57.02 ± 4.99	1.60 ± 0.10	21.95 ± 0.79	185.80 ± 10.70

Table 2: Correlational analysis of Visual reaction time with various Anthropometric parameters (N=50)

	Height	Weight	BSA	BMI
R value	0.213	0.216	0.226	0.060
P value	0.136*	0.130*	0.113*	0.676*
* Not significant				

DISCUSSION

Our study demonstrates that there is a positive correlation between the various anthropometric parameters (height, weight, BSA and BMI) and visual reaction time. Hence with an increase in the value of these parameters there is a prolongation of the visual reaction time.

A study by Deore DN et al observed a prolonged VRT in the underweight as well as overweight/obese individuals as compared to normal girls and it was statistically significant.[5] In contrast to the above study which does not specify the exact timing of VRT recording i.e. phase of menstrual cycle, in our study we took the VRT readings in a specific period of the menstrual cycle i.e. the proliferative period.

Similarly a study by Simran G et al found a significantly longer VRT to yellow color in obese group as compared to control group and non-significant prolongation for red and green color.[6] Other studies have also reported similar findings as far as the relationship between VRT and BMI is concerned.[7,8,9]

It has been observed that motor as well as sensory nerve conduction velocity show a non-significant slowing with increasing BMI in several nerves in younger age group.[10]

The probable reason for this positive correlation between BMI and VRT maybe because elevations of BMI can potentially lead to pathophysiologic changes like vascular changes, impaired insulin regulation,

systemic inflammation, and reduced cardiovascular fitness which can impact cognitive functioning, thereby slowing the processing capability and leading to a longer reaction time.[4]

CONCLUSION

Visual reaction time is prolonged with increase in BMI, even within the normal range of BMI, hence factors other than accumulation of adipose tissue may also contribute to this aspect.

Conflict of Interest – None

Source of Funding- Nil

Ethical Clearance – Obtained from institutional ethical clearance committee

REFERENCES

1. Kranzler JH. Mental chronometry. In: Seel NM, editor. Encyclopedia of the Sciences of Learning. New York: Springer; 2011. p. 2180-2182.
2. Sharma RN and Sharma R. Experimental Psychology. New Delhi: Atlantic Publishers & Dist,; 2006. p. 226-231.
3. Birx HJ. Encyclopedia of Anthropology. New Delhi: Sage publications; 2006.
4. Gunstad J, Paul RH, Cohen RA, Tate DF, Spitznagelc MB, Gordon E. Elevated body mass index is associated with executive dysfunction in otherwise healthy adults. Comprehensive Psychiatry. 2007;48: 57-61.
5. Deore PN, Surekha P, Masrooir SS, Khan ST, Kathore V. A cross sectional study on the relationship between the body mass index (BMI) and the audiovisual reaction time (ART). Journal of Clinical and Diagnostic Research. 2012;6(9):1466-1468.
6. Simran G, Lily W, Vidushi G, Tegbir SS. Assessment of auditory and visual reaction time in healthy obese individuals. Journal of Advance Researches in Biological Sciences. 2013;5(1):32-36.
7. Nikam LH, Gadkari JV. Effect of age, gender and body mass index on visual and auditory reaction times in Indian population. Indian J Physiol Pharmacol. 2012;56(1): 94–99.
8. Nene AS, Pazare PA, Sharma KD. Short communication. A study of relation between body mass index and simple reaction time in healthy young females. Indian J Physiol Pharmacol. 2011;55(3):288–291.
9. Skurvydas A, Gutnik B, Zuoza AK, Nash D, Zuoziene IJ, Mickeviciene D. Relationship between simple reaction time and body mass index. Homo. 2009;60(1):77-85.
10. Pawar SM, Taksande AB, Singh R. Effect of body mass index on parameters of nerve conduction study in Indian population. Indian J Physiol Pharmacol. 2012;56(1):88-93.

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A Comparative Study of QT Interval and Its Dispersion among Hypertensive and Normotensive Subjects

Mangala Gowri S R[1], Vinay G[2]

[1]Assistant Professor, Department of Physiology, [2]Associate Professor, Department of Anatomy, MES Medical College, Perinthalmanna, Kerala

ABSTRACT

Background: Hypertension is the most prevalent non communicable disease and it markedly increases both morbidity and mortality. Variation in QT intervals has been proposed as early markers of vulnerability to ventricular arrhythmias and considered as potential predictors of mortality. This study was taken up to assess early detection of changes in QT interval among hypertensive subjects and early management of cardiac abnormalities.

Aim: To assess the cardiac function status in patients with essential hypertension by analyzing QT interval, corrected QT intervals (QTc) and QT dispersion (QTd).

Method: 50 hypertensive and 50 normotensive male subjects between the age group of 40 -60 years were selected. Computerized ECG system with Nivi qure software was used for the study. Mean QT intervals, QTc and their dispersions (QTd), were assessed to observe cardiac function status. Statistical analysis was done by using paired "t" test.

Results: Mean QT intervals, QTc intervals and their dispersions were significantly higher in hypertensive subjects ($p < 0.001$).

Conclusion: The levels of both systolic and diastolic blood pressures are related to the generation of ventricular rhythm problems either via increasing left ventricular mass which results in an increase in QT parameter measurements.

Keywords: *Cardiac arrhythmias, Hypertension, QT intervals.*

INTRODUCTION

Hypertension is the most common cardiovascular disorder affecting 20% of adult population worldwide, which is also an important public health problem, both in the developed and developing countries[1]. It markedly increases both morbidity and mortality. The adverse effects of hypertension principally involve the heart, the blood vessels, the retina, and kidneys including central nervous system[2].

Hypertension is also associated with target organ damage like left ventricular hypertrophy (LVH), heart failure, coronary arterial disease, peripheral arterial disease, micro albuminuria, retinopathy and stroke. Hypertension doubles the risk of cardiovascular disease and is considered as one of the major risk factors for cardiovascular mortality, which accounts for 20- 50% of all deaths[3]. There is a significant association of cardiovascular risk with the severity of blood pressure (BP) and the level of BP control.

QT intervals are the electrocardiographic measurements of cardiac depolarization and repolarization periods. QT prolongation is associated with various components of the insulin resistance syndrome, age body mass index, left ventricular hypertrophy, persistently elevated blood pressure[4].QT interval prolongation has been associated with an increased risk of ventricular arrhythmias and sudden death in the myocardial infarction[5], in chronic heart failure[6], in diabetic patients[7] and also among general population[8]. An abnormal ventricular repolarization has also been described in patients with hypertensive heart disease[9,10] and a prolonged QT interval is a risk factor for ischemic heart disease in hypertensive subjects[11].

Increased QT dispersion have been found in patients with hypertension, diabetes, left ventricular hypertrophy, myocardial infarction, hypertrophic cardiomyopathy, chronic heart failure, mitral valve prolapse and long QT syndrome which is genetically related[12]. Left ventricular hypertrophy (LVH) and prolonged QT interval at ECG are common in arterial hypertension (AH), and are considered as major risk factors for cardiovascular disease and sudden death[13]. Studies have also shown the association of corrected QT intervals and their dispersions were significantly higher in the hypertensive group and showed direct relation with the level of systolic and diastolic blood pressures[14].

Variation in QT intervals has been proposed markers of vulnerability to ventricular arrhythmias and potential predictors of mortality. This study was taken up to assess early detection of changes in QT interval among hypertensive subjects and early management of cardiac abnormalities.

MATERIALS AND METHOD

The present study was conducted in the Department of Physiology, between June 2010 to June 2012. 50 known case of hypertensive male subjects and 50 normotensive male subjects between age group of 40-60 years were selected for the study. Smokers, alcoholics; patients with history of diabetes mellitus, congestive cardiac failure, symptomatic coronary artery disease, atrial fibrillation; subjects with secondary arterial hypertension – like pheochromocytoma, renal artery disease etc, and history of drug treatment other than antihypertensive were excluded from the study group.

All subjects were encouraged for voluntary participation after explaining the procedures to be undertaken. Informed written consent was taken from them. The subjects were advised to have their meal by 9: 00 pm, to have a good sleep at night before and to remain free from any physical or mental stress, not to take sedatives or any drugs affecting central nervous system. The subjects were also asked to avoid tea or coffee at breakfast and attend Physiology lab between 9.00 AM to 11.00 AM on the day of examination. All subjects were clinically examined and detailed history was taken with reference to duration of hypertension, family history, personal history like smoking, alcoholism etc and previous drug history. Physical examination was done. Then the subject was kept under complete bed rest in supine position for 15-20 minutes in a cool and calm environment. During this period subject was advised not to perform physical or any mental activity. Blood pressure was recorded in supine position using mercury sphygmomanometer. A standard adult size cuff measuring 23 cm by 12 cm was used for all subjects. Three readings were taken and average of second and third was used for the study.

Subjects were rested in supine position for at least 10 minutes, after which resting ECG was recorded with the subjects remaining supine for 5 minutes. ECG was acquired using digital ECG system, an instantaneous heart rate at RR intervals were continuously plotted using Niviqure software on a Microsoft window based computer. The digital ECG system was used to save multiple records and provided with additional filter settings, calculation tools, automated analysis and auto report generation facilities. QT and RR intervals were analyzed. Corrected QT (QTc) was calculated using Bazett's formula

$$QTc\ (Bazett) = \frac{QT}{\sqrt{RR}}$$

and QT dispersion was determined by taking the difference between longest (QT max) and shortest (QT min) QT interval.

STATISTICAL ANALYSIS

The results were given as Mean ± Standard Deviation and range values. Comparisons were performed using student's t-test for 2 group comparisons. The p value of 0.05 or less was considered as statistical significance.

RESULTS

Mean values and standard deviation of Electrocardiographic parameters are depicted in the table in detail. Hypertensive subjects showed statistically highly significant mean QT(ms) interval as compared to normotensive ($p<0.000$). RR(ms) interval was significantly higher in hypertensive patients ($p<0.000$). QT Max and QT min was highly significant in hypertensives ($p<0.000$). Corrected QT interval(QTc) was significant in hypertensives as compared to normal subjects ($p<0.008$). Hypertensive subjects showed significantly higher QT dispersion (QTd) as compared to normal subjects ($p<0.007$).

DISCUSSION

Hypertension is the most prevalent non communicable disorder in the world. It is a big concern because of the devastating effects of its chronic complications involving multisystem in body. Over years HRV has gained so much interest because of its non invasive and bed side procedure for early detection of cardiovascular pathology.

Over 6 decades epidemiological studies have proved increase in heart rate has increased cardiovascular morbidity in cardiovascular patients and also in general population with or without risk factors[15,16]. Our study showed elevated heart rate in hypertensive subjects. Increased heart rate is correlated with higher Blood pressure. Increased sympathetic tone manifested by higher heart rate is common among hypertensive subjects[17].

There was significant reduction in RR interval. Similar findings were reported in Pavithran et al[18]. Reduced RR interval and elevated heart rate shows decreased vagal modulation and higher sympathetic activity in hypertension patients. This study showed that QT and QTc dispersions increased in hypertensive patients had a direct relation with the occurrence of ventricular rhythm problems. QTd has been shown to be a useful noninvasive method for the detection of inhomogeneity of ventricular recovery times[19-24]. We found a relation between systolic and diastolic blood pressure levels and QT intervals, increased QT intervals and dispersions were related with increased blood pressures. The present study has shown that, even prior to the development of hypertensive heart disease there is prolongation of QT interval.

Table 1: Electrocardiographic Parameters In Study Subjects

	Hypertensive subjects		**Normotensive Subjects**		**Normotensive subjects V/S Hypertensive subjects**		
	mean	**sd**	**Mean**	**sd**	***t value***	***p value***	
QT (ms)	567.230	80.0526	460.424	47.7721	8.101	< 0.000	HS
RR(ms)	848.3914	166.81783	949.1316	140.38980	-3.267	< 0.001	HS
QTc(ms)	768.688	7.199	491.365	59.829	2.714	< 0.008	S
QT max(ms)	567.230	80.0526	460.424	47.7721	8.101	< 0.000	HS
QT min(ms)	515.98	103.869	436.98	46.821	4.903	< 0.000	HS
QTd	51.250	71.6337	23.444	4.7224	2.739	< 0.007	S

* Unpaired t-test NS – Not significant, HS- Highly significant, S- Significant

LIST OF ABBREVIATIONS USED

ANS – Autonomic nervous system

BMI – Body mass index

BP - Blood pressure

DBP – Diastolic blood pressure

ECG – Electrocardiogram

Mm Hg – millimeter of mercury

ms - milliseconds

SBP – Systolic blood pressure

QTc - Corrected QT intervals

CONCLUSION

In conclusion, testing cardiac function status is an important area of investigation in hypertensive patients, to look for ventricular arrhythmias. Since prolongation of QT interval is associated with cardiac arrhythmias, suggesting that these hypertensive patients may have risk for occurrence of cardiac arrhythmias in future. These simple noninvasive measures can be used for early detection and treatment of cardiac arrhythmias and other variations in cardiac autonomic function.

Ethical Clearance was taken from Institutional Ethical committee, JJMMC, Davangere.

Conflict of Interest – None

Source of Funding – None

REFERENCES

1) WHO, The World Health Report 1997. Hypertension, P 39-45.

2) Naomi D.L. Fisher, Williams H.G. Hypertensive Vascular Disease. In: Kasper DL, Braunwald E, Fauci AS, Mauser SL, Longo DL, Jameson JL editors. Harrison's principles of internal medicine. 17lh ed. Vol. 2, USA: McGraw Hill Companies; 2005:p.1549-1562.

3) Park K. Hypertension. In: Park's textbook of preventive and social medicine. 19th ed. Jabalpur: M/s Banarsidas Bhano; 2007:p.309-314.

4) Festa A, D'Agostino R Jr, Rautaharju P, Mykkänen L, Haffner SM. Relation of blood pressure, left ventricular mass, insulin sensitivity, and coronary artery disease to QT interval duration in nondiabetic and type 2 diabetic subjects. Am JCardiol 2000;86:1117-22.

5) Schwartz PJ, Wolf S: QT interval prolongation as a predictor of sudden death in patients with myocardial infarction.Circulation1978; 57: 1074–1077.

6) Davey PP, Bateman J, Mulligan IP, Forfar C, Barlow C,Hart G: QT interval dispersion in chronic heart failure and left ventricular hypertrophy: relation to autonomic nervous system and Holter tape abnormalities. Br Heart J1994; 71: 268–273.

7) Sawicki PT, Dahne R, Bender R, Berger M: Prolonged QT interval as a predictor of mortality in diabetic nephropathy.Diabetologia1996; 39: 77–81.

8) Schouten EG, Dekker JM, Meppelink P, Kolk FJ, Vanderbroucke JP, Pool J: QT interval prolongation predicts cardiovascular mortality in an apparently healthy population.Circulation1991; 84: 1516–1523.

9) Oikarinen L, Nieminen MS, Viitasalo M, et al: QRS duration and QT interval predict mortality in hypertensive patients with left ventricular hypertrophy. The Losartan Intervention for Endpoint Reduction in Hypertension Study. Hypertension2004; 43: 1029–1034.

10) Kulan K, Ural D, Komsuoglu B, Agacdiken A, Goldeli O, Komsuoglu SS: Significance of QTc prolongation on ventricular arrhythmias in patients with left ventricular hypertrophy secondary to essential hypertension. Int J Cardiol 1998; 64: 179–184.

11) Schillaci G, Pirro M, Ronti T, et al: Prognostic impact of prolonged ventricular repolarization in hypertension. Arch Intern Med2006; 166: 909–913.

12) Barr CS, Naas A, Freeman M, Lang CC, Struthers AD. QT dispersion and sudden unexpected death in chronic heart failure. Lancet 1994;343:327-9.

13) Pontiroli AE, Pizzocri P, Saibene A, Girola A, Koprivec D, Fragasso G. Int J Obes Relat Metab Disord. Left ventricular hypertrophy and QT interval in obesity and in hypertension: effects of weight loss and of normalisation of blood pressure. 2004 Sep;28(9):1118-23.

14) Kaftan ah, Kaftan O: QT Intervals and Heart Rate Variability in Hypertensive Patients, Jpn Heart J 2000; 41: 173-182.

15) Cooney MT, Vartiainen E, Laatikainen T, Juoleivi A, Dudina A, Graham IM. Elevated resting heart rate is an independent risk factor for cardiovascular disease in healthy men and women. Am Heart J.2010;159:612-619.e3.

16) Fox K, Ford I, Steg PG, Tendera M, Robertson M, Ferrari R. heart rate as a prognostic risk factor in patients with coronary artery disease and left ventricular systolic dysfunction. A subgroup analysis of randomized controlled trial. Lancet 2008;372:817-821

17) Dominiczak AF, Negrin DC, Clark JS, Brossnan MJ, McBride M, Alexander MY. Genes and hypertension from gene mapping in experimental models to vascular gene transfer strategies. Hypertens 2000;35:164-72

18) Pavithran P, Madanmohan, Mithun R,Jomal M, Nandeesha H. Heart rate variability in middle aged men with new onset hypertension. Ann non invasive electrocardiol 2008;13(3):242-8.

19) Zabel M, Portnoy S, Franz MR. Electrocardiographic indexes of dispersion of ventricular repolarization. An isolated heart validation study. J Am Coll Cardiol 1995; 25: 746-52.

20) Day CP, Mc Comb JM, Campbell RWF. QT dispersion: an indication for arrhythmia risk in patients with long QT intervals. Br Heart J 1990; 63: 342-4.

21) Day CP, Mc Comb JM, Campbell RWF. QT dispersion in sinus beats and ventricular extrasystoles in normal hearts. Br Heart J 1992; 67: 39-41.

22) Dritsas A, Gilligan D, Nichoyannopoulos P, et al. Amiodarone reduces QT dispersion in patients with hypertrophic cardiomyopathy. Int J Cardiol 1992; 36: 345-9.

23) Cowan JC, Yusoff K, Moore M, et al. Importance of lead selection in QT interval measurement. Am J Cardiol 1988; 61: 83-7.

24) Day CP, McComb JM, Matthews J, et al. Reduction in QT dispersion by sotalol following myocardial infarction. Eur Heart J 1991; 12: 423-7.

25) Perkiomaki JS, Ikaheimo MJ, Pikkujamsa SM, et al. Dispersion of the QT interval and autonomic modulation of heart rate in hypertensive men with and without left ventricular hypertrophy. Hypertension 1996; 28: 16-21.

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A Study on Correlation of Intraocular Pressure and Blood Pressure in Different Age Groups

Sivasankar PR[1], Baby Sai Rani B[2]

[1]Assistant Professor, Department of Ophthalmology, [2]Assistant Professor, Department of Physiology, Government Medical College, Anantapuramu, Andhra Pradesh

ABSTRACT

Background: Intraocular pressure of the eye is governed by the formation, presence and out flow of the aqueous humor produced by the ciliary body of the eye. Any disturbances in this mechanism will lead to Glaucoma, a second leading cause of blindness in the world. Certain systemic parameters such as hypertension, age, sex etc will influence the levels of intraocular pressure and thence may form risk factors for glaucoma. The current study was aimed at know the relation of intraocular pressure and other systemic parameters especially of blood pressure.

Materials and Method: The current prospective study carried out at Departments of Physiology and Ophthalmology, Government Medical College and General Hospital, Anantapuramu and included 150 subjects of which 75 were male and 75 were females. Standard methods were used for recording as well as analysis of data.

Results: The results of this study indicated that IOP increased with age in both sexes and it higher in women than men. The relation is statistically significant with p value <0.0001. It can also be emphasized that values of blood pressure, mean arterial pressure and Pulse pressure positively correlated with the intraocular pressure.

Conclusion: It is recommended that Intra Ocular Pressure(IOP) estimation should be made as a routine health checkup in everyone, especially in females over 40 years of age, whose systemic blood pressure, mean arterial pressure and pulse pressure values are high because of their high chances of having high intraocular pressure.

Keywords*: Age, Blood pressure, Gender, Glaucoma, Intra Ocular Pressure.*

INTRODUCTION

The aqueous humor of the eye is produced by ciliary body and drained out of the eye via trabecular complex plays an important metabolic role by providing nutrition to the avascular structures of the eye viz., cornea, lens and vitreous and thence maintains optical transparency and maintains proper intraocular pressure within the eye which is the key factor in maintaining the structural integrity of the eye globe. Normal Intra Ocular Pressure (IOP) in human beings ranges from 10-21 mm of Hg (mean 16±2.5)[1]. Under normal circumstances the Intraocular Pressure is maintained through a balance between Aqueous humor production and absorption. Various systemic body variables such as age, gender, heredity, blood pressure (B.P), posture etc., influence the intraocular pressure. This decreased physiological reserve in eye and cardiovascular system are reflected as changes in intraocular pressure and blood pressure respectively. Hypertension influences the change in Intra Ocular Pressure (I.O.P) and there by results in dysfunction of the eye leading to loss of vision.

Elevated Intraocular Pressure is one of the major risk factors for developing Glaucoma, a disease of eye that is characterized by increased intraocular pressure, field changes and optic neuropathy is a second major cause of permanent blindness in the world and accounts for 7-8 million bilaterally blind people[2].

Corresponding author:
Dr. P R Sivasankar
Assistant Professor, Department of Ophthalmology, Government Medical College, Anantapuramu-515 001, Andhra Pradesh. Mobile+91 9440515167,
Email: dr.maheshgajula@gmail.com

In the circumstances cited above, the current study is principally aimed at established relationship between the intraocular pressure and the blood pressure in different age groups with a special emphasis to find out the relationship of Intraocular Pressure with varying Blood Pressure and to determine the relationship of Intraocular Pressure with increasing age.

MATERIALS AND METHOD

The current prospective study was carried out at Departments of Physiology and Ophthalmology, Government Medical College and General Hospital, Anantapuramu, Andhra Pradesh from January'2015 to December 2015 after obtaining clearance form institutional ethics committee.

The sample size of present study is 150, which includes both females 75 (50%) and males 75 (50%) between the age groups of 31-60 years. The inclusion criteria were persons above 30 years of age, hypertensives who are not under treatment and exclusion criteria included hypertensives on treatment, persons below 30years and above 60 years of age, subjects suffering with glaucoma, subjects who are blind and people suffering from systemic diseases.

Intra ocular pressure is recorded in both eyes using Schiotz's tonometer and blood pressure was recorded using sphygmomanometer as per standard recording protocols. Intraocular pressure is estimated using Friedenwald nomogram. Blood pressure was measured and classified as per the Seventh Report of the Joint National Committee. Subsequently pulse pressure (P.P) and Mean Arterial Pressure(MAP) values were deduced from the blood pressure recordings using standard formulae.

The data obtained from the study is recorded in a pretested proforma and was analyzed using appropriate statistical methods.

OBSERVATIONS AND DISCUSSION

Intra Ocular Pressure(IOP) is an inherited[3,4] biological parameter which is inter related with other systemic parameters like age, sex, height, weight and Blood Pressure. Correlates of Intra Ocular Pressure(IOP) measurement may need to be considered in investigating determinants of it. Relationship between systemic parameters (example: Age, Sex, BP,) emphasize the physiologic interdependence of the eye with other organ systems.

Age and Intraocular pressure: It is observed from **Table No.1** that the Mean IOP in men of the age group 31-40 years was 13.3±1.7 mmHg, between 41-50 years was 14.5±1.9mmHg and 51-60 years was 16.2±2.2mmHg and in the mean IOP females (Table No.2) between age group 31-40 years was 13.5±2mmHg, 41-50 years was 14.7±1.8mmHg and 51-60 years was 16.7±2.3mmHg. Mean IOP increased with age both in males and females. In both the sexes it is clear that the mean raise of intraocular pressure is statistically significant **(p value <0.0001)** with the progression of age.

The present study is correlating with that of "The Beaver Dam Study" (1988-90) done by Klein BE & Klein R[5] and Qureshi (1997)[6]. However, the studies conducted by Carel RS[7] et.al and Mc Leod et.al[8] stated contrary to the finding.

The possible reason for increased IOP with age might be due to structural changes in trabecular mesh work and schlemm's canal which will reduce the out-flow facility of aqueous humor.

Table-1: Variation of IOP with Age in Men

Sex	Age in Years	No of subjects	Intraocular Pressure(mmHg)				F value	P value
			Mean	S. D	Minimum	Maximum		
Men	31-40	25	13.268	1.7425	11.2	17.3	13.581	< 0.0001
	41-50	25	14.544	1.9177	11.2	18.9		
	51-60	25	16.16	2.2104	11.2	18.9		

Table-2 Variation of IOP with Age in Women								
Sex	**Age in Years**	**No of subjects**	**Intraocular Pressure(mmHg)**				**F value**	**P value**
			Mean	**S. D**	**Minimum**	**Maximum**		
Women	31-40	25	13.484	1.9928	11.2	17.3	15.464	< 0.0001
	41-50	25	14.728	1.7983	12.2	18.9		
	51-60	25	16.66	2.284	12.2	20.6		

Gender and IOP: On perusal of **Table No.3**, it is evident that the mean Intraocular pressure in females (15±2.4) is higher than in males (14.7±2.3 mmHg). However, these findings are not statistically significant (p value-0.4334326). Similar findings are noted in the studies conducted by Klein BE et. al [5] and David R et.al[3]. Menopausal changes are one of the possible reasons for ocular hypertension in females as suggested by some authors [6].

Table-3 Comparison of IOP Between Male and Female					
Sex	**Number of subjects**	**Intraocular Pressure**			
		Mean	**S.D**	**Minimum**	**Maximum**
Male	75	14.6573	2.2762	11.2	18.9
Female	75	14.9573	2.3998	11.2	20.6
t value	0.7854718711				
P value	0.4334326 Not Significant				

Systolic Blood Pressure and IOP: **Table No.4** indicate that Subjects who were having systolic BP less than 120mmHg had mean IOP of13.5±1.9mmHg, between 120-139mmHg had mean IOP of 14.9±2.2mmHg and subjects between 140-160mmHg mean IOP of 16.3±2.1mmHg. An increase in mean IOP values are observed with increasing Systolic B.P. Values are statistically highly significant (p<0.0001). Leske M C, Wu Sy etal[9] and Bulpitt C. J[10] have found out similar findings in their studies.

One of the explanation provided for the strong relation between IOP and hypertension is that IOP may be thought of as a physiological equilibrium state in response to high BP, a relationship that does not exists in glaucoma and may involve a compromised vascular auto regulation mechanism resulting as a damage to the small vessels of the optic disc and mechanical strain on the optic nerve as it passes through the lamina cribrosa. The other possible mechanism is Increased ultra-filtration of aqueous fluid owing to increased perfusion at the level of ciliary body. The hypertension also decreases the out flow of aqueous humor by increasing episcleral venous pressure. Increased retinal blood volume due to raise in central venous pressure owing to increased blood pressure in the adjacently situated central retinal artery.

Table-4: Variation of IOP With Systolic BP					
Systolic Blood Pressure	**Number of Subjects**	**Intraocular Pressure(mmHg)**			
(mm hg)		**Mean**	**S.D**	**Min.**	**Max.**
<120	50	13.494	1.89159	11.2	18.9
120-139	59	14.8881	2.24323	11.2	20.6
140-160	41	16.2926	2.0537	12.2	20.6
F value	20.46821552				
P value	< 0.000001 Significant				

Diastolic Blood pressure and Intraocular Pressure: Subjects who were having diastolic blood pressure of less than 80mmHg had mean IOP of 13.7±2.1mmHg, between 80-90 had mean IOP of 15.3±2.2mmHg and 90-100 had mean IOP of 16.5±1.9mmHg. the statistical values are highly significant and were depicted in **Table No.5.** Similar results are put forwarded by Jong Soo Lee et. al[11].

Table-5: Variation of IOP with Diastolic BP

Diastolic Blood Pressure	Number of Subjects	Intraocular Pressure(mmHg)			
(mm hg)		Mean	S. D	Min.	Max.
<80	59	13.6694	2.0584	11.2	20.6
80-90	70	15.2685	2.243	11.2	20.6
91-100	21	16.4666	1.8837	13.4	18.9
F value	16.50713579				
P value	< 0.000001 Significant				

Pulse pressure and IOP: It can be inferred from **Table No. 6** that Subjects who were having pulse pressure between 31-44 had mean IOP of 13.8±2mmHg between 45-58 had mean IOP of 15.9±2.2mm Hg and 59-72 had mean IOP of 15.5±2.4mmHg. increase in intraocular pressure is directly proportional to increase in pulse pressure. These values are statistically significant.

Table-6: Variation of IOP with Pulse Pressure

Pulse Pressure (mm Hg)	Number of Subjects	Intraocular Pressure(mmHg)			
		Mean	S. D	Min.	Max.
30-44	77	13.8247	1.99803	11.2	18.9
45-58	61	15.9115	2.20817	11.2	20.6
59-72	12	15.5	2.38441	11.2	18.9
F value	17.24215757				
P value	< 0.000001 Significant				

Mean Arterial Pressure and IOP: It can be derived from **Table No.7** that Subjects who were having MAP of ≥80 mmHg had mean IOP of 13.0±1.4mmHg, between 80.1-95 mmHg had mean IOP of 13.7±1.9mmHg, between 95.1-110 mmHg had mean IOP of 15.6±2.4mmHg and MAP of>110 mmHg had mean IOP of 16.6±1.8mmHg. An increase in mean IOP. values are observed with increasing MAP. Values are highly significant.

Table-7: Variation of IOP with Mean Arterial Pressure

MAP (mm Hg)	Number of subjects	Intraocular Pressure(mmHg)			
		Mean	S. D	Min.	Max.
≥ 80.0	3	13.000	1.3856	12.2	14.6
80.1-95.0	68	13.7191	1.8865	11.2	17.3
95.1-110.0	62	15.6064	2.3502	11.2	20.6
< 110	17	16.5647	1.7905	13.4	18.9
F value	14.07919977				
P value	< 0.000001 Significant				

CONCLUSION

The results of this study indicated that IOP increased with age in both sexes and it higher in women than men. It can also be emphasized blood pressure positively correlated with the intraocular pressure. Hence, prediction of increased IOP can be anticipated depending upon simple systemic parameters like age, sex and blood pressure. Early diagnosis of increased IOP can prevent complications and in turn reduces morbidity of glaucoma.

Based on our study we recommend that IOP estimation should be made as a routine health checkup in everyone, because of the availability of effective screening tests. Measurement of IOP estimation is mandatory in individual especially in females over 40 years of age, whose systemic blood pressure values are high.

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Conflict of Interest: Nil

REFERENCES

1. Khurana AK. Comprehensive Ophthalmology, 5th Edition. 2012.pp. 155.
2. Higginbotham EJ, Kilimanjaro HA, Wilensky JT, Batenhorst RL, Hermann D. The Effect of Caffeine on Intraocular Pressure in Glaucoma Patents. Ophthalmology. 1989 May 31;96(5):624-6.
3. Wong TT, Wong TY, Foster PJ, Crowston JG, Fong CW, Aung T. The relationship of intraocular pressure with age, systolic blood pressure, and central corneal thickness in an Asian population. Investigative ophthalmology & visual science. 2009 Sep 1;50(9):4097-102.
4. Wiggs JL. Genetic etiologies of glaucoma. Archives of ophthalmology. 2007 Jan 1;125(1):30-7.
5. Klein BE, Klein R, Knudtson MD. Intraocular pressure and systemic blood pressure: longitudinal perspective: The Beaver Dam Eye Study. British Journal of Ophthalmology. 2005 Mar 1;89(3): 284-7.
6. Qureshi IA. Intraocular pressure: a comparative analysis in two sexes. Clinical physiology. 1997 May 1;17(3):247-55.
7. Carel RS, Korczyn AD, Rock M, Goya I. Association between ocular pressure and certain health parameters. Ophthalmology. 1984 Apr 30;91(4):311-4.
8. MacLeod SD, West SK, Quigley HA, Fozard JL. A longitudinal study of the relationship between intraocular pressure and blood pressure. Invest Ophthal-mol Vis Sci. 1990; 31:2361-6.
9. Leske MC, Wu SY, Hennis A, Honkanen R, Nemesure B, BESs Study Group. Risk factors for incident open-angle glaucoma: the Barbados Eye Studies. Ophthalmology. 2008 Jan 31;115(1):85-93.
10. Bulpitt CJ, Charles Hodes M.G. Everit. Intraocular Pressure and Systemic Blood Pressure in Elderly. British Journal of Ophthalmology 1975, 59. 717-720.
11. Lee JS, Lee SH, Oum BS, Chung JS, Cho BM, Hong JW. Relationship between intraocular pressure and systemic health parameters in a Korean population. Clinical & experimental ophthalmology. 2002 Aug 1;30(4):237-41.
12. Best & Taylor's Physiological Basis of Medical Practice 13th Edition 2012. Williams and Wilkins. P.P 1222.

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VO2 Max and Body Mass in Overweight and Obese Young Adults

K Umamaheswari[1], Y Dhanalakshmi[1], S Karthik[1], D. Niraimathi[2], S V Umadevi[2], Nitin Ashok John[3]

[1]Assistant Professor, [2]Associate Professor, [3]Professor & HOD, Department of Physiology, Indira Gandhi Medical College, Puducherry

ABSTRACT

Background: Low levels of cardiovascular fitness and unfavorable cardiovascular risk profiles are detected in the young population. Clinical studies have recognized a strong association between low cardio respiratory fitness and mortality. Cardio respiratory fitness can be best assessed by measuring aerobic capacity or maximal oxygen consumption. Body composition factors like fat percentage and lean body mass have close relationship with cardiorespiratory fitness. Researchers have tried correlating BMI, body fat and fat free mass with VO2 max and have reported conflicting results. Therefore, our aim was to investigate the relation between BMI, Body fat percentage and VO2Max in overweight and obese young adults.

Method: Volunteers (n=62) in the age group of 19-30 years of age with BMI ≥ 25kg/m2 were included in the study. Height, weight were measured and BMI calculated using Quetelet index, Skin fold measurements were taken and fat percent, lean body mass were derived using standard equations. VO2 max was estimated according to Bruce protocol.

Results The relation between BMI, Fat percent and lean body mass was done using Karl Pearson's correlation. There was an inverse correlation between BMI ($p<0.001$) and a positive correlation between LBM and VO2 max ($p<0.001$). Fat percent showed a negative correlation but was not statistically significant ($p=0.14$).

Conclusion: The important determinant of cardiorespiratory fitness is BMI and Lean body mass. To attain a worthy cardiorespiratory fitness level in overweight and obese individuals' any physical activity should target an increase in lean body mass and a reduction in fat percent.

Keywords: *Body mass index, Maximum oxygen consumption, obese individuals, VO2 max.*

INTRODUCTION

The global epidemic of overweight and obesity –'globesity' is emerging as a public health problem in many parts of the world[1]. Changing lifestyle and faulty food habits are adding to this epidemic of global obesity. Almost 30-65% of adult urban Indians are either overweight or obese or have abdominal obesity. [2] It is associated with an increased risk of developing various non-communicable diseases including hypertension, coronary heart disease, diabetes, stroke and some forms of cancers.. The leading cause for mortality and morbidity worldwide are cardiovascular diseases. Recently, cardiovascular ailments are increasing in the younger generation. Low levels of cardiovascular fitness and unfavorable cardiovascular risk profiles are detected in them. It has evolved as an important factor for developing cardiovascular comorbidities later in middle age. [3] Numerous clinical studies have recognized a strong association between low cardio respiratory fitness and mortality [4, 5]. Cardio respiratory fitness can be best assessed by measuring aerobic capacity or maximal oxygen consumption (VO2 max). Aerobic capacity is an integral functional capacity of all systems

Corresponding author:
Dr. K Umamaheswari
Associate Professor, Department of Physiology,
ESIC Medical College & PGIMSR, KK Nagar,
Chennai 600078. Tamilnadu, INDIA
Mobile No. 9790218060
Email Id: dr.umamaheswari89@gmail.com

involved in supply, transportation and energetic oxygen transformation [6] Body composition factors like BMI, fat percentage and lean body mass have close relationship with cardiorespiratory fitness.

Researchers have tried correlating BMI, body fat, fat free mass and VO2 max and have found conflicting results. Therefore, we aimed at investigating the relation between BMI, Body fat percentage and VO2max in overweight and obese young adults.

METHOD

This was a cross sectional study done at Indira Gandhi medical college hospital, Puducherry, in the department of Physiology, after obtaining institute ethical committee clearance. Volunteers in the age group of 19-30 years of age with BMI ≥ 25kg/m2 were included in the study. Written informed consent were taken. Individuals with history of cardiac disease, lung disorders, smokers, on medication for chronic ailments were excluded from the study. All procedures followed were according to revised Helsinki Declaration of 2000.

Sixty two overweight/ obese individuals, staffs of our college and relatives of patients attending various out-patient departments, who volunteered for the study and satisfied the inclusion criteria, were selected. Complete clinical examination, ECG and echocardiogram were taken. The weight was taken on a weighing scale with standard minimum clothing to the nearest 0.5kg. Height was measured on a vertical scale with the heel, buttocks and occiput against the wall and the head in the Frankfurt plane to the nearest 0.5cm. Body mass index (BMI) was calculated by Quetelet Index [7], the formula BMI= (weight in kg)/ (height in mts) [2]

Measurement of body composition:

Skin fold measurements were taken from various sites including biceps, triceps, scapular, abdominal, suprailiac, thigh and medial calf sites according to standard procedures using skin fold caliper. All skinfolds were measured to the nearest 1 mm. Mean of 3 readings was recorded at all the sites. All measurements were taken by the same investigator. Durnin's age specific equations (1974) was adopted to calculate body density that was further used in Siri's equation (1961) to determine the total body fat. Fat percentage, fat mass, lean body mass [8] were derived using standardized equations [9]. Maximal oxygen consumption (VO2max) was estimated using Bruce treadmill test. It is a reliable and widely used method for estimation of VO2 max using predicted equations [10]

For Men $VO2max = 14.76 – (1.379 \times T) + (0.451 \times T^2) – (0.012 \times T^3)$

For Women VO2max = 4.38 x T - 3.9.

All data were entered and analyzed using SPSS software version 19. The relation between BMI, fat percent and fat free mass or lean body mass with maximal oxygen consumption was done using Karl Pearson's correlation. The level of significance was considered statistically significant if $p < 0.05$.

RESULTS

62 obese individuals with mean BMI 28.62 ± 2.54 in the age group of 19 - 30 years of age volunteered to participate in the study. Descriptive statistics of the study population is shown in table 1. Correlation values and significance between BMI, Fat percent, Lean Body mass and VO2max is given in table 2. Though there was an inverse correlation between fat percent and VO2 max it was not statistically significant. There was an inverse correlation between BMI and VO2 max as depicted in Fig 1 with an r value of - 0.84 ($p<0.0001$). The relation between Lean body mass and VO2 max is depicted in Fig 2 which shows a significant positive correlation with an r value of 0.9 and (p value <0.0001).

DISCUSSION

In India, the prevalence of overweight and obesity are increasing in children and young adults which are reflected in various studies [11]. Obesity is a modifiable risk factor of cardiorespiratory disease. It is therefore, important to maintain a fit cardiorespiratory profile. Cardiorespiratory fitness is a health-related component of physical fitness defined as the ability of the circulatory and respiratory systems to supply oxygen during sustained physical activity. The single valid method to assess cardiorespiratory fitness is by estimating VO2 max.[12] Though obesity and aerobic capacity are independent prognostic markers of cardiovascular mortality, the stronger predictor appears to be aerobic capacity. Thus it is beneficial to target aerobic capacity before weight loss, although improvement in both risk factors seems to be ideal. [13]

Chatterjee et al [14] in their study assessing

cardiorespiratory fitness of obese boys compared obese with non-obese boys and reported significantly higher absolute VO2max among obese boys, reasoning it be because of higher values of body mass and LBM, which in turn exhibited significant positive correlation with VO2max (l/min) ($r = 0.82$, $P<0.001$, $r = 0.93$, $P<0.001$ respectively whereas, Researchers [15, 16] have observed a significant inverse correlation between BMI, percent body fat and VO2 max.

Huttunen et al [17] who reported that obese children were physically less fit than normal weight children as judged by pedaling time and maximum oxygen consumption related to lean body mass ($p<0.001$). Thus there is a dearth of clarity regarding the relation between VO2max and body mass. Therefore, our study assessed VO2 max in relation to body mass index and found a significant inverse correlation. This relationship gives a misleading impression that heavier persons have a relatively lower oxygen uptake and hence low aerobic capacity [18]. In fact Nevil et al [19] reported that lighter persons were more likely to be placed in a low VO2 max category. In order to have a definite result, we aimed at finding a correlation between fat percent, lean body mass with VO2 max. Our results indicate that there was a significant positive correlation with lean body mass. Fat percent had a negative correlation but was not statistically significant.

Goran et al [20] examined the influence of body weight and body composition (FM vs FFM) on aerobic fitness. The results of this study indicated that the maximal oxygen consumption of fat-free tissue is independent of body fat mass. FM does not have any effect on VO2max. , these findings suggest that obese individuals do not have lower maximal aerobic capacity of their FFM compared with lean individuals or impaired cardio-respiratory and pulmonary responses to exercise. Thus inferring, VO2 max may be normal even in individuals with higher BMI.

Since aerobic capacity is body weight dependent, the overweight and obese individuals require a greater proportion of their aerobic capacity to conduct weight-bearing physical activities. Thus, these obese individuals are more likely to find it physiologically difficult to participate in physical activities that require movement of their increased body mass. [21]

The reduction in the physical activity affects body composition factors like body fat percentage, and body muscle mass. With decrease in body fatness, there is increase in aerobic fitness. Researchers [22] have also established low VO2max in obese groups and suggested that excessive fat mass imposes unfavorable burden on cardiac function and oxygen uptake by working muscles and indicated that reduced oxygen utilization by adipose tissue during exercise reduces overall VO2max. Also in obese individuals there is increase in type II muscle fibers and decrease in type I muscle fibers which may have important effect on reduced oxygen uptake [9]

Ulf et al [23] in their study comparing oxygen uptake adjusting for body composition between obese and normal weight adolescents, reported a significant partial correlations for the VO2max and FFM relationship after controlling for FM in both groups. Hence it was considered as the important determinant of VO2 max and dividing VO2 max by FFM seemed to be an appropriate procedure when comparing groups who differ in body size. Since our results found a positive correlation between VO2 max and lean body mass it augments to the observations that lean body mass must be taken into consideration when estimating VO2 max as a measure of cardio respiratory fitness.

RESULTS

Table 1: Descriptive statistics of the study population

Variables	Mean ± SD
Age (years)	23.32 ± 6.05
BMI (Kg/m^2)	28.62 ± 2.54
Weight (Kg)	78.53 ± 9.17
Height (cm)	163.30 ± 8.32
Lean body mass (Kg)	50.879± 5.54
Fat%	34.16± 2.31
VO2 Max (ml/min/Kg)	42.80± 2.35

Table 2: Correlation between BMI, LBM, Fat% and VO2 max

Parameters	Correlation coefficient (r)	Significance (p)
BMI*	-0.84	<0.0001
Lean body mass*	0.90	<0.0001
Fat %	-0.19	0.14

*$p<0.01$ significance

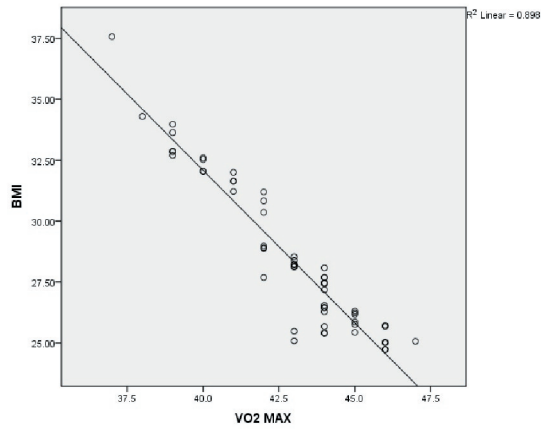

Fig 1 correlation between BMI and VO2 max

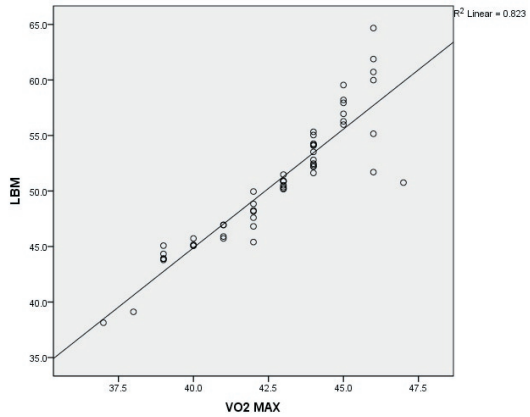

Fig 2: Correlation between Lean Body mass and VO2 max

CONCLUSION

Our results found a significant positive correlation between lean body mass and an inverse correlation between BMI ($p<0.05$), fat percent ($p = 0.14$) with VO2max. It appears that people with higher BMI have relatively low O_2uptake. It is also evident that, lean body mass has to be considered as an important determinant while estimating VO2 max. Moreover, any physical activity for improving cardiorespiratory fitness should target on improving lean body mass and a decrease in fat mass.

Institute ethical committee clearance obtained

Conflict of Interest – Nil

Source of Funding - Self

REFERENCES

1. Kavita Vasudevan , Umamaheswari K., Vedapriya D.R., Palanivel Chinnakali . . Overweight and obesity in young adults: food for thought. Int J Cur Res Rev, Dec 2012 / Vol 04 (24). 38-41.
2. Gupta R, Gupta VP, Sarna M, et al. Prevalence of coronary heart disease and risk factors in an urban Indian population: Jaipur Heart Watch-2. Indian Heart J 2002;54(1):59-66.
3. Mercedes R, Carnethon, Samuel S, Gidding, Rodrigo N, Stephen S. Cardiorespiratory fitness in young adulthood and the development of cardiovascular disease risk factors. JAMA 2003;290:3092-3100.
4. Lee CD, Blair SN. Cardiorespiratory fitness and smoking related and total cancer mortality in men. Med Sci Sports Exerc 2002; 34:735-739.
5. Lee CD, Blair SN. Cardiorespiratory fitness and stroke mortality in men. Med Sci Sports Exerc 2002;34:592-595.
6. Ponoroc N, et al. VO2 max. Acta med medianae. 2005;44(4):17-20.
7. Eknoyan G, Adolphe Quetelet (1796–1874)—the average man and indices of obesity. Oxford Journals, Nephrology Dialysis Transplantation 2007; 23(1): 47-51.
8. Kshitija UP, Anjali SJ. Comparison of VO2max in obese and non-obese young Indian population. 1ndian J Physiol Pharmacol. 2011; 55 (2): 188–192.
9. Singh KD, Dhillon JK, Anupreet A, Gill. BS. Receiver operating characteristic curve analysis of BMI and percentage body fat in type 2 diabetics of Punjab. Indian J Physiol Pharmacol 2000; 44 (4): 73–80.
10. Suhas Y Shirur, Rajeshwari L, Swathi H N. Effect of increased adiposity on cardiorespiratory fitness of young Indian individuals. IJBR (2014) 05 (11): 662-664.
11. Nageshwari K, Rajeev S, Divyanshoo RK. Assessment of respiratory and sympathetic cardiovascular parameters in obese school children. Ind J Physiol Pharmacol 2007; 51(3):235-243.
12. Duck-chul Lee, Enrique GA, Xuemei S and Steven NB. Mortality trends in the general population: the importance of cardiorespiratory fitness, J Psychopharmacol. 2010; 24(4_suppl): 27–35.
13. Arnt E T, Sang J L, Oivind R, Tomas O. Stølen, A B, Per M H, Jan P L et al. , Aerobic Interval Training Versus Continuous Moderate Exercise as

a Treatment for the Metabolic Syndrome: A Pilot Study. Circulation 2008;118;346-354.

14. Chatterjee S, Chatterjee P, Bandyopadhyay A. Cardiorespiratory fitness of obese boys. Indian J Physiol Pharmacol 2005;49:353-357.
15. Laxmi CC, Udaya IB, Vinutha Shankar S. Effect of body mass index on cardiorespiratory fitness in young healthy males. 2014; 4 (2):. 1-4.
16. Peter Pribris, Carol A Burtnack, Sonya O Mckenzie, Jerome Thayer. Trends in body fat, body mass index and physical fitness among male and female college students. Nutrients. 2010;2:1075-85.
17. Huttunen NP, Paavilainen T. Physical activity and fitness in obese children. Int J Obesity. 1986;10: 519-25.
18. Vanderburgh PM, Katch FI. Ratio scaling of VO2 max penalizes women with larger percent body fat, not lean body mass. Med Sci Sports Exerc. 1996;28:1204-08.
19. Nevill AM, Ramsbottom R, Williams C. Scaling physiological measurements for individuals of different body size. Eur J Appl Physiol. 1992;65: 110-17.
20. M.Goran, DA Fields, GR Hunter, SL Herd, RL Weinsier. Total body fat does not influence maximal aerobic capacity. Inter J of Obesity. 2000;24:841-48.
21. Brooks LL. The effect of after school physical activity and adult encouragement on adolescent. University of Wisconsin, 2002.
22. Chatterjee S, Chatterjee S, Bandopadhyay A. Enumeration of validity for predicted Vo2max by Queen's College Step Test in Bengalese boys. Ind J Physiol and Allied Sci 2001;55(3):123-7.
23. Ekelund, Ulf, Paul W. Franks, Nicolas J. Wareham,JAN Å. Oxygen uptakes adjusted for body composition in normal-weight and obese adolescents. Obes Res. 2004;12:513–520.

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A Study of Nerve Conduction Velocity in Newly Diagnosed Hyperthyroid Females

Adikesavan B [1], Sangeetha P[1]

[1]*Associate Professor, Department of Physiology, Govt.Vellore Medical College, Vellore*

ABSTRACT

Hyperthyroidism is a common endocrinological disorder due to excessive levels of T4 and T3 affecting primarily muscle function and the central nervous system. It is associated with neuropsychiatric and neurologic syndromes and myopathy. To evaluate neuromuscular dysfunction in newly diagnosed hyperthyroid patients, nerve conduction studies were done. A significant reduction in peroneal nerve motor amplitude was observed with P value of 0.05.In sural nerve sensory conduction study, the latency and conduction velocity showed significant difference from control group. The H reflex study was also done but it did not show any difference from control group. In contrast to the previous studies we found in our study that sensory motor axonalneuropathy also occurs in hyperthyroid patients. As a conclusion electrophysiological studies can be useful in the diagnosis of asymptomatic polyneuropathy in hyperthyroid patients.

Keywords: *Hyperthyroidism, Nerve conduction study, Axonal neuropathy.*

INTRODUCTION

Hyperthyroidism results from excessive levels of T4 and T3. Hyperthyroidism manifests systemically affecting primarily muscle function and the central nervous system. . Causes of hyperthyroidism includes Graves's disease, Toxic multinodular goiter, Toxic adenoma, Iodide-induced hyperthyroidism, Subacute thyroiditis. It is associated with neuropsychiatric and neurologic syndromes and myopathy. The frequency and severity of neuromuscular complications vary considerably and are probably related to the degree of hyperthyroidism. Chronic thyrotoxic myopathy is a common complication. This myopathy is characterized by progressive weakness and wasting of skeletal musculature. More than 50% of thyrotoxic patients have some degree of myopathy. The myopathy is slowly progressive; the pelvic girdle and thigh muscles are affected preferentially.

Corresponding author:
Adikesavan B
Associate Professor, Department of Physiology,
Govt.Vellore Medical College, Vellore-632011.
E-mail: balajiadhi@yahoo.com, Mobile: 9443686517

To evaluate neuromuscular dysfunction in newly diagnosed hyperthyroid patients an electro diagnostic procedure like EMG and nerve conduction studies can be done. The nerve conduction studies play an important role in identifying the patho physiology such as axonal or demyelinating peripheral neuropathy.It provides an objective and quantitative measure of nerve function and it also helps in predicting the prognosis of neuropathy.

A nerve conduction study (**NCS**) is a test commonly used to evaluate the function, especially the ability of electrical conduction, of the motor and sensory nerves of the human body. Nerve conduction velocity (**NCV**) is a common measurement made during this test, measurements like velocity, amplitude, duration. area are also available which plays important role in making axonal type of neuropathy.NCS are used mainly for evaluation of paresthesias. The NCS consists of the following components such as Motor NCS,Sensory NCS,F-wave study, H-reflex study.

In thyrotoxic subjects motor responsiveness was significantly enhanced but sensory thresholds did not differ from control values[1]. The polyneuropathy in hyperthyroidism is probably caused by hypermetabolism in thyroid hyperfunction[2]. Electrophysiological studies can be useful in the diagnosis of asymptomatic polyneuropathy in hyperthyroid patients[3]. Although

the CNS involvement either in hypothyroidism or in hyperthyroidism have previously been shown on the basis of visual, auditory and somatosensory evoked potentials studies, less is known about the function of central motor pathways in both disorders[4]. The frequency and severity of neuromuscular complications vary considerably and are probably related to the degree of hyperthyroidism,although in some patients the neuromuscular dysfunction is caused by associated disorders rather than by hyperthyroidism per se[5].

MATERIALS AND METHOD

This study was conducted in Neurophysiology lab at Stanley medical college,Chennai. The study was approved from the Institutional Ethical committee,Stanley medical college,Twenty adult female patients with normal thyroid profile were taken as controls,16 patients of hyperthyroid patients before treatment were taken as study group who were attending Endocrinology OPD in the hospital. Patients with H/o diabetes mellitus, alcoholism, any neuro muscular disease, leprosy, drug induced neuropathy, Family H/o neuropathy, other serious illness like malignancy & HIV infection, Liver and kidney disease, pre-existence of myopathy were excluded from the study. All patients were studied after getting informed and written consent, history taking and examination were performed.

By using the standard RMS ENMG EP MARK II machine NCV recordings were done by using standard procedures. The latency, amplitude, duration, area and velocity of motor and sensory nerves were studied. The motor nerve conduction velocity (MNCV) and F wave latency of Median and Peroneal nerves and the sensory nerve conduction velocity (SNCV) of median and sural nerves were studied. All studies were done on left side but H-REFLEX was done bilaterally for all patients. The study was done with careful distance measurements, recording of well-defined artifact free responses, appropriate placement of surface electrodes and careful application of nerve stimulus.

Motor Nerve Conduction Study: Motor NCS performed by electrical stimulation of a peripheral nerve and recording from a muscle supplied by this nerve, characterized by its latency, amplitude, duration, area and conduction velocity. Latency in milliseconds(ms) is the time from the onset of stimulus to the point of take off from baseline, is an index of speed of impulse travel[6]. Size of the response called amplitude (in mV), measured from the baseline to the top of the motor response. Conduction velocity (in M/s) reflects the fastest motor axons[7].

CV (M/s) = Distance (mm) / Latency prox – Latency distal (ms)

Duration in ms signifies the onset of peak to the peak, while the area denotes the product of amplitude and duration and expressed in mVms. Both parameters reflects the density of nerve fibres conducting the impulse.

Sensory Nerve Conduction Study: SNAP(Sensory nerve action potential) is obtained by directly stimulating a sensory nerve and recording directly from it or its branches. Here too, latency, amplitude, duration, area, conduction velocity were calculated. The interpretation of Nerve conduction studies is complex. There may be generalized or focal peripheral neuropathy evident from the nerve affected and changes in latencies, amplitude and conduction velocity[7].

F-Wave Response: It evaluates the conduction velocity of nerves between the limb and spinal cord. By keeping the recording and reference electrodes in the same position, a supramaximal stimulus was given at distal point of stimulus antidromically**.** An average of 15 waves were studied. From the F wave responses displayed, F minimal latency was measured by adjusting the marker provided in the system. It is a late response long latency muscle action potential after motor response (M wave) following a mixed nerve supramaximal stimulation. 10- 20 F waves were obtained, of which shortest latency F wave are used [6].

The H-reflex (“H”OFFMAN-REFLEX STUDY): Subjects were asked to lie in prone position with leg and thigh firmly supported and feet to hang freely with dorsum at right angle to tibia. The recording electrode was placed at the distal edge of calf muscle and the reference electrode 3cms distal to it or on Achilles tendon. Ground electrode was placed between stimulus point and recording electrode. Stimulation was given at midpoint of popliteal crease where large sensory nerve fibres of Tibial nerve were stimulated. This study contains a sensory and a motor branch. The H-reflex is a monosynaptic reflex studied only with a submaximal stimulus and is abolished by supramaximal stimulation. H reflexes remain constant in response to repetitive

stimuli because it occurs from activating the same motor neuron pool. Minimum of 5 H responses were recorded and studied. On increasing the strength of the stimulus, the H response amplitude decreased, simultaneously M response amplitude increased. From the responses obtained, the latency of H REFLEX and its amplitude were obtained. This study was done bilaterally for all subjects. In contrast F-waves represent recurrent discharges from different groups of motor neurons with different conduction characteristics[8].

RESULTS

One way ANOVA F-test and multiple comparisor by Bonferroni t-test were used to compare the means between groups. P values <0.05 were considered significant. In addition, Pearsons correlation co-efficient test were used to correlate T4, TSH and BMI on motor and sensory nerve conduction studies.

1. MOTOR NERVE CONDUCTION-In this mean value of median nerve conduction velocity, peroneal nerve conduction velocity and peroneal nerve amplitude in both the control group as well as the study group were studied. A significant reduction in peroneal nerve motor amplitude was observed with P value of 0.05. The F response latency or minimal latency (F mini) of both median and peroneal nerve were 24.33 (SD 2.38) and 42.5 (SD 5.33). The results did not show significant difference from control group.

Table 1: Comparison of Motor Nerve Conduction Between Hyperthyroid And Control Females

MOTOR NERVE STUDY	CONTROL	STUDY GROUP	P-VALUE
MEDIAN NERVE (CV)	57.81(SD5.63)	58.42(SD7.03)	
PERONEAL NERVE(CV)	49.25(SD2.85)	47.37(SD5.86)	
PERONEAL NERVE AMPLITUDE	4.48(SD2.06)	2.7(SD1.85)	0.05
F-RESPONSE (F-MINI)			
MEDIAN NERVE	24.9(SD2.01)	24.33(SD2.38)	
PERONEAL NERVE	42.5(SD3.36)	42.5(SD5.33)	

2. SENSORY NERVE CONDUCTION: In sensory nerve conduction study the mean value of median nerve action potential area in control group was 22.9 (SD 20.1) whereas in hyperthyroid was 11.98 (SD 11.93) with P value < 0.02.

Table 2: Comparison of Median Nerve Action Potential Between Hyperthyroid And Control Females

MEDIAN SENSORY STUDY	CONTROL GROUP	STUDY GROUP
AREA	22.9(SD20.1)	11.98(SD11.93)
CONDUCTION VELOCITY	54.43(SD7.16)	52.25(SD8.78)

In sural nerve sensory conduction study, the latency and conduction velocity showed significant difference from control group. The mean value of sural nerve latency when compared with study group was significant with P value of 0.004. We got a significant P value of 0.001 while comparing the mean value of sural nerve conduction velocity in hyperthyroid. The amplitude and area of sural nerve action potential were also reduced in 9 out of 16 patients. The mean value of amplitude, duration and area were also observed in study group.

Table 3: Comparison of Sural Nerve Conduction Between Hyperthyroid And Control Females

SURAL NERVE STUDY	CONTROL GROUP	STUDY GROUP	P-VALUE
LATENCY	2.45(0.25)	3.46(SD1.01)	0.004
AMPLITUDE	7.725(SD3.29)	4.53(SD2.26)	0.002
DURATION	2.32(SD0.62)	3.22(SD2.5)	0.05
AREA	16.42(SD7.5)	7.89(SD4.46)	0.001
CONDUCTION VELOCITY	52.7(SD5.76)	43.45(SD8.03)	0.001

3. The H reflex study was also done but did not show much difference from control group.

4. Pearsons correlationwas done between BMI and Sural Nerve Amplitude in New hyper thyroid patients and found to be positive which is shown below in Fig1.

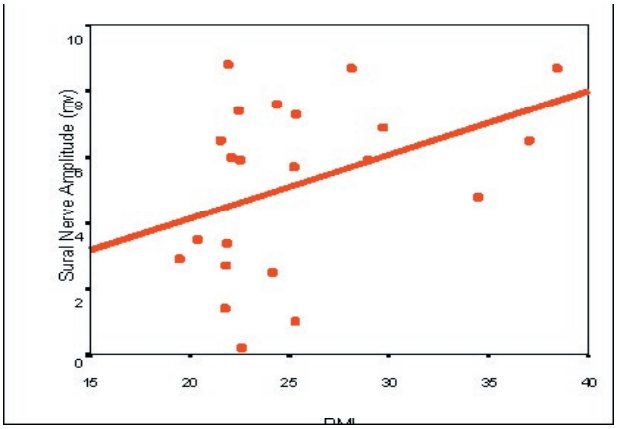

Fig1:Shows the positive correlation between BMI and Sural Nerve Amplitude in New hyper thyroid

DISCUSSION

This prospective cohort study shows that the prevalence of neuromuscular disorders in thyroid dysfunction varies between 20% to 80% as per the literature [3,9]. Our data suggests that a high prevalence of neuromuscular symptoms in thyroid dysfunction is due to a late diagnosis.The findings of motor nerve conduction studies in median and peroneal nerve were within normal range in hyperthyroid patients. But a decrease in motor nerve conduction was observed in previous studies[10,11]. A normal F response was seen in our study group.

In our study decrease in amplitude of peroneal nerve CMAP reveals myopathic changes in new hyperthyroid group. Decrease in latency, amplitude and conduction velocity of sural nerve which was observed in our study may be due to sensory axonal neuropathy. Our findings were consistent with previous studies[12].

Electrophysiogically the neuropathies in hyperthyroid groups seen are predominantly sensory. Even when motor nerve conduction velocity is still within normal range, the sensory nerve action potential may be reduced at early phase of disease. Our findings suggest the presence of initial axonal type of polyneuropathy. The polyneuropathy in hyperthyroid is probably caused by hypermetabolism in thyroid hyperfunction.

CONCLUSION

The neuromuscular signs and symptoms may occur in newly diagnosed patients with thyroid disease. Sensory motor neuropathy which commonly occurs in hypothyroid patients was also observed in our study. These neuronal changes which was observed in our study (newly diagnosed hyperthyroid) should be taken into account in clinical practice. As a conclusion electrophysiological studies can be useful in the diagnosis of asymptomatic polyneuropathy in hyperthyroid patients.

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

Source of Funding: Self

Ethical Clearance: The study was approved from the Institutional Ethical committee,Stanley Medical College.

REFERENCES

1. O'Malley BP, Abbott RJ, Timson L, Beck AD, Rosenthal FD et al London. Sensory thresholds and motor responsiveness in thyroid disease: their responses to treatment and warming.Clin Endocrinol (Oxf) 1985 Jul: 23(1): 17-23, PMID 4028463(PubMed– indexed for MEDLINE)

2. Berlit P, Mahlberg U, Usadel KH et al,Germany. Polyneuropathy in hyperthyroidism - a clinical

neurophysiologic study.Scheweiz Arch Neurol Psychiatr 1992; 143 (1): 81-90, PMID 1373252 (PubMed – indexed for MEDLINE)

3. SozayS,Gokce-kutsalY,Celikeret al ankara,Turkey Neuroelectrophysiological evaluation of untreated hyperthyroid patients,Thyroidology 1994 Aug; 6(2): 55-9, PMID 7536451 (PubMed – indexed for MEDLINE)
4. Ozata M, Ozkardes A, Dolu H, Corakci A, Yardim M, Gundogan MA.Turkey. Evaluation of central motor conduction in hypothyroid and hyperthyroidpatients. J .Endocrinol Invest .1996.Nov;19(10):670-7. PMID: 9007698 [PubMed-indexed for MEDLINE .
5. Annie W. C. Kung Neuromuscular complications of thyrotoxicosis.Clinical Endocrinology doi: 10.1111/j.1365-2265. 2007.02902.x. www.black well.synergy.com
6. Kimura, J., 1986. Electrodiagnosis in diseases of nerve and muscle. Principles and Practices, pp: 109-118.
7. Mishra, U.K. and J. Kalitha, 2005. Clinical Neurophysiology.
8. Lai CL, Tai CT, Liu CK, Lin RT et al Taiwan. A longitudinal study of central and peripheral nerve conduction in hypothyroid rats.J Neurol Sci 1997 May 29;148 (2):139-45, PMID 9129109 (PubMed – indexed for MEDLINE)
9. Torres CF Moxley RT: hypothyroid neuropathy and myopathy- Clinical and electrodiagnostic and longitudinal findings, J Neurol 1990:237:271-4.
10. Cruz MW, Tendrich M, Vaisman M, Novis Sa et al Brasil. Electroneuromyography and neuromuscular findings in 16 primary hypothyroidism patients. Arq Neuropsiquiatr 1996 Mar; 54(1): 12-8 PMID 8736138 (PubMed – indexed for MEDLINE)
11. Rao SN, Katiyar BC, Nair KR, Misra S et al Neuromuscular status in hypothyroidism. Acta Neurol Scand 1980 Mar; 61(3): 167-77 PMID 7395461 (PubMed – indexed for MEDLINE)
12. Ruurd F Duyff, Joan Van den Bosch,et al. Neuromuscular findings in thyroid dysfunction.study Department of Neurology and clinical Neurophysiology Amsterdam the Netherlands. J Neurol Neurosurg Psychiatry 2000, 68:750-755 (June).

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Correlation between BMI and Blood Pressure with Arterial Stiffness among Middle Aged Offspring of Diabetic Parents

Niruba R[1], Vijiyalakshmi[2], Subha K C[3]

[1]Assistant Professor, Annapoorana Medical College, Sankagiri Main Road, Salem, [2]Assistant Professor, Department of Physiology, VMKVMCH, Salem, [3]Associate Professor, Department of Physiology, Annapoorana Medical College, Salem

ABSTRACT

BACKGROUND: In India there is a need to reduce the cardiovascular morbidity due to diabetes in predisposed individuals as diabetes is fast gaining the status of a potential epidemic with more than 62 million diabetic individuals currently diagnosed with the disease [1,2] So we aimed to correlate BMI and systolic blood pressure with arterial stiffness among the normoglycemic offspring of type 2 diabetic parents. Noninvasive method of measuring arterial stiffness can be applied to assess the elasticity of the vessel wall and reduce the cardiovascular morbidity. **STUDY DESIGN**: Cross sectional observational study. **MATERIALS AND METHOD: SUBJECTS** n= 100 males, Age group 35-45 years. All participants had a sedentary life style, blood pressure and glycemic status were measured . Subjects with history of peripheral vascular disease, smokers and any other illness that affects arterial compliance were excluded. Arterial stiffness was assessed from Augmentation index (AI) and stiffness index (SI). AI and SI was measured using IR1 model digital finger tip photo pulse plethysmograph. **RESULTS:** Mean age = 37 ±2 years, Mean BMI = 25± 3, Mean SBP = 124± 4, Mean Stiffness index = 7.4 ±1.4 m/s, Mean Augmentation index= 48 ±2.8 %.Pearson correlation was applied BMI correlated positively with both augmentation index and stiffness index with r value is +0.215 and + 0.406 respectively. Systolic blood pressure(SBP) correlated positively with both augmentation index and stiffness index with r value is +0.391 and + 0.597 respectively. **CONCLUSION:** We conclude that increase in arterial wall stiffness was observed with increase in BMI and systolic blood pressure which might be the consequences of metabolic regulation, inflammatory pathways and other mechanisms.

Keywords*: BMI, SBP, Augmentation Index, Stiffness Index.*

INTRODUCTION

Obesity, increased blood pressure and arterial wall stiffness are independent predictors of cardiovascular diseases with high prevalence among first degree relatives[3,4]of diabetic subjects. Cardiovascular diseases are the most common cause of disability and death among subjects with non–insulin- dependent diabetes mellitus [5]. The atherosclerotic process begins during the prediabetic phase characterized by impaired glucose tolerance, hyperinsulinemia,and insulin resistance. Studies have suggested that glucose and insulin can substantially alter the structure and function of the arterial wall and affect the development of atherosclerosis [6]. These alterations are not late consequences of the disease, because recent studies have shown that arterial distensibility and wall thickness are altered also in subjects with glucose intolerance who do not have but are predisposed to diabetes [7,8] . Arterial stiffening is a natural consequence of aging, but a number of disease states have been shown to contribute to arterial stiffening, such as hypertension, chronic kidney disease (CKD), obesity, and diabetes [9]. Recording of peripheral pulse wave and digital volume pulse is a reliable index to assess stiffness index which can reflect large artery stiffness. Reflection index can assess medium and small artery stiffness [7].

Corresponding author:
Dr. R. Niruba, MBBS, MD (Physiology)
Assistant Professor, Annapoorana medical college, sankagiri main road, Salem**.** Contact no- 09360048333, E-mail- kktrniruba@gmail.com

AIM

To correlate BMI and systolic blood pressure with arterial stiffness among normoglycemic middle aged offspring of diabetic parents.

STUDY DESIGN: Observational/cross sectional study.

MATERIALS AND METHOD

All participants gave a written informed consent to participate in this study. Information details about sociodemographic characteristics, disease history, family history, alcohol consumption, cigarette smoking, drug intake and occupational history were obtained by a structured questionnaire. All participants had a sedentary lifestyle. Institutional ethical committee clearance was obtained

SUBJECTS

Inclusion criteria: 100 healthy volunteers normoglycemic males with paternal or maternal history of diabetes, Age= 35- 45 yrs, Blood pressure = < 140/90 mmHg, Fasting blood sugar = 90-100 mg/dl.

Exclusion Criteria: Subjects with history of peripheral vascular disease , smokers, and any other illness that affects arterial compliance , Anthropometric measurements were taken.

Height was measured using stadiometer and weight was measured using precalibrated weighing machine. Quetlet's index was used to calculate Body mass index (weight/height in m2).Blood pressure was measured using a standard mercury sphygmomanometer. Fasting blood glucose was measured to rule out diabetic mellitus.

Recording of digital volume pulse (DVP): Digital volume pulse was recorded by in house built instrument IR1 model digital finger photoplethysmography [11]. The signal from the instrument placed on the right index finger was digitalized by digital converter with a frequency of 100 Hz which was connected to the computer. DVP was analyzed by software virtual oscilloscope.

Digital volume pulse contains 2 peaks:

1. Systolic peak.

2. Diastolic peak.

Initially Systolic peak is formed by pulse wave transmitted from the left ventricle to the finger directly.[10] Second peak or diastolic peak arises from pulse wave transmitted along the aorta to the small arteries in the lower body, from where they are again reflected along the aorta as a reflected wave[11]. This path length is proportional to the subject's height (h). Pulse transit time (PTT or ΔT) is the time interval between systolic peak and diastolic peak. It was measured by software image tool. Magnitude of systolic and diastolic peak were also measured .Stiffness index is based on the subjects height [12].

Stiffness index and Reflective index were calculated by the following formulas.

Stiffness index (SIDVP) = Subject's height (h).

Pulse transit time (ΔT).

Augmentation index (AI) = Magnitude of diastolic peak (b) × 100.

Magnitude of systolic peak (a).

RESULT

Statistical analysis was done Using SPSS Software version 16.0. The descriptive statistics of Age, BMI, Blood sugar, Systolic blood pressure, Diastolic blood pressure are mentioned in table 1.

Pearson correlation was applied. Correlation between BMI with stiffness index and augmentation index was analyzed among study group and it showed a positive correlation with r value is +.406 and +.215 respectively .Systolic blood pressure showed positive correlation with stiffness index and augmentation index with r value is +.579 and +.391 respectively (Table 2).

DISCUSSION

Our study showed a positive correlation of BMI and systolic blood pressure with stiffness index and reflective index. Indicating increased body weight and systolic blood pressure affects the vessel wall compliance in predisposed individuals.Obesity as measured by BMI[13] is the risk factors for diabetes mellitus and cardiovascular disease, such as ischemic heart disease and stroke [13,14]. Conversely, rapid weight gain with visceral fat accumulation appears to be associated with the development of arterial stiffening, although this may in part be attributable to rises in blood pressure [15]. Blood pressure plays a significant role in determining vessel wall structure, with remodeling occurring to compensate for changes in wall stress [16].Aortic pulse wave velocity (PWV) is associated with endothelial dysfunction in patients with isolated systolic hypertension, a condition

resulting from large artery stiffening [17]. The finding that the normoglycemic healthy offspring of patients with type II diabetes mellitus have decreased arterial distensibility and greater pulse pressure also suggests that arterial stiffening may occur at an early stage[18] despite apparently normal arterial structure. Arterial stiffness appears to be affected by the presence of increasing numbers of components of the metabolic syndrome[19] although the mechanisms remain unclear. Potential causes include inflammation, dyslipidemia, andoxidative stress, although these are rarely taken into accountas independent confounding factors. It is also worthwhile remembering the confounding nature of blood pressure in such studies. Non-invasive measurement of vascular wall elasticity can assess functional status of the arteries and early detection of pathologies before the onset of clinical symptoms [20,21]. Alvarez et al and Abate et al stated that after weight loss, the increased stiffness is reversed in parallel with reduction of heart rate which might be due to neural sympathetic over activity[22,23]. In addition to hypothalamic receptors, receptors for leptin have been observed on the vascular endothelium and on smooth muscle cell [24,25]. Accordingly, leptin can exert receptor-mediated influence on vessel tone and growth and, in cell culture, stimulate vascular smooth muscle proliferation and migration [26]. Peripheral Pulse Pressure, central Pulse Pressure and augmentation index, which provide additional information on wave reflection, are considered "surrogates" of arterial stiffness [27,28,29].

Table -1: Descriptive statistics:

N= 50		Mean ± SD
Age	(yrs)	37±2
BMI	(kg/m2)	25±3
Stiffness index(SI)	(m/s)	7.5 ±0.9
Augmentation index(AI)	(%)	54 ±2.8
Fasting Blood sugar	(gm/dl)	94 ±3
Systolic blood pressure	(mm Hg)	124±4
Diastolic blood pressure	(mm Hg)	82±3

Table -2: Correlation between BMI, Systolic blood pressure(SBP) with stiffness index (SI) and Augmentation index(AI).

N=50	Stiffness index (SI)	Augmentation index(AI)
BMI(kg/m2) r value	.406	.215
SBP (mm Hg) r value	.579	.391

CONCLUSION

Vessel wall compliance as measured by arterial stiffness is altered in obese and overweight individual. we assessed small and large artery function in our study. We conclude that increase in arterial wall stiffness was observed with increase in BMI and systolic blood pressure which might be the consequences of metabolic regulation, inflammatory pathways and other mechanisms.

Implicaion of Study : Our study suggest life style modification to the predisposed group like offspring of diabetic parent to improve the vessel wall compliance prevent further progression to cardiovascular diseases.

Source of Funding : None

Conflict of Interest : None

REFERENCES

1) Joshi SR,Parikh RM.India - diabetes capital of the world: now heading towards hypertension. J Assoc Physicians India. 2007;55:323–4.

2) Kumar A, Goel MK, Jain RB, Khanna P, Chaudhary V. India towards diabetes control: Key issues. Australas Med J. 2013;6(10):524–31.

3) Blonde CV, Webber LS, Foster TA et al Parental history and cardiovascular disease risk factor variables in children. Prev Med.1981;10:25-37.

4) Burke GL,Savage PJ,Sprafka JM et al. Relation of risk factor levels in young adultwood to parental history of disease:the cardia study; Circulation 1991;84:1176-1187.

5) Barrett-Connor E, Orchard T. Diabetes and heart disease. In: Harris M, ed. Diabetes in America. Washington, DC:NIH; 1984; XVI :1-41.

6) Veikko Salomaa, MWard Riley,Jeremy D et al Non–Insulin-Dependent Diabetes Mellitus and Fasting Glucose and Insulin Concentrations Are Associated With Arterial Stiffness Indexes,Circula tion.1995; 91: 1432-1443.

7) Henry RM, Kostense PJ, Spijkerman AM, Dekker JM, Nijpels G, Heine RJ, Kamp O, Westerhof N, Bouter LM, Stehouwer CD. Arterial stiffness increases with deteriorating glucose tolerance status: the Hoorn study. Circulation. 2003; 107: 2089–2095.

8) Cruickshank K. Riste L, Anderson SG, Wright JS, Dunn G, Gosling RG. Aortic pulse-wave velocity

and its relationship to mortality in diabetes and glucose intolerance: an integrated index or vascular function? Circulation. 2002; 106: 2085–2090.

9) Arterial Stiffness in Children: Pediatric Measurement and ConsiderationsJonathan D. Savant,[a] Susan L. Furth,[a,b,*] and Kevin E.C. MeyersPulse (Basel). 2014 May; 2(1-4): 69–80.

10) Millasseau SC,Kelly RP,Ritter JM et al .Determination of age related increases in large artery stiffness by digital pulse contour analysis. Clin Sci (lond) 2002;103:371-7.

11) G Sivagami,Milind Bhutkar,A Comparitive study of arterial stiffness indices between normotensive and hypertensive subjects-NJBMS,2014 : 4(3); pg-177-179.

12) Chen CH, Nevo E ,Fetics B et al .Estimation of central aortic pressure waveform by mathematical transformation of radial tonometry pressure.Validation of generalized transfer function. Circulation 1997;95:1827-36.

13) Garrow JS, Webster J. Quetelet's index (W/H2) as a measure of fatness. Int J Obes 1985; 9: 147–153.

14) Krauss RM, Winston M, Fletcher RN, Grundy SM. Obesity: impact of cardiovascular disease. Circulation 1998; 98:1472–1476.

15) Orr JS, Gentile CL, Davy BM, Davy KP. Large artery stiffening with weight gain in humans: role of visceral fat accumulation. Hypertension.2008;51: 1519 –1524.

16) Flamant M, Placier S, Dubroca C, Esposito B, Lopes I, Chatziantoniou C,Tedgui A, Dussaule JC, Lehoux S. Role of matrix metalloproteinases in early hypertensive vascular remodeling. Hypertension. 2007;50:212–218.

17) Wallace SM, Yasmin, McEniery CM, Maki-Petaja KM, Booth AD, Cockcroft JR, Wilkinson IB. Isolated systolic hypertension is characterized by increased aortic stiffness and endothelial dysfunction. Hypertension. 2007;50:228 –233.

18) Giannattasio C, Failla M, Capra A, Scanziani E, Amigoni M, Boffi L,Whistock C, Gamba P, Paleari F, Mancia G. Increased arterial stiffness in normoglycemic normotensive offspring of type 2 diabetic parents. Hypertension. 2008;51:182–187.

19) Ghiadoni L, Penno G, Giannarelli C, Plantinga Y, Bernardini M, Pucci L,Miccoli R, Taddei S, Salvetti A, Del Prato S. Metabolic syndrome and vascular alterations in normotensive subjects at risk of diabetes mellitus. Hypertension. 2008;51: 440–445

20) Oliver JJ, Webb DJ. Noninvasive assessment of arterial stiffness and risk of atherosclerotic events. Arterioscler. Thromb. Vasc. Biol. 2003; 23: 554–566.

21) Mattace-Raso F, Cammen T, Hofman A. et al. Arterial stiffness and risk of coronary heart disease and stroke. The Rotterdam Study. Circulation 2006; 113: 657–663.

22) Alvarez GE, Beske SD, Ballard TP, Davy KP: Sympathetic neural activation in visceral obesity. Circulation 106, 2002 : 2533– 2536.

23) Abate NI, Mansour YH, Tuncel M, Arbique D, Chavoshan B, Kizilbash Over weight and sympathetic overactivity in black Americans. Hypertension 2001;38: 379–383.

24) Oda A, Taniguchi T, Yokoyama M: Leptin stimulates rat aortic smooth muscle cell proliferation and migration. Kobe J Med Sci,2001; 47: 141–150.

25) Sierra-Honigmann MR, Nath AK, Murakami C, Garcia-Cardena G, Papapetropoulos A, Sessa WC, Madge LA, Schechner JS, Schwabb MB, Polverini PJ, Flores-Riveros JR: Biological action of leptin as an angiogenic factor. Science ,1998;281: 1683– 1686.

26) Schafer K, Halle M, Goeschen C, Dellas C, Pynn M, Loskutoff DJ, Konstantinides S: Leptin promotes vascular remodeling and neointimal growth in mice. Arterioscler Thromb Vasc Biol , 2004;24: 112–117

27) Robb AO, Mills NL, Din JN, Smith IB, Paterson F, Newby DE, Denison FC. Influence of the menstrual cycle, pregnancy, and preeclampsia on arterial stiffness. Hypertension. 2009;53:952–958.

28). Joly L, Perret-Guillaume C, Kearney-Schwartz A, Salvi P, Mandry D,Marie PY, Karcher G, Rossignol P, Zannad F, Benetos A. Pulse wave velocity assessment by external noninvasive devices and phase-contrast magnetic resonance imaging in the obese. Hypertension. 2009;54: 421–426.

29) Li Y, Wang JG, Dolan E, Gao PJ, Guo HF, Nawrot T, Stanton AV, Zhu DL, O'Brien E, Staessen JA. Ambulatory arterial stiffness index derived from 24-hour ambulatory blood pressure monitoring. Hypertension. 2006;47:359 –364.

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Effect of Duration of Diabetes on Cognitive Function in Non-insulin Dependent Diabetics

Mythri G[1], Manjunath ML[2], Girish Babu M[3]

[1]Assistant Professor, Department of Physiology, Subbaiah Institute of Medical Sciences, Shivamogga, [2]Professor and HOD, [3]Associate Professor, Department Of Physiology, Shivamogga Institute of Medical Sciences, Shivamogga

ABSTRACT

Background: The increase in diabetes among the elderly is of concern because in addition to the wide range of traditional diabetes complications, evidence has been growing that diabetes is associated with increased risk of cognitive decline.

Aims and Objectives: To find out if there is any association between cognitive function and duration of diabetes.

Materials and Method: The study was carried out in 100 individuals aged between 40-65 years consisting of 100 diagnosed cases of Non Insulin Dependent Diabetes Mellitus and 100 non-diabetics irrespective of duration of Diabetes from OPD of Mc Gann Hospital, Shivamogga. Rye's Auditory Verbal Learning Test, Verbal Fluency Test and Working Digit Span Test to assess short-term memory, Visual Reproduction Test and Validation Span Test were used to assess working memory. Statistical analysis was done using SPSS 21.

Results: Memory test scores of non insulin diabetics were significantly reduced ($p<0.001$) when compared to the memory scores of age and gender matched non-diabetics. Duration of diabetes was found to have a negative correlation with memory scores for all 5 tests: AVLT ($r=-0.849$ & $p<0.001$), VFT ($r=-0.927$, $p<0.001$), VRT ($r=-0.816$, $p<0.001$), WDST ($r=-0.829$, $p< 0.001$) and VST ($r=-0.955$, $p<0.001$).Subjects with diabetes for >10 years showed greatest cognitive decline.

Conclusion: The decreased memory status in diabetic patients may be due to many factors like hyperglycemia, hypoglycemia, vascular disease, insulin resistance, amyloid deposition and also some of the factors combine to produce additive effects like, type of diabetes, co-morbidities, age of onset, duration of the disease and type of therapy. These observed effects of duration of diabetes on memory status are of potential clinical importance because even mild cognitive impairment could interfere with day today activities.

Keywords: *Diabetes; duration; memory.*

INTRODUCTION

Memory is the complex function of the brain that uses several storage buffers of different capacity and duration. Memory function includes registration (encoding or acquisition), retention (storage or consolidation), stabilization and retrieval (decoding or recall).[1]

Corresponding author:
Dr Mythri G,
Assistant Professor, Department of Physiology, Subbaiah Institute of Medical Sciences, Shivamogga, Karnataka. E-mail: g.mythri@gmail.com

Short term memory refers to the function that temporarily retains stimuli that have just been perceived and lasts for ~20 seconds. Working memory is a short term memory system that allows concurrent retention and manipulation. It is used for thinking about what are already known and deriving conclusions on the basis of that knowledge.[2]

The deleterious effects of diabetes mellitus on the retinal, renal, cardiovascular, and peripheral nervous systems are widely acknowledged. Less attention has been given to the effect of diabetes on cognitive function. Neurological consequences of diabetes appear parallel

to those observed in aging brain. The main hypothesis to explain the pathophysiology of cognitive decline associated with diabetes involves hyperglycemia, hypoglycemia, microvascular injury, insulin resistance, hyperinsulinemia, hyperphosphorylation of tau protein and amyloid-β_2 deposition.[3]

Hence, this study was done to evaluate the short term and working memory in non insulin dependent diabetics and compare it with age and gender matched non diabetics and also know the effect of duration of the diabetes on cognitive function.

MATERIALS AND METHOD

The study was carried out in 200 individuals aged between 40-65 years consisting of 100 diagnosed cases of Non Insulin Dependent Diabetes Mellitus and 100 non-diabetics from OPD of Mc Gann Hospital, Shivamogga.

Institutional Ethical Committee clearance was obtained. Details of the study protocol were explained to the subjects who volunteered for the study and Informed consent was taken General information, present complaints, history of diabetes and hypertension if present, duration and treatment of same, any past illness, drug history and family history was noted. Pulse and Blood Pressure was recorded. Laboratory investigations include Fasting Blood Sugar (FBS), Post-prandial blood sugar (PPBS) and Glycosylated Hemoglobin.

Inclusion Criteria For both the groups:

1. Age 40-65 years who have given written consent.

2. Educational status: Minimum primary school.

Exclusion Criteria for both the groups:

1. History of any known psychiatric disorders,

2. History of any other known endocrinal disorders,

3. History of any sedative/narcotic abuse,

4. History of any other known medical disorders causing dementia,

5. History of intake of any drugs known to cause dementia.

The following tests were carried out on the subjects (study & control) in a relaxed state and privacy was given utmost importance: Rye's Auditory Verbal Learning Test (AVLT), Verbal Fluency Test (VFT) and Working Digit Span Test(WDST) to assess short-term memory, Visual Reproduction Test(VRT) and Validation Span Test (VST) were used to assess working memory. [1, 4]

Statistical analysis was done using SPSS software version 21.Initially data was tested for normality using Kolmogorov-Smirnov Test and Shapirowik Test. Since the data doesn't follow normal distribution, non-parametric tests were used which include Mann Whitney U Test and Correlation Regression Analysis was done using Spearman Rank Correlation.

RESULTS

The memory scores (%) for all 5 memory tests in the non insulin dependent diabetic patients were found to be decreased and the decrease in the scores were statistically significant when compared to normal subjects (P value< 0.001) by Kruskall Wallis Anova Test.

In this study Diabetic patients were divided into 3 groups according to their duration of the disease as; Group A - Diabetes patients of ≤ 5years duration, Group B – Diabetes patients of 6-10years duration and Group C – Diabetes patients of >10years duration.

Median and IQR of all the memory test for diabetic patients of Group A, B and C are shown in Table 1. The median scores of the tests are depicted in Figure. Table No.1also shows statistical analysis by Kruskal Wallis One Way Anova Test.

1. Auditory Verbal Learning Test:

The Median memory score of the Group A diabetes patients were found to be 56%, Group B - 44% and Group C - 28.65%. The pairwise comparisons of AVLT memory score were found to be statistically significant. (P<0.001).

2. Verbal Fluency Test:

The Median memory score of the Group A diabetes patients were found to be 67.5 % when compared with scores of Group B - 48.75% and Group C - 32.5%. The pair wise comparisons of VFT memory score were found to be statistically significant. (P<0.001).

3. Visual Reproduction test:

The Median memory score of the Group A diabetes patients were found to be 94 % when compared with scores of Group B - 84% and Group C - 65%. The pair wise comparison of VRT memory score was found to be statistically significant. (P<0.001).

4. Working Digit Span Test:

The Median memory score of the Group A diabetes patients were found to be 84% when compared with scores of Group B - 54% and Group C - 34%. The pairwise comparison of WDST memory score was found to be statistically significant. (P<0.001).

5. Validation Span Test:

The Median memory score of the Group A diabetes patients were found to be 52% when compared with scores of Group B - 34% and Group C - 7%. The pairwise comparision of VST memory score was found to be statistically significant. (P<0.001).

Inter-group Significance by Kruskal Wallis One way Anova Test for the memory scores of Diabetics of different duration showed a significant p-value of <0.001 (Table No. 1) during overall comparison as well as pair wise comparison between the three groups(Group A, Group B and Group C)of Diabetic Subjects of different durations. Group C patients showed a significantly reduced score compared to Group A and Group B patients, and Group B patients showed a significantly reduced score compared to Group A patients for all the five memory tests with a significant p-value(p<0.001).

When the duration of the diabetes was correlated with the scores of memory tests using Spearman Rank Correlation, the following results were found (Table no. 2)A statistically significant correlation was found between the duration of the diabetes and scores of AVLT (r=-0.849 & p<0.001) indicating that as the duration of the disease increased the scores of AVLT deceased. VFT scores were found to be decreased with the increase of the duration of the disease which was statistically significant. (r=-0.927, p<0.001) which has negative correlation. Scores of VRT were found to be negatively correlated with the duration of the diabetes. (r=-0.816, p<0.001). WDST scores were decreased with the increase of the duration of the diabetes which was found statistically significant (r=-0.829, p< 0.001). A statistically significant negative correlation was found between the duration of the diabetes and scores of VST (r=-0.955, p<0.001).

The study revealed that an increase in duration of diabetes worsened the cognitive status (by Kruskall Wallis Anova) and also memory scores and duration were negatively correlated (by Spearman rank Correlation).

TABLE NO.1: STATISTICAL ANALYSIS

MEDIAN (MED) & INTER-QUARTILE RANGE (IQR) OF MEMORY SCORES (%), P VALUES OF KRUSKAL WALLIS ONE WAY ANOVA TEST OF MEMORY TESTS OF DIABETICS OF DIFFERENT DURATION

TESTS	DIABETIC PATIENTS						INTER GROUP SIGNIFICANCE
	Group A <5years		Group B 6-10years		Group C >10years		
	MED	IQR	MED	IQR	MED	IQR	
1. AVLT	56	5.7	44	9.7	28.65	20	OVERALL: P-VALUE<0.001 (S) PAIRWISE: C,B : p-VALUE< 0.001 (S) C, A : p-VALUE< 0.001 (S) B,A : p-VALUE< 0.001 (S)

Cont... **TABLE NO.1: STATISTICAL ANALYSIS**

2.	VFT	67.5	20.6	48.75	10	32.5	9.4	OVERALL : P-VALUE<0.001 (S) PAIRWISE: C,B : p-VALUE< 0.001 (S) C, A : p-VALUE< 0.001 (S) B,A : p-VALUE< 0.001 (S)
3.	VRT	94	9	84	8	65	34	OVERALL: P-VALUE<0.001 (S) PAIRWISE: C,B : p-VALUE< 0.001 (S) C, A : p-VALUE< 0.001 (S) B,A : p-VALUE< 0.001 (S)
4.	WDST	84	16	54	17	34	7	OVERALL : P-VALUE<0.001 (S) PAIRWISE: C,B : p-VALUE< 0.001 (S) C, A : p-VALUE< 0.001 (S) B,A : p-VALUE< 0.001 (S)
5.	VST	52	13	34	9	7	8	OVERALL: P-VALUE<0.001 (S) PAIRWISE: C,B : p-VALUE< 0.001 (S) C, A : p-VALUE< 0.001 (S) B,A : p-VALUE< 0.001 (S)

TABLE 2: STATISTICAL ANALYSIS

CORRELATION CO-EFFICIENT (r) AND P-VALUE OF MEMORY SCORES (%)OF MEMORY TESTS AND DURATION OF DIABETES IN DIABETIC PATIENTS USING SPEARMAN RANK CORRELATION

SL. NO.	TESTS	CORELATION COEFFICIENT(r)	P-VALUE
1	AVLT	-0.849	<0.001 (S)
2	VFT	-0.927	<0.001 (S)
3	VRT	-0.816	<0.001 (S)
4	WDST	-0.829	<0.001 (S)
5	VST	-0.955	<0.001 (S)

DISCUSSION

When pair wise comparison was done using Kruskal Wallis one way Anova Test among Group A (≤5yrs duration) patients, Group B (6-10yrs duration) and Group C (>10 years duration) diabetic patients for all memory tests; Group C patients showed a significantly reduced score compared to Group A and Group B patients, and Group B patients showed a significantly reduced score compared to Group A patients for all the five memory tests with a significant p-value($p<0.001$). Further, correlation regression analysis was done using Spearman Rank Correlation showed a significant negative correlation between duration of diabetes and all the five memory test scores(p-value<0.001).

In the present study it was observed that decrease in the all memory tests score were statistically significant when compared within the groups (Group :< 5yrs duration, Group B: 5-10years duration and Group C: >10years duration). This was may be because of increased duration of the diabetes[5,6-7](Mean, 7.48±3.72years), early onset of the disease[8], less years of schooling[6], poorly controlled diabetes and hyperglycemia[9] (FBS: 153.9±21.31 mg%; PPBS:237.6±38.05 mg% and HbA_{1C}: 8.15±1.05). These results are agreeable to few of the other workers like Alencar[6], Ebady[7] S.A & Weli Xu.[8]

Bhagoji SB , Patil M, Mirje M in their study entitled "Effect of Duration of Type 2 Diabetes On Short term and Working Memory " on 114 type 2 diabetics showed that short term and working memory status was negatively correlated with duration of the diabetes.[4]

Grodstein F, Chen J, Wilson R and Manson JE in their study entitled "Type2 Diabetes And cognitive Function an Community Dwelling Elderly Women" on 82 women with type 2 Diabetes, longer duration of diabetes was associated with lower scores.[10]

Korf ESC, White LR, Scheltens P, Launer LJ in their study entitled "Brain Aging In Very Old Men With Type 2 Diabetes" , on 204 non-diabetics and 202 Type 2 diabetics showed that compared with the subjects with diabetes for ≤ 5years (n=53), those with diabetes of ≥20 years(n=25) had more cognitive decline with more lacunaes , hippocampal atrophy and infarcts.[11]

Rosebud O. Roberts, Yonas E. Geda, David S. Knopman, Teresa J.H. Christianson, V. Shane Pankratz & Bradly F. Boeve et.al in their study entitled "Duration and Severity of Diabetes Are Associated with Mild Cognitive Impairment" found that Mild cognitive impairment was associated with onset of diabetes mellitus before age 65yrs (Odds Ratio, OR=2.20), diabetes mellitus duration of 10years or longer (OR=1.76), treatment with insulin (OR=2.01) & the presence of diabetes mellitus complications (OR=1.80) after adjustment for age, sex & education.[12]

Alencar RC, Cobas RA and Gomes MG in a cross sectional study entitled "Assessment of cognitive status in patients with type 2 diabetes through the mini-mental status examination" in 2007 found that 12.1% of diabetic patients in the study group with a duration of the diabetes 12.3±9.1yrs had diagnosis of dementia & this was also associated with years of study.[13]

Ebady SA, Arami MA & Shafiq MH studied 60 diabetic patients and 60 non diabetic controls & found a significant negative correlation between duration of disease and cognitive dysfunction.[7]

In the present study it was found that increase in the duration of the diabetes worsened the memory status in diabetes patients (By Kruskal Wallis Anova) and further it was also observed that all the memory tests showed memory status and duration of the diabetes were negatively correlated (Spearman Rank correlation-regression analysis) which is similar to the study by Ebady S.A.[7] This decrease in the memory was may be due to the deposition of senile plaques in the brain[14], progressive insulin resistance[15] and natural age related memory deficits[5].

LIMITATIONS

Prospective studies are required to examine the putative link between non insulin dependent diabetes and cognitive dysfunction, because only by using such study designs can a causal relationship be established. Since different studies have utilized different psychological tests, there is a need to develop a standard study design that can be employed in testing cognitive impairment in type 2 diabetes.

CONCLUSION

This study shows that the short term and working memory scores were decreased in diabetic patients and this decrease in memory status was statistically significant when compared to normal subjects. The main hypothesis to explain the decline in memory status in diabetic patients with respect to duration, gender, age, blood sugar levels and glycemic control are hyperglycemia, hypoglycemia, microvascular injury, insulin resistance, hyperinsulinemia, hyperphosphorylation of tau protein and amyloid-β_2 deposition.

The relationship is worth investigating further, because both diabetes and dementia are becoming major public health threats in view of the continuous aging of the population. A better understanding of the mechanisms linking diabetes to cognition may uncover new possibilities for prevention of age-related cognitive decline.

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REFERENCES

1. Kasper DL, Braunwald E, Fauci AS, Hauser SL, Longo DL, Jameson JL, editors. Harrison's Principles of Internal Medicine. 16th ed. NewYork: McGraw-Hill; 350: 2393-5.
2. Sommerfield AJ, Deary IJ, McAulay V, Frier BM. Short term, delayed and working memory are impaired during hypoglycaemia in individuals with type 1 DM.Diabetes Care 2003; 26: 2
3. Szeman B, Nagy G, Varga T, Veres-Szekely A, Sasvari M et al. Changes in cognitive function in patients with diabetes mellitus. OrvHetil March 2012; 153(9): 323-9.
4. Bhagoji SB, Patil M, Mirje M. Effect Of Duration Of Type 2 Diabetes On Short Term And Working Memory . IJMPS Oct 2015; 4(6): 26-30.
5. Perlmuter LC, Hakami MK, Hodgson-Harrington C, Ginsberg J, Katz J, Singer DE, Nathan DM. Decreased cognitive function in aging non-insulin-dependent diabetic patients. Am J Med . 1984;77: 1043–8.
6. Alencar RC, Cobas RA,Gomes MB. Assessment of cognitive status in patients with type 2 diabetes through the mini-mental status examination: a cross-sectional study. Diabetology & Metabolic Syndrome 2010;2:10.
7. Ebady SA, Arami MA, Shafiq MH. Investigation on the relationship between diabetes mellitus type 2 and cognitive impairment. Diabetes Res Clin Pract. 2008;82:305-9.
8. Xu W, Qiu C, Margaret G, Pedersen NL, JohanssonB, FratiglioniL. Mid- and Late-Life Diabetes in Relation to the Risk of Dementia. Diabetes 2009; 58:71-7.
9. Solanki RK, Dubey V, Munshi D. Neurocognitive impairment and comorbid depression in patients of diabetes mellitus.J Diabetes Dev Ctries. 2009 Jul-Aug; 29(3): 133–38.
10. Grodstein F, Chen J, Wilson R and Manson JE .Type2 Diabetes And cognitive Function in Community Dwelling Elderly Women. Diabetes Care 2001; 24:1060–5.
11. Korf ESC, White LR, Scheltens P, Launer LJ .Brain Aging In Very Old Men With Type 2 Diabetes. Diabetes Care 2006; 29:2268–74.
12. Roberts RO, Geda YE, Knopman DS, Christianson TJH, Pankratz VS, Boeve BF, et al. Association of Duration and Severity of Diabetes Mellitus With Mild Cognitive Impairment. ARCH NEUROL 2008; 65:1066-73
13. Anthony K, Reed LJ, Dunn JT, Bingham E, Hopkins D, Marsden PK, et al.Attenuation of insulin-evoked responses in brain networks controlling appetite and reward in insulin resistance: the cerebral basis for impaired control of food intake in metabolic syndrome? Diabetes 2006; 55:2986–92.
14. Heitner J, Dickson D .Diabetics do not have increased Alzheimer-type pathology compared with age-matched control subjects. A retrospective postmortem immunocytochemical and histofluorescent study. Neurology 1997; 49:1306–11.
15. Yaffe K, Blackwell T, Whitmer RA, Krueger K, Barrett Connor E .Glycosylated hemoglobin level and development of mild cognitive impairment or dementia in older women. J Nutr Health Aging 2006; 10:293–295.

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Prediction of Insulin Resistance with Anthropometric Measures in Adolescence

B L Preethi[1], K M Prasannakumar[2]

[1]Associate Professor, Department of Physiology, M.S. Ramaiah Medical College, Bangalore,
[2]Professor Endocrinology, Center for Diabetes & Endocrine Care (HBR Layout), Bangalore

ABSTRACT

In regions of higher incidence of diabetes, more frequent screening is recommended to improve diabetes management and to initiate prevention strategies. Some developed countries screen Obese children with higher BMI with oral glucose tolerance test each year. There is a need to validate use of anthropometric measures for screening and early detection of subjects who are at risk of developing diabetes. We hypothesized that normoglycemic young adult who are siblings of diabetics or obese subjects are genetically predisposed & they are known to have a higher substantial heritable component of insulin resistance than the siblings of non-diabetics. This study evaluated simple anthropometric measures that will be optimally required to predict insulin resistance in normoglycemic. Siblings of Diabetics were obese compared to siblings of non diabetics. Siblings of diabetics had higher BMI and Waist circumference with significantly lower IS values & higher IR values. It was observed that ISI_{0-120} indices showed a significantly better correlation with compared to HOMA IR in siblings of diabetics in both first & second degree relatives. ISI_{0-120} values were significantly lower in Siblings of Diabetics with higher BMI, longer Waist circumference. Significant correlation with clinical measures like BMI & waist circumference was observed. BMI <23.9 there were 50 subjects and in Group B: BMI > 24 there were 30 subjects.

Keyword: *Insulin sensitivity, Insulin resistance, IR, IS, ISI, HOMA IR, BMI, Waist Circumference*

INTRODUCTION

World Health Organization (WHO) reported the Globally the prevalence of Diabetes is increasing and is expected to double by 2030 . Type 2 diabetes (T2DM) constitutes 85-90%, it is largely attributed to notably greater longevity and being overweight or obese . There is an increase incidence in developing countries due to urbanization, lifestyle changes, less physically demanding work and the global nutrition transition. It is also observed that increasing sedentary lifestyles, marked increased intake of foods (high energy-dense but nutrient-poor)[1, 2]. Currently 62 million Indians suffer from diabetes i.e, 7.1% of the adult population. The average age on onset being 42.5 years. 1 million Indians die due to diabetes every year [3]. India is projected to be home to 109 million individuals with diabetes by 2035[4].

The Review of Guidelines for Screening and Treatment affirms the use of fasting plasma glucose test (FPG) or a 2-hour plasma glucose (2hPG) as a screening tool[5]. In regions of higher incidence of diabetes, more frequent screening is recommended to improve diabetes management and to initiate prevention strategies. Some developed countries screen Obese children with higher BMI with oral glucose tolerance test each year[6]. Insulin resistance (IR) exists when physiological normal concentration of insulin produces a less than normal biological response. Obese youth have a potential for developing metabolic syndrome, Therefore, it is critical to measure insulin resistance (IR) before the onset of IGT in order to implement preventive measure[7-17]. A simple Oral glucose tolerance test (OGTT) is the simplest and most commonly used method for evaluating IR. many mathematical models

Author for Correspondence:
Dr. B.L.Preethi
Associate Professor, Department of Physiology
M.S.Ramaiah Medical College, MSRIT Post,
Bangalore, Karnataka State, India.
E mail: blpreethi97@gmail.com
Mobile:+91-9845803787

of IS or IR [12,13].

There is a need to validate use of anthropometric measures for screening and early detection of subjects who are at risk of developing T2DM. We hypothesized that normoglycemic young adult who are siblings of diabetics (SD) or obese subjects are genetically predisposed & they are known to have a higher substantial heritable component of insulin resistance than the siblings of non-diabetics(SND) [19,20]. We study the correlation of anthropometric measures with Insulin Resistance (IR) derived from OGTT [14-22].

The objective of this study was to evaluate anthropometric measures that can optimally predict insulin resistance (IR) in normoglycemic subjects.

MATERIAL AND METHOD

With informed consent, 80 healthy young adult volunteers were recruited for the study. The study subject's demographic and clinical data were collected. Complete clinical evaluation included weight and height measured while the subjects were fasting overnight and wore light clothes without shoes. Waist and hip circumferences (to the nearest 0.5 cm) were measured using a plastic tape meter at the umbilicus level and at the greater trochanters, respectively, and waist-to-hip ratio (WHR) was calculated. Blood pressure was measured using a standard mercury sphygmomanometer on the left arm after at least 10 min of rest, Mean BP were determined from two independent measurements.

Laboratory evaluation: A standard (75 g) OGTT was performed on all the study subjects. Blood samples for determination of plasma glucose; insulin levels were drawn at 0(fasting), 30min, 120 min after solution ingestion. Assays: Fasting (basal), 30, 120 min venous plasma glucose during OGTT was determined by glucose oxidase method on site using glucose auto analyzer. The serum plasma was stored at - 20 0C until assayed. Corresponding specific insulin concentration was determined by radioimmuno assay (RIA) using a human specific antibody RIA kit, which does not cross-react with human proinsulin. The WHO diabetes criteria for labelling the subjects as normoglycemic: a fasting venous plasma glucose concentration of less than < 6.1 mmol /l (<110mg/dl) and a 2 hour post glucose load <7.8 (<140mg/dl) was used. The data was systematically collected in the case record form designed for the study and a coded master chart prepared for data analysis. Assessment of insulin Sensitivity, the index values were calculated using physiological mathematical models like HOMA IR, QUICKI, ISI 0-120, I0 G0 Ration, and their formulas derived from OGTT. The Formulas for calculating IR/IS values are HOMA-IR = (FPI x FPG)/22.5 for IR. ISI_{0-120} = MCR / log MSI = *m* / MPG / log MSI. Insulinogenic Index = [30min insulin level – fasting insulin level (IU/ml)] / [30min plasma glucose – fasting plasma glucose (mg/dl)] [29-34].

RESULTS

In this prospective study, 79 healthy young adult volunteers were enrolled, mean age was 19.01 (18 to 25 years), Bangalore urban, Male: 33 (41.3%) and Female: 47 (58.8%). Overall clinical and laboratory characteristics of the study subjects is seen in (Table 1). 40 subjects were siblings of diabetics (SD) and 39 were siblings of non-diabetics (SND). Clinical parameters SD & SND is seen in Table 1, SD were obese compared to SND. both the groups were matched physically, clinically and by routine laboratory parameters and were found to be similar with no statistically significance.

SD are known to be more prone to develop T2DM, they had significantly higher body mass index(BMI). It was observed that SD had significantly lower insulin sensitivity indices ISI_{0-120} (56.27, $p<0.002$) and a trend towards significance was seen with QUICKI (0.29578, $p< 0.056$).

The correlation between BMI & HOMA IR is significantly higher (r=0.387, Moderate) in With SD compared to SND (r=0.144, small). The correlation between Waist circumference and HOMA_IR is significantly higher (r=0.329, moderate) in SD compared to SND (r=0.090, trivial) (Table 2). HDL decreases (to wards Abnormal) ISI 0-120 also decreases (towards Abnormal) in SD (Table 3).

It was observed that in SD, BMI and Waist circumference significantly lower IS values & higher IR values. It was observed that ISI_{0-120} indices showed a significantly better correlation with compared to HOMA IR in SD in both first & second degree relatives.

ISI_{0-120} values were significantly lower [in] subjects (SD) with higher BMI, longer Waist circumference. Significant correlation with clinical measures like BMI & waist circumference was observed Figure 1 & 2. BMI <23.9 there were 50 subjects and in Group B: BMI >

24 there were 30 subjects. The study subjects Clinical characteristics in both the healthy Groups were similar. subjects with higher BMI were significantly taller with higher waist hip ratio (Table 1). BMI in Group Ranged from 14.7 to 23.78 and Group B ranged from 24.11 to 39.48. SD had significantly higher BMI (Table 4).

DISCUSSION

It is interesting to study whether decreased IS or IR exists at a much younger age before the onset of impaired glucose tolerance (IGT) in the normoglycemic subjects. Do simple anthropometric measures correlate with IR derived from OGTT [10-15, 34].

Warram JH et al in their study on the siblings of diabetic parents found that in truly normoglycemic subjects the presence of IR was the best predictor of development of T2DM[21]. In our study siblings of diabetics had a significantly lower IS values than the sibling of non diabetics, demonstrating the feasibility of Mathematical models like ISI, QUICKI etc derived from OGTT in evaluating IR/IS in normoglycemic young adults.

Jin Ook Chung et al, observed a higher BMI was associated with higher homeostasis model assessment values for insulin resistance (HOMA-IR), as well as lower levels of insulin sensitivity index composite (ISI_{comp}). we observed similar relationsin ship between BMI , Waist circumference in our study [35].

There is substantial evidence that insulin resistance, typically defined as decreased sensitivity or responsiveness to the metabolic actions of insulin, is a precursor of the metabolic syndrome and type 2 diabetes. Alvar Loria et al, in their study to establish a cut-off point for hyperinsulinemia demonstrated that Subjects with BMI <25 Kg/m2 the subjects fasting plasma glucose < 100mg/L has a mean insulin of 13.7. It is important detect IR/IS earlier as it helps in planning preventive strategies for the subjects being evaluated and the population at large.

Table 1: Comparison of Clinical parameters in subjects with & without family history

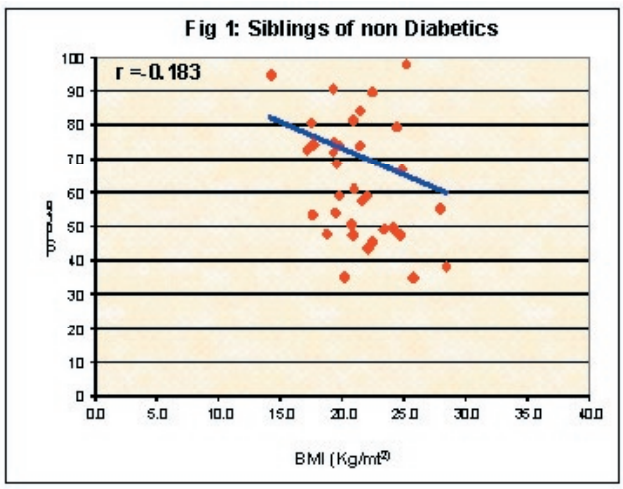
Clinical parameters	With Family history	Without family history
Height (cms)	162.06±10.13	164.79±8.47
Weight (Kg)	61.36±13.86	58.03±10.34
BMI	23.35±4.75	21.39±3.05
Waist (cms)	75.68±12.44	74.45±8.53
Hip (cms)	94.14±9.92	91.19±7.40
Waist Hip Ratio	0.79±0.068	0.81±0.067
Systolic BP (mmHg)	119.90±6.24	119.50±6.24
Diastolic BP (mmHg)	74.40±5.11	74.45±5.72

Table 2: Correlation of HOMA_IR with clinical parameters

Correlation between HOMA_ IR with	**With Family History**	Without Family History
BMI	0.387 **(p=0.014)**	0.144 (p=0.374)
W/H ratio	0.206 (p=0.203)	0.051 (p=0.725)
Waist circumference in cm	0.329 **(p=0.038)**	0.090 (p=0.581)

Table 3: Correlation of ISI_{0-120} with clinical & lab parameters

Correlation between ISI_{0-120} with	With Family History	Without Family History
BMI	-0.319 **(p=0.045)**	-0.183 (p=0.252)
W/H ratio	-0.217 (p=0.178)	-0.137 (p=0.400)
Waist circumference in cm	-0.266 **(p=0.097)**	-0.157 (p=0.335)
HDL	0.289 (0.071)	0.099 (P=0.544)



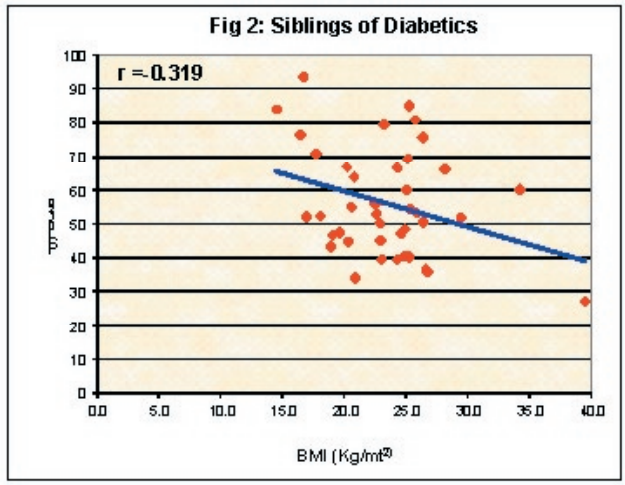


Table 4: BMI <23.9 there were 50 subjects and in Group B: BMI > 24 there were 30 subjects. The study subjects Clinical characteristics in both the healthy Groups were similar. subjects with higher BMI were significantly taller with higher waist hip ratio (Table 1). BMI in Group Ranged from 14.7 to 23.78 and Group B ranged from 24.11 to 39.48. Siblings of Diabetics had significantly higher BMI.

	Group A: BMI < 23.9	**Group B: BMI ≥24**			
	n=50		**n=30**		**P value**
	mean	**SD**	**mean**	**SD**	**Significance (2-tailed)**
Siblings of Diabetics	40% (n=20)	49%	67% (n=20)	48%	0.021
Height	163.708	9.14	162.953	9.91	0.02
Weight (Cms)	53.65	8.441	69.767	11.04	0.736
Waist (Cms)	70.12	7.48	83.317	9.994	0
Hip (Cms)	87.92	6.432	100.567	6.218	0
Waist Hip Ratio WHR	0.7965	6.36E-02	0.8267	7.14E-02	0.053
Total Cholesterol	152	27.064	165.533	23.218	0.025
Triglycerides	94.78	28.005	98.667	28.389	0.021
HDL	40.3	5.019	41.267	4.283	0.382
VLDL	18.58	4.725	19.7	5.621	0.342
LDL	93.428	28.446	104.233	22.266	0.079
hs CRP	1.03878	2.03304	2.08	2.08747	0.032
HOMA_IR	1.53756	1.10752	1.94881	1.56937	0.107
HOMA %B	181.89%	157.59	352.7	549.43%	0.042
ISI(0-120)	66.9201	22.9313	58.1182	21.5915	0.093

CONCLUSION

Simple anthropological measures like BMI, Waist Circumference correlate well with IS/IR derived from OGTT. In developing countries like India simple and cost effective parameters like Waist circumference & BMI can be used as screening tool for detection of individuals at risk of developing diabetes. Detection Insulin resistance in pre-disease condition help in initiating preventive measures for high risk individuals to prevent them to progressing to metabolic disease states.

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REFERENCE

1. Wallace TM, Matthews DR. The assessment of insulin resistance in man. Diabet Med. 2002 Jul ;19(7):527-34.
2. Michael H. Shanik, Yuping Xu, Jan Škrha, Ra chel Dankner, Yehiel Zick, Jesse Roth. Insulin Resistance and Hyperinsulinemia. Diabetes Care. 2008 Feb:31 (Supplement 2) S262-S268
3. Modan, Michaela, Halkin H, Almog S, Lusky A, Eshkol A, Shefi M, Shitrit A, Fuchs Z. Hyperinsulinemia:A link between hypertension obesity and glucose intolerance. J. Clin. Invest. 1985 March. 75 (3): 809–817.
4. Danker, Rache, Chetrit A, Shanik MH, Raz I, Roth J . Basal-stat hyperinsulinemia in healthy normoglycemic adults is predictive of type 2 diabetes over a 24-year follow-up. Diabetes Care. 2009 August. 32 (8): 1464–1466.
5. Modan, Michaela; Halkin H; Almog S; Lusky A; Eshkol A; Shefi M; Shitrit A; Fuchs Z. (March 1985). "Hyperinsulinemia: A link between hypertension obesity and glucose intolerance". J. Clin. Invest. 75 (3): 809–817.
6. Supamai Soonthornpun, worawong setasuban, atchara thamprasit,wanne chayanunnukul, chatchalit rattarasarn, alan geater. Novel Insulin Sensitivity Index Derived from Oral Glucose Tolerance Test. J Clin Endocrinol Metab. 2003 Jan. 88(3):1019–1023
7. Catherine w. yeckel, ram weiss, james dziura, sara e. taksali, sylvie dufour,tania s. burgert, william v. tamborlane, and sonia caprio. Validation of Insulin Sensitivity Indices from Oral Glucose Tolerance Test Parameters in Obese Children and Adolescents. J Clin Endocrinol Metab. 2004 March. 89(3):1096–1101
8. Jaetaek Kim, Seungjin Choi, Beongho Kong, Yeonsahang Oh, Soonhyun Shinn. Insulin Secretion and Sensitivity during Oral Glucose Tolerance Test in Korean Lean Elderly Women. J Korean Med Science. 2001. 16: 592 -597.
9. Ho LT, Chang ZY, Wang JT, Li SH, Liu YF, Chen Y-DI, Reaven GM. Insulin insensitivity in offspring of parents with Type 2 diabetes mellitus. Diabetic Med. 1989. 7:31–34.
10. Matthews DR, Hosker JP, Rudenski AS, Naylor BA, Treacher DF, Turner RC. Homeostasis model assessment: insulin resistance and beta-cell function from fasting plasma glucose and insulin concentrations in man. Diabetologia 1985. 28: 412–419.
11. Arie Katz, Sridhar S. Nambi, Kieren Mather, Alain D. Baron, Dean A. Follmann, Gail Sullivan et al. Quantative Insulin sensitivity check index: a simple , accurate method for assessing insulin sensitivity in humans. The journal of clinical endocrinology & metabolism June 2000. 85(7): 2402 -2410.
12. Wallace. T.M., Matthews. D.R. The assessment of insulin resistance in man. Diabetes Medicine. 2002July.19 :(7): 527-534
13. Falta W, Boller R . Insularer und insulinresistenter Diabetes. Klin Wochenschr. 1931.10: 438–443.
14. Himsworth HP. Diabetes mellitus: its differentiation into insulin-sensitive and insulin-insensitive types. Lancet 1936. 1: 127–130.
15. Gutt. M., Davis C.L., Spitzer S.B., Llabre M.M., Kumar M., Czarnecki E.M. Validation of the insulin sensitivity index (ISI 0,120): comparison with other measures. Diabetes Research and Clinical Practice 2000. 47: 177 - 184.
16. Yeckel CW, Weiss R. Validation of Insulin Sensitivity Indices from Oral Glucose Tolerance Test Parameters in Obese Children and Adolescents. J Clin Endocrinol Metab.. 2004. 89(3): 1096-1101
17. Harris MI, Eastman RC. Early detection of

undiagnosed diabetes mellitus: a US perspective. Diabetes Metab Res Rev. 2000.16(4):230-6.

18. Warram JH, Martin BC, Krolewski AS, Soeldner JS, Kahn CR. Slow glucose removal rate and hyperinsulinemia precede the development of Type II diabetes in the offspring of diabetic parents. Ann Int Med. 1990.113:909–915
19. Masafumi Matsuda, Ralph A. De Fronzo. Insulin Sensitivity Indices Obtained From Glucose Tolerance Testing, Comparison with euglycemic Clamp technique. Diabetes Care.1999. 22(9): 1462 - 1470.
20. Haffner SM, Stern MP, Hazuda HP, Mitchell BD, Patterson JK. Increased insulin concentrations in nondiabetic offspring of diabetic parents. New Eng J Med .1988. 319:1297–1301.
21. Elbein SC, Maxwell TM, Schumacher MC. Insulin and glucose levels and prevalence of glucose intolerance in pedigrees with multiple diabetic siblings. Diabetes. 1991. 40:1024–32.
22. Bergman RN, Prager R, Volund A, Olefsky J. Equivalence of the insulin sensitivity index in man derived by the minimal model method and the euglycemic glucose clamp. J Clin Invest . 1987. 79:790–800.
23. Osei K, Cottrell DA, Orabella MM. Insulin sensitivity, glucose effectiveness, and body fat distribution pattern in nondiabetic offspring of patients with NIDDM. Diabetes Care. 1991. 4: 890–896.
24. World Health Organization, Global Report on Diabetes. Geneva, 2016. Accessed 30 August 2016.
25. Wild S, Roglic G, Green A, Sicree R, King H (2004). "Global prevalence of diabetes: Estimates for the year 2000 and projections for 2030". Diabetes Care. 27 (5): 1047–53
26. Gale, Jason (November 7, 2010). "India's Diabetes Epidemic Cuts Down Millions Who Escape Poverty". Bloomberg. Retrieved 8 June 2012.
27. Wild, Sarah, Gojka Roglic, Anders Green, Richard Sicree, and Hilary King. "Global Prevalence of Diabetes." Diabetes Care. American Diabetes Association, 26 Jan. 2004. Web. 22 Apr. 2014.
28. Canadian Agency for Drugs and Technology in Health (CADTH-HTIS). (2010b). Diabetes in Aboriginal Populations: Review of Guidelines for Screening and Treatment. Prepared by Health Technology Inquiry Service (HTIS). August 2010.
29. Ur, Ehud; Chiasson, Jean-Louis; Ransom, Tom; Rowe, Richard (2008) Screening for Type 1 and Type 2 Diabetes. In Canadian Diabetes Association Clinical Practice Guidelines Expert Committee (ed.) 2008 Clinical Practice Guidelines.
30. Johnston C, Ward WK, Beard JC, McKnight B, Porte D. Islet function and insulin sensitivity in nondiabetic offspring of conjugal Type 2 diabetic patients. Diabetic Med. 1990. 7:119–125.
31. Eriksson J, Franssila-Kallunki A, Ekstrand A, Saloranta C, Widén E, Schalin C, Groop L. Early metabolic defects in persons at increased risk for non-insulin-dependent diabetes mellitus. New Eng J Med. 1989. 321:337–343.
32. Gulli G, Ferrannini E, Stern M, Haffner S, DeFronzo RA. The metabolic profile of NIDDM is fully established in glucose-tolerant offspring of two Mexican-American NIDDM parents. Diabetes. 1992. 41:1575–1586.
33. O'Rahilly SP, Nugent Z, Rudenski AS, Hosker JP, Burnett MA, Darling P, Turner RC. Beta-cell dysfunction, rather than insulin insensitivity, is the primary defect in familial Type 2 diabetes. Lancet. 1986;2:360–364.
34. Wallace. T.M., Matthews. D.R. The assessment of insulin resistance in man. Diabetes Medicine 2002.July. 19 :(7): 527 – 534
35. Haffner SM, Stern MP, Hazuda HP, Mitchell BD, Patterson JK. Increased insulin concentrations in nondiabetic offspring of diabetic parents. New Eng J Med. 1988. 319:1297–1301.

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Correlation of Cardiovascular Efficiency with Regular Physical activity in First Year MBBS Students

Anupama Gupta[1], Ipsita Choudhury[2], Hajra Banoo[3], J J Tambe[4]

[1]Assistant Professor, Department of Physiology, [2]Associate Professor, Department of Biochemistry, [3]Professor, Department of Physiology, Rama Medical College, Kanpur, [4] Specialist (Paed) Central Govt. Health Services, Kanpur

ABSTRACT

Aim- Correlation of Cardiovascular efficiency with regular Physical activity in First Year MBBS Students . **Method**- cross-sectional study was conducted on 50 MBBS students in age group of 18-24 yrs of Rama medical college and research centre. Cardiovascular fitness was measured by performing Harvard step test. **Data analysis**- The samples were analysed using SPSS-22 programme through Pearsons correlation method**. Conclusion-** any kind of moderate physical exercise improves physical fitness.

Keywords- *physical fitness index, Harvard step test.*

INTRODUCTION

Physical fitness implies not only the absence of disabling deformity or disease and the capacity to perform a sedentary task efficiently but also a sense of physical well-being and the capacity to deal with emergencies demanding unaccustomed physical effort.[1]

Over the past two decades cardiovascular fitness, i.e. the efficiency of the cardiovascular systems, has been the subject of a very large number of studies involving endurance-trained athletes. In contrast, it is only recently that the cardiovascular fitness of the general adult population has received much attention. This is due to the fact that diseases of the respiratory and cardiovascular systems have become a major cause of adult deaths in Western nations.[2]

MBBS students during the course are subjected to different kinds of stressors predominantly the pressure of academics leading to the successful completion of the educational course. Physical & mental fitness are the key to such a successful outcome. Physical fitness is used in two close meanings: general fitness-a state of health and well-being and specific fitness -a task-oriented definition based on the ability to perform specific aspects of sports or occupations. It is the result of regular exercise, proper diet and nutrition, and proper rest for physical recovery. There has been a decrease in physical activity due to a more sedentary lifestyle.

An individual is considered to be fit for a particular task or activity, when he can accomplish it with a reasonable degree of efficiency without undue fatigue and with rapid recovery from the effect of exertion. Physiological fitness implies the capacity for skillful performance and rapid recovery.[3]

MATERIALS AND METHOD

This study was conducted on 50 M.B.B.S. students in age group of 18-24 years, of Rama Medical College and Research center.The study was approved by Ethical committee of Rama Medical College and Research center. Height, weight, Body Mass Index (BMI), resting blood pressure and pulse rate were measured. Students suffering from any physical or medical abnormality and those who were unwilling to take any part in the study were excluded.

Informed consent was taken from all the students.

25 students were engaged in some kind of regular physical activity like sports, running etc. and 25 students were exercising occasionally. Resting pulse for full one minute and blood pressure was taken. Test procedure was explained beforehand. Platform of 50 cm. was used for test. As the signal begins “up, up” subject steps up with right foot , then brings the left foot up besides right foot. Then subject steps down by first bringing right foot down followed by left one, when instructed “down, down”. Rate of stepping is 30 steps per minute

for 5 minutes. Those who exhausted before completing 5 minutes were excluded from the study. Exhaustion time is taken as the point at which subject cannot maintain stepping rate for 15 seconds.[4,5,6.]

Subject immediately sits down on completion of the test and heart beats are counted for 1 to 1.5, 2 to 2.5, 3 to 3.5 minutes. Recovery index is calculated as follows.

Physical fitness index / cardiovascular fitness index =

Duration of exercise in seconds x 100 / (sum of 3 pulse counts) x2

The samples were analyzed using SPSS-22 PROGRAMME through Pearsons correlation method.

RESULTS

On statistical analysis between students who were doing occasional physical exercise (control) and regular physical exercise (cases), by SPSS 22 program through Pearson's correlation method, the mean ± SD of control was found to be 59.53 ±3.01. as compared to 72.18±6.40. among the cases. This showed a highly significant difference with the "p" value of < 0.001.

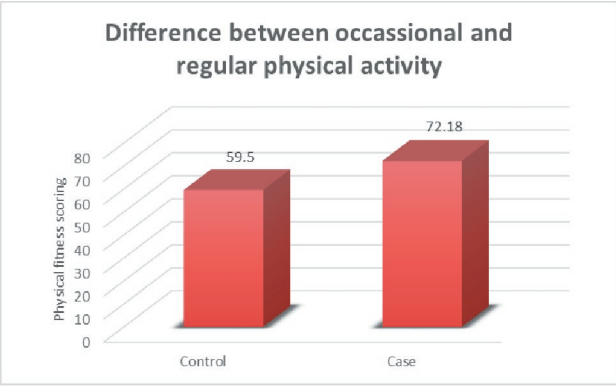

Fig 1: Difference between occasional (control) and regular (cases) physical activity

DISCUSSION

Physical fitness is normally referred to the ability of an individual to perform physical activity. To increase the longevity of the individual, the attribute of being physically fit, in order to maintain good health is exceedingly important.

In the present modern machine era which is forcing our life towards more and more sedentary style and habit of junk food has drastically reduced the good health at all ages. Therefore the incidence of obesity, cardiovascular diseases are increasing. It is predicted by the year 2025; developing countries will contribute more than half the burden of Diabetes in the world.

India will have the largest number of diabetic patients (approximately 57 million in any one country.) India would be known as the diabetic capital of the world. obesity a feature of diabetes and cardiovascular disease is a major complication that is increasingly becoming a feature of even the young population leading to morbidity and even mortality.[7]

To reduce the intensity of this alarming situation, it will be an inexpensive alternative for the population to adopt regular moderate physical activity.[8] An ideal age group will be the young individuals as this would allow greater interventions in this age group.

According to the formula applied on the subjects, students with exercise had a score of 72.186.±6.40 as mean value as compared to 59.53±3.01 the occasional exercise students. Upon applying the Pearson's correlation, p value was found to be statistically significant. p value (<0.001).

This can be explained by the fact that regular physical activity improves muscle strength and boosts endurance. Exercise delivers oxygen and nutrients to tissues, helps cardiovascular system work more efficiently. When the heart and lungs improve, we have more energy to tackle daily chores.

Boosts high density lipoproteins (HDL), or good cholesterol and decreases unhealthy triglycerides. This keeps blood flowing smoothly, which decreases the risk of cardiovascular diseases.

Heart rate increases with physical activity to supply more oxygenated blood to your muscle. The fitter you are the more efficiently your heart can do this, allowing you to work out longer and harder. As a side effect, this increased efficiency will also reduce your resting heart rate. Your blood pressure will also decrease as a result of new blood vessels forming.

When you work out regularly, your brain gets used to this frequent surge of blood and adapts by turning certain genes on or off. Many of these changes boost brain cells function and protect from diseases such as Alzheimer's, Parkinson's or even stroke, and ward off age related decline.

A number of neurotransmitters are also triggered as endorphins, serotonin, dopamine, glutamate, and GABA. Some of these are well known for their role in mood control. Exercise in fact is one of the most effective prevention and treatment strategies for depression.[9]

So this study proves that physical activity is an important determinant and predictor of physical fitness.

CONCLUSION

Students with regular physical activity have better fitness index; so we should motivate our students to involve in some regular physical activity which will improve their academic performance also.

Conflict of Interest- Nil

Source of Funding- Self

REFERENCES

1. Dharmes parmar, Nikita Modh. Study of physical fitness index using Modified. Harvard step test in relation with gender in Physiotherapy students. International Journal of science and Research. July 2015 ; 4(7).
2. U.S. Department of Health and Human Services. Physical activity and health: a report of the Surgeon General. Atlanta: U.S. Department of Health and Human Services, Centers for Disease control and Prevention,, National Center for Chronic Disease Prevention and Health Promotion; 1996.
3. Shashiala L., Geetanjali H. Efficiency of Recovery pulse rate as an index of physical fitness. Indian Journal of fundamental and applied life science.2014; 4(2).
4. Brouha I. Health CW, Gray B. A step simple method of measuring physical fitness for hard muscular work in adult men. Rev Canadian Biol 1943; 2:86.
5. Rhyming I. A modified Harvard Step Test for Evaluation of Physical Fitness. Arbeitphysiologie 1953; 15(3): 235-50.
6. Sengupta P, Sahoo. S. Evaluation of health Status of the fishers: Prediction of Cardiovascular fitness and anaerobic power.World Journal of life Sciences and Medical research 2011; 1(2): 25-30.
7. KingH, Aubert Re, Herman WH: Global burden of diabetes, 1995-2025: prevalance, numerical estimates, and projections. Diabetic care 1988: 21: 1414-1431.
8. Assesment of Cardiopulmonary Efficiency Levels in Student Population. International Journal of Scientific and Research Publications, May 2014; 4(5).
9. fitness.mercola.com/sites/fitness/archive/2013/09/20/exercise-health-benefits.aspx

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Anisocytosis in Hyperglycemic Patients - Why is it Important?

Babitha R[1], Rangarajan R[2]

[1] *Associate Professor, Department of Physiology, Annapoorana Medical College, Salem, TamilNadu, India,*
[2] *Professor, Department of Biochemistry, Government MohanKumaraMangalam Medical College, Salem, Tamil Nadu, India*

ABSTRACT

Background: Incidence and prevalence of diabetes is increasing all over the world . Increased blood glucose level is an important risk factor in the development of diabetic microvascular and macrovascular complications. Hyperglycemia induces biochemical and haematological changes. Erythrocyte deformability improves blood flow in microvessels. Both persistent and variable hyperglycemia causes various changes in the RBC membrane and its cytoplasm. This leads to modification in the deformability of RBC membrane. With prolonged exposure of RBCs to hyperglycemic conditions, the deformability of RBCs is further decreased, and its aggregation increases. This makes whole blood more viscous and responsible for microvascular complications. This decreased deformability is reflected as anisocytosis in peripheral smear. This study is aimed at finding the correlation between hyperglycemia and anisocytosis and educating the diabetic population about the importance of maintaining the blood glucose levels under control.

Method: This study was done in 150 subjects in the age group 25 to 50 years (50 control (25 male and 25 female)with normal fasting blood glucose level 70 -110 mg/dl, 50 subjects (25 male and 25 female) having blood glucose level between 126-200 mg/dl and 50 subjects (25 male and 25 female) having blood glucose levels between 200-300 mg/dl of Annapoorana Medical college hospitals. Patients with anaemia, malnutrition, and other chronic diseases whose RBCs may show anisocytosis were excluded. Fasting blood glucose level was measured. Peripheral smear was prepared and stained with Leishman's stain. Smear was focused under oil immersion objective, and the image was captured using a digital camera. Image was transferred to the computer system and RBC diameter was measured using UTHSCA image tool software. Variation in size of the RBCs between control and subjects was compared using Pearson's product moment correlation coefficient and Paired sample t test.

Results: Graded increase in the variation in the size of RBCs (anisocytosis) was observed with graded increase in blood glucose levels. By using Pearsons product moment correlation coefficient ,significant r value of 0.5,0.8 and 0.95 were got in male control group, mild hyperglycemic(125-200 mg/dl) group and moderate hyperglycemic (200-300 mg/dl) group and r value of 0.4, 0.7 and 0.76 were got in female control, moderate hyperglycemic and severe hyperglycemic group. Comparing blood glucose and anisocytosis using Paired sample t test, significant p value of < 0.01 was got in male and female mild hyperglycemic and moderate hyperglycemic group.

Conclusions: Erythrocytes of diabetes mellitus patients are floating in hyperglycemic environment during their life span. Hyperglycemia induces the production of ROS(Reactive Oxygen Species) causing oxidative stress as well as lipid peroxidation which may accelerate vascular complications in diabetes. This induces the changes in erythrocyte deformability and causes the aggregation of RBCs, in turn, affects their flow properties in the blood vessels. This accelerate the vascular complication in diabetics.

Keywords: *Hyperglycemia, Red Blood Cell membrane deformability, Oxidative stress, Peripheral smear, Image tool, Anisocytosis.*

Corresponding author:
Dr. R Babitha
Associate Professor, Department of Physiology, Annapoorana Medical College, Salem, Tamilnadu, India. Phone (or Mobile) No: 8883631144.
Email: babiranga16@gmail.com

INTRODUCTION

The incidence and prevalence of Diabetes Mellitus is increasing in the world, due to sedentary life style and improper food habits. Type II diabetes mellitus has reached epidemic levels not only in developed nations

but also in developing nations. Since the requirement for physical effort in home and at work place is also reduced, there is continuous increase in the rate of over weight , obesity and type II diabetes mellitus. More than 50% children of this generation are spending most of their time with televisison and playing video games in laptop with packets of junk food and carbonated drinks near them. This leads to development of type II diabetes mellitus at an earlier age. DM is a metabolic disorder caused by defective insulin production or inappropriate utilization of insulin by the cells resulting in abnormal carbohydrate metabolism which causes hyperglycemia (high blood glucose levels).Hyperglycemia is a major factor in development of diabetic complications. This hyperglycemia causes changes in the RBC membrane. Importantly hyperglycemic environment decreases the deformability of RBCs. Erythrocyte deformability improves blood flow in microvessels. Both persistent and variable hyperglycemia causes various changes in the RBC membrane and its cytoplasm. This leads to modification in the deformability of RBC membrane. [1] With prolonged exposure of RBCs to hyperglycemic conditions, the deformability of RBCs is further decreased, and its aggregation increases. This makes whole blood more viscous and responsible for microvascular complications. [2] Diabetes is the most common cause of polyneuropathy and responsible for non traumatic amputations, nephropathy, and retinopathy. [1] There are only few studies about the changes occurring in RBC membrane in hyperglycemia. In this study we aimed at finding the impact of hyperglycemia on anisocytosis. By making the diabetic population to visualize the anisocytosis in their own peripheral smear we can educate them and prevent the diabetic complications more effectively.

METHOD

This study was conducted in 150 subjects between the age group 25 -50 years who attended the Annapoorana Medical College Hospital. This study was started after getting ethical clearance from the ethical committee of Annapoorana Medical College and Hospitals. 50 (25 male and 25 female) subjects with normal fasting blood glucose levels(70-10 mg/dl) were included in the control group. 50 (25 male and 25 female) subjects with mild hyperglycemia (125-200 mg/dl) and 50 (25 male and 25 female) subjects with moderate hyperglemia (200-300 mg/dl) were included in the test group. Written consent was got from all the subjects who participated in the study. Ideal peripheral smears were prepared and stained with Leishman's staining. Smear was focused under oil immersion objective, and the image was captured using a camera. Image was transferred to the computer system and RBC diameter was measured using UTHSCA image tool software. The calibration image was taken from the Neubauer's counting chamber smallest square of RBC which is 50 micron. Magnification factor was kept constant for all the images. We compared the the variation in the size of erythrocytes between the control with normal blood glucose levels, and subjects with increased blood glucose levels. Since the details of morphology of RBCs cannot be obtained by automated analysers, manual method of measuring anisocytosis was preferred in this study. Best diagnostic support was given by Systematic examination of blood film and all the other test were either complimenting or confirming it.[3] Computer based image analysis method to determine red cell size, provides an accurate and reliable measurement, which is simple and cost effective. [4] The diameter of 25 RBCs were measured from each image. The variation in the size of RBCs (anisocytosis) (largest diameter_ smallest diameter) , between the control and hyperglycemic subjects were compared.

RESULTS

We used Pearson's product moment correlation coefficient and Paired sample t test to find the correlation between hyperglycemia and anisocytosis. If the r value is near 1, there is significant correlation, if r value is positive there is positive correlation and if the r value is negative there is negative correlation. There is graded increase in variation in the size of RBCs (anisocytosis) in mild and moderate hyperglycemic subjects. Hyperglycemia was positively and significantly correlated with anisocytosis. The r values got after comparing the hyperglycemia and anisocytosis in male control and male mild and moderate hyperglycemic subjects were 0.5, 0.8 and 0.95 respectively. For female control and mild and moderate hyperglycemic subjects the r values got were 0.4 and 0.7 and 0.76 respectively. (Table 1)

The normal variation in the rbc size is 1-2 microns. But, in mild and moderate hyperglycemic subjects , the variation in the RBC size (anisocytosis) is 2.5 and 3.7 microns respectively which gives the significant r values (Table2). By comparing the anisocytosis with hyperglycemia using Paired sample t-test ,

the significant p value of < 0.05 was got in male and female hyperglycemic subjects. (Table 3) (Figure1 and Figure2).

DISCUSSION

From our study, we come to know that, hyperglycemia is positively and significantly correlated with anisocytosis. Diabetes mellitus (DM) is a group of metabolic disorder characterized by abnormal carbohydrate metabolism resulting chronic hyperglycemia (high blood glucose levels) caused by defective insulin production or appropriate and efficient utilization of insulin by cells. Severe complications are caused due to inappropriately managed diabetes. These chronic, long term complications are related to blood vessel diseases. Blood vessel diseases are generally classified into micro vascular disease (small vessel disease) such as retinopathy, nephropathy and neuropathy) and Macro vascular disease concerning the heart and blood vessels (large vessel disease)[5]. Hyperglycemic induced variation in hematological parameters has been reported by several studies. Elevation in glucose concentration is one of the major factor that effects the erythrocyte morphology i.e., the severity in the change of erythrocyte shape depend upon the plasma glucose level. This in turn, affects their flow properties through alteration and deformation at individual level and aggregation at collective level.[6] The functional properties of erythrocytes are changed due to addition of altered biochemical and tissue products in the blood .[7]

Hyperglycemic state glycosylates hemoglobin, creates oxidative stress inside the RBC and puts the cellular components at risk.[8] Oxidative stress also causes, conformation changes in membrane cytoskeleton protein which alters fluidity of the membrane, erythrocyte shape, size and osmotic fragility.[9] Erythrocytes stay in hyperglycemic environment during their life span are exposed to oxidative stress, which is confirmed by the presence of (MDA) –MalonDiAldehyde(indicator of lipid peroxidation) and decreased glutathione in the RBCs, which provokes the changes in erythrocyte deformability and the aggregation. Peroxidation of the cell membrane lipids changes the membrane permeability. [10]

Lipid peroxidation causes polymerization of membrane components and decreases cell deformability[11]. In general, the overall effect of lipid peroxidation is to decrease membrane fluidity. [12] It has been shown that peroxidation of erythrocyte membranes causes formation of high-molecular-mass protein aggregates within the membrane. [13] The impairment of erythrocyte deformability is attributed to the alterations in the membrane structure. These changes may include: Altered concentration ratio of cholesterol / phospholipid in the membrane core, amplified membrane lipid peroxidation. [14] Alteration in lipid –protein interactions, along with increased glycosilation derived internal viscosity leads to altered viscoelastioc properties of erythrocyte membrane which leads to decreased deformability of RBCs in diabetes. [15]

Membrane proteins spectrin and actin in sub membraneous cytoskeletal meshwork are responsible for viscoelastic properties of RBC membrane.[16] There is structural deteriotion of erythrocyte membrane in diabetes. [17] In hyperglycemic environment beta spectrin is most glycosilated, and spectrin is oxidatively damaged, leading to decreased deformability. [18] Regarding enzyme and ionic balance, in RBCs exposed to hyperglycemic environment, there is alteration in Na+ K+ ATP ase (decreased) which plays a central role in regulation of intracytoplasmic homeostasis.[19] Hyperglycemia induces the production of ROS causing oxidative stress as well as lipid peroxidation which may accelerate vascular complication in diabetics. [2] Oxidative stress, also result in endothelial dysfunction[20].

The red blood cell (RBC), is a non-nucleated cell. So it exhibits a very limited biosynthesis capacity and poor repair mechanisms. So they are vulnerable to physical and/or chemical stress. Oxidative stress, causes oxidative damage to the lipids and proteins in the RBC membrane. The erythrocyte is a good model to study the oxidative damage of lipids and proteins occurring in pro inflammatory and oxidative conditions. [21] Higher oxidative stress leads to reduced erythrocyte survival and results in anisocytosis due to an increase in the proportion of circulating premature erythrocytes. [22] So we compared blood glucose levels and anisocytosis in this study.

TABLE :- 1. Correlation between hyperglycemia with anisocytosis using Pearson's product moment correlation coefficient.

Variable	Male control r value	Male mild hyperglycemic subject r value	Male moderate hyperglycemic subject	Female control r value	Female mild hyperglycemic subject r value	Female moderate hyperglycemic subject.
Blood sugar	0.5	0.8*	0.95*	0.4	0.7*	0.76*

Positively Significant r values were got between hyperglycemia and anisocytosis in mild hyperglycemic group and moderate hyperglycemic group.

Table 2 : Variation in RBC size between control and hyperglycemic subjects.

Study subjects.	Range of RBC size (microns)
Male controls (n= 25)	6.2 to 7.9
Male mild hyperglycemic subjects (n= 25)	5.8 t0 8.5
Male moderate hyperglycemic subjects (n= 25)	5.8 to 10.2
Female controls (n= 25)	6.1 to 7.8
Female mild hyperglycemic subjects (n= 25)	5.8 to 8.3
Female moderate hyperglycemic subjects (n= 25)	5.7 to 9.1.

Table:-3. Correlation ofhyperglycemia with anisocytosis using Paired sample t Test.

		CONTROL	Mild hyperglycemia	Moderate hyperglycemia						
		Mean	Std. Deviation	Sig. (2-tailed) -(p value)	Mean	Std. Deviation	Sig. (2-tailed) -(p value)	Mean	Std. Deviation	Sig. (2-tailed) -(p value)
MALE	ANI	1.6	.23		2.5	.30		3.6	.52	
	B.Sugar	92	19	0.008	149	18	.000**	244	29	.000**
FEMALE	ANI	1.6	.2		2.4	.2		3.3	.15	
	B.Sugar	98	12.2	.065	146	12.6	.000**	222	24	.000**

* significant at P < 0.01In the present study , we observed significant correlation, P value (< 0.01) increased blood sugar and Anisocytosis in mild and moderate hyperglycemic group.

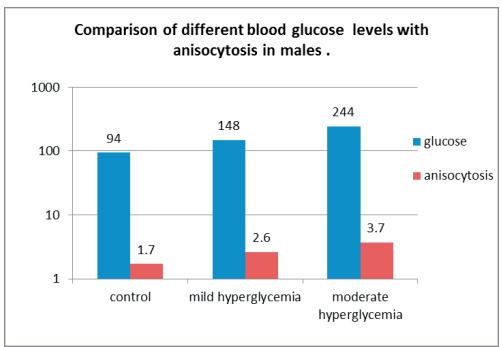

Figure :- 1. Comparison of different blood glucose levels with anisocytosis in males .

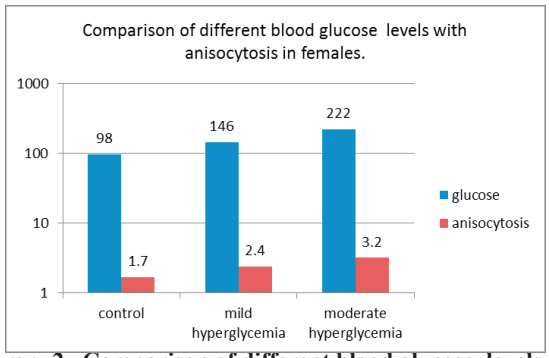

Figure :- 2. Comparison of different blood glucose levels with anisocytosis in females.

CONCLUSIONS

The disease burden of diabetes is increasing day by day. The microvascular and macrovascular complications of diabetic patients are also increasing. In our study we found positive correlation between hyperglycemia and anisocytosis. Glycosylated hemoglobin stimulates oxidative stress, which increases the reactive oxygen species, which increases the rigidity of the RBC membrane and decreases the deformability of RBC membrane leading to anisocytosis. This decrease in erythrocyte membrane fluidity in hyperglycemic patients reduces the rate of blood flow (in particular in the microcirculation) and the oxygen diffusion through the erythrocyte membrane and its exchange with tissues, which causes the further complications. Good glycemic control (either by diet or oral hypoglycemic drugs) could be supportive and beneficial in reducing harmful effects in diabetics. So it is high time we have to sensitise and educate the diabetic population in an effective manner. With this computer based image analysis method , we can make the patients to visualize the anisocytosis in their RBC. we can explain them if anisocytosis is present in their blood, they are prone for vascular complications, and diabetic patients will keep their blood glucose levels under control and prevent themselves from vascular complications of diabetes.

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Conflict of Interest: None declared.

Ethical approval: This study was approved by Instituitional Ethics Committee.

REFERENCES

1. Sehyun Shin et al Erythrocyte deformability and its variation in Dibetes mellitus. Indian journal of experimental biology, Jan 2007 , vol.45, p121-128.
2. Farah Jabeen et al Hyperglycemic induced variations in Hematological Indices in Type 2 Diabetics. International Journal of Advanced Research (2013), Volume 1, Issue 8, 322-334.
3. Dr. Prasanna N Kumar, Peripheral blood examination, Laboratory haematology:2005;11: 83-90.
4. Satish Kumar NS , Aswini Dutt R , Maruthy KN, Dinakar Nadig ,Neevan D R Dsouza A Simple imaging method for demonstrating red cell sizes to life sciences students. National Journal of Basic Medical Sciences. 2011; Volume - I, Issue – 3 : 133-36.
5. Jawa, Ali., Kcomt, Juanita., Fonseca., Vivian, A.(2004): Diabetic nephropathy and retinopathy. Med Clin N Am. (88): 1001–1036.
6. Singh M, Shin S. Changes in erythrocyte aggregation and deformability in diabetes mellitus.Indian Journal of Experimental Biology. 2009; 47(1):7-15.
7. Jones RL, Peterson CM.:Hematologic alterations in diabetes mellitus. (1981) Am J Med. 70(2):339-52.
8. Gauri S Vahalkar and Vijaya A Haldankar, RBC membrane composition in Insulin Dependent Diabetes Mellitus in context of oxidative stress . Indian Journal of Clinical Biochemistry, 2008 / 23 (3) 223-226
9. Edward Kowalczyk et al, Estimation of cell membrane properties and erythrocyte red-ox balance in patients with metabolic syndrome. Mol Biol Rep (2012) 39:11113–11118
10. L.Madhikarmi,KRS.Murthy,G.Rajagopal,PP Singh.Lipid peroxidation and antioxidant status in patients with type 2 diabetes in relation to obesity in Pokhara - Nepal Journal of Diabetology, February 2013; 1:3: 1-8.
11. Haest CWM, Plasa G, Kamp D, Deuticke B. Spectrin as a stabilizer of the phospholipid asymmetry in the human erythrocyte membrane. Biochim Biophys Acta 1978; 509: 21-32
12. Formigueira X, Cantón A. Obesity: epidemiology and clinical aspects. Best Pract Res Clin Gastroenterol 2004; 18: 1125-46.
13. Ricther C. Biophysical consequences of lipid-peroxidation in membranes. Chem Phys Lipids 1987; 44:175 -89.
14. Rizvi SI,Zaid MA, Anis R Mishra.N, Protective role of tea catechins against, oxidation induced damage of Type2 diabetic erythrocytes .Clin.Exp eriment.Pharmacoi Physiol.32(2005) 70.
15. Walata C, Witas H, Olszowska L& Piasccki w,--The association between erythrocyte internal viscosity , protein non enzymatic glycosilation and erythrocyte membrane dnamic properties in juvenile diabetes mellitus. Int.J.Exp.Pathol 73

(1992) 655.

16. Picart C, Dalhaimer P,& Discher DE.- actin profilament orientation in deformation of the erythrocyte membrane skeleton .Biophys.J 79 (2000)2987.
17. Bryszewska M, walaata C& Torzecka W. Changes in fluidity and composition of erythrocyte membrane and in composition of plasma lipids in type 1 diabetes.Br. J Haematol.62 (1986) 111.
18. Schwartz RS, Madsen JW, Rybicki aC,& Nagel R L- oxidation of spectrin and deformability defects in diabetic erythrocytes, Diabetes 40(1991) 701.
19. Garay RP, Elghozi JL, Dagher G& Meyer P. laboratory distinction between essential and secondary hypertension by measurement of erythrocyte cation fluxes. N.En (1980) 769.
20. Shurtz-Swirski R, Sela S, Herskovits AT, Shasha SM, Shapiro G, Nasser L, Kristal B. (2001): Involvement of peripheral polymorphonuclear leukocytes in oxidative stress and inflammation in type 2 diabetic patients. Diabetes Care. 24(1):104-10.
21. Austin H, Austin JMJr, Partridge EE, Hatch KD, Shingleton HM. Endometrial cancer, obesity and body fat distribution. Cancer research 1991 Jan 15;51(2):568-72.
22. Kuldip Singh1 and Saranpal Singh. Impact of Obesity on Malondialdehyde and Certain Antioxidants in North Indian Obese Punjabi Population. Research Journal of Pharmaceutical, Biological and Chemical Sciences July– August 2015 RJPBCS 6(4) Page No. 1383-89.

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Study of Effect of Visual Stimuli on Heart Rate Varibilityin Young Adult Males

Chethan H A[1], Priya C Rao[2], Kiran Jowar[2]

[1]Associate Professor, [2]Assistant Professor, Department of Physiology, Subbaiah Institute of Medical Sciences, Shimoga

ABSTRACT

The effects of visual stimuli on cardiac autonomic activity using Heart Rate Variability (HRV)was studied in 50 healthyadult males. Beat tobeat R-R intervals were cotinuously recorded under closed eye condition (CEC) and the open eye condition(OEC). HRV frequency domain parameters like LF nu, HF nu, LF/HF were obtained with the helpof RMS polyrite – D version 3.0.11.There was a significant ($p<0.05$) decrease in HF nu in OEC when compared to CEC, and a significant($p<0.05$)increase in LF nu and LF-HF ratio in OEC when compared to CEC. Indicating increased sympathetic activity and reduced parasympathetic activity in OEC[1].

Keywords: *Autonomic activity, Heart Rate Variability, visual stimuli.*

INTRODUCTION

Physiological responses to environmental stimuli have been investigated intensly[2,3]. Heart rate at rest is regulated through the activity of cardiac autonomic nervous system. The stimulation in the sympathetic nervous system increases heart rate and excitation of parasympathetic nervous system reduces heart rate by increasing vagal tone. Heart Rate Variability (HRV) is a specific and sensitive non-invasive tool to evaluate cardiac autonomic activity. HRV is the degree of variation of the heart rate under the balanced influence of sympathetic and parasympathetic components of the cardiac autonomic nervous system. HRV also indicates the extent of neuronal damage to autonomic nervous system. Human beings are very sensitive to light exposure, and changes of light intensity can shift many physiological parameters like melatonin, alertness, body temperature, heart rate (HR), and heart rate variability (HRV)[4,5]. This study is an effort to assess the effect of visual stimuli on cardiac autonomic activity using Heart Rate Variability in young adult males as sudden cardiac death in later ages can be prevented if life style modifications are brought in earlier.

MATERIALS AND METHOD

Parameters

Study was designed and carried out in the Department of Physiology of Subbaiah Institute of Medical Sciences. Fifty subjects, who were young adult males (18-21 years) from general population were considered for the study. They were subjected to two sets of five minute digital ECG recording at 9 a.m. following light breakfast without tea or coffee.

Ethical clearance was obtained from our institution ethical committee and informed consent was obtained from all the subjects.

Inclusion criteria:

Healthy50 healthymalesof adolescent age group of 18-21 years were included in the study.

Exclusion criteria:

Subjects who are obese or with history of diabetes mellitus, hypertension, respiratory illness, cardiacdiseases and endocrinal disorders were excluded. Subjects on any medications were also excluded.

Measurement of Heart Rate Variability parameters:

Subjects were made to listen to constant low volume white noise to remove the bias of sound on HRV.

Basic anthropometric measurements were done like weight , height without footware.

Instruments used:

RMS polyrite – D version 3.0.11.

Subjects were explained in detail about the ongoing procedure, ECG was digitally recorded after 10 minutes rest using lead II. 5 minutes ECG in supine position was recorded, with subject breathing normally and used to determine the LFnu, HFnu and LF/HF.

Two such recordings were obtained.One while the subjects kept their eye closed initially, and thenwith eyes opened .The heart rate variability between open and closed eye state were compared.

Fast Fourier Transformation spectrum - FFT was done using Welch's periodogram method and Hanning window analysis of RMS polyrite – D version 3.0.11 to calculate HFnuLFnu and LF/HF.

STATISTICAL METHOD

Descriptive statistical analysis has been carried out in the present study. Results on continuous measurements are presented on Mean SD (Min-Max) and results on categorical measurements are presented in Number (%). Significance is assessed at 5 % level of significance. Analysis of variance (ANOVA) has been used to find the significance of study parameters between three or more groups of patients, Student t test (two tailed, independent) has been used to find the significance of study parameters on continuous scale between two groups Inter group analysis). Effect size has been computed to find the effect of obesity on HRV parameters. Student 't' test (two tailed; independent) has been used to test the homogeneity samples based on of age (or continuous parameters).

FINDINGS

The values ofLFnu, HFnu and LF/HF for all the subjects under both the closed -eye condition (CEC) and open- eye condition(OEC) were obtained. .Values of LFnu and LF/HF under CECappear to be smaller than those OEC .The mean value of HFnu for under CEC was significantly greater (< 0.05 level) when compared to OEC.

DISCUSSION

Light plays a central role in life. Without sunlight there is no life on earth. Effects of light stimulation and light therapy on autonomic functions (e.g., body temperature, HR, or HRV) were already investigated in several human studies[9,10,11]. Changes in automaticity of the pacemaker caused by increased activity of pacemaker caused by increased activity of parasympathetic nerves are rapid due to quick activation of special acetylcholine –regulated K^+ channels in the cardiac cells and decay of the cardiac response is quick due to rapid hydrolyzation of acetyl choline.the cardiac response to increased sympathetic nervous activity is much slower than the response increased parasympathetic activity due to a delayed release of noradrenaline and to media tion via a slow second messenger system. Thus changes in the activity of parasympathetic nervous system can alter heart rate much more rapidly exerting beat –by –beat control of heart rate compared to sympathetic nervous system[6]. LF-HF ratio is sensitive measure of sympathovagal balance[7] .Increase in LF-HF ratio indicates increased sympathetic activity and decrease in ratio incicates increased parasympathetic activity[1]. HFnu is an index of parasympathetic activity.In one of the studies participants who were exposed to red light (versus a control color) exhibited a decrease in HF-HRV, and this result was associated with worse cognitive performance[8].

Table 1: Basic characteristics of subjects

Variables	Subjects
Age in years	20.14±1.32
BMI (kg/m^2)	23.06±0.31

Table 2: Comparision of FFT spectrum between CEC and OEC

HRV	CEC	OEC	P value
LF nu	30.624±2.68	35.949±3.049	<0.05*
	(25.609-41.817)	(30.609-46.817)	
HF nu	69.375±4.085	64.05±3.04	<0.05*
	(58.183-74.391)	(53.183-69.391)	
LF/HF	0.446±0.06	0.568±0.08	<0.05*
	(0.344-0.718)	(0.441-0.88)	

Values Mean ± SD

(Range of data)

* Highly significant

LIMITATIONS OF THE STUDY

The present study is focused only at the effect of visual stimuli on the cardiac autonomic frequency domain parameters. The study is limited to one geographical area and confined to one gender of a specific age group.

SCOPE FOR FURTHER STUDY

Present study can be expanded in comparing the effect of auditory stimulus on the cardiac autonomic frequency domain and time domain parameters in a various environmental and geographical conditions, in other gender, also in different age groups and during meditation and yoga which involves closure of eye for obtaining more clarity on the relation of these stimuli on heart rate variability.

SUMMARY AND CONCLUSION

The parasympathetic component of the cardiac autonomic activity increased during the closed eye condition when compared to the open eye condition. It signifies that closing eyes for a while might help heart by increasing the parasympathetic component of the cardiac autonomic activity.

Conflict of Interest: Nill

Ethical Clearance: Ethical clearance was obtained from the institutional ethical clearance committee.

Funding: Self

REFERENCES

1. Seals DR ,Johnsons DG and Fregosi RFHypoxia potentiates exercise induced sympathetic neural activation in humans .J Applied physiology ,1992; 71:1030 -1040.
2. Ohnuki Y ,Araki Y and Sasaki H . The influence of low altitude training on collegiate distance runners .Jpn.J Biometeor2000 ;37:123-129 .
3. Alberto M .Heart rate variability : from bench to bedside.Europ J Int Med 2005;16:12-20
4. Litscher D, Wang L, Gaischek I, The Influence of New Colored Light Stimulation Methods on Heart Rate Variability, Temperature, and Well-Being: Results of a Pilot Study in Humans. Evidence-Based Complementary and Alternative Medicine, 2013 ;21: 107-117
5. C. Cajochen, M. Münch, S. Kobialka et al., High sensitivity of human melatonin, alertness, thermoregulation, and heart rate to short wavelength light, Journal of Clinical Endocrinology and Metabolism, vol. 90, no. 3, pp. 1311–1316, 2005.
6. Bern R M &Levy MN 2000; Principles of Physiology .3rd edition ;118-192
7. Pal GK .Spectral analysis of Heart rate variability .in text book of Medical physiology 2nd edition .New Delhi :Ahuja Publications 2010 ;222-226
8. A. J. Elliot, V. Payen, J. Brisswalter, F. Cury, and J. F. Thayer, "A subtle threat cue, heart rate variability, and cognitive performance," Psychophysiology, vol. 48, no. 10pp. 1340–1345, 2011.
9 T. Rechlin, "Does bright-light therapy influence autonomic heart-rate parameters?" Journal of Affective Disorders, vol. 34, no. 2, pp. 131–137, 1995.
10. N. E. Rosenthal, A. A. Levendosky, R. G. Skwerer et al., "Effects of light treatment on core body temperature in seasonal affective disorder," Biological Psychiatry, vol. 27, no. 1, pp. 39–50, 1990.
11. C. I. Eastman, L. C. Gallo, H. W. Lahmeyer, and L. F. Fogg, "The circadian rhythm of temperature during light treatment for winter depression," Biological Psychiatry, vol. 34, no. 4,pp. 210–220, 1993.

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Progressive Muscle Relaxation Training Blunts Cardiovascular Autonomic Excitatory Response in Offspring of Hypertensive Parents

Ganesh K[1], Sivaprasad H[2]

[1]Assistant Professor, Physiology, Government Theni Medical College, Theni,
[2]Professor, Physiology, Raichur Institute of Medical Sciences, Raichur

ABSTRACT

The objective of the study was to study the effect of progressive muscle relaxation on cardiovascular autonomic functions in offspring of hypertensive parents. A total of 40 normotensive offspring of hypertensives, who were participants of relaxation training programme at Bengaluru, were divided into study group and control group with 20 subjects in each group by randomization. Initially, the HR, HRV and BP response to mental stress were measured in all the subjects. Then the study group underwent twelve weeks of progressive muscle relaxation training whereas the control group did not. At the end of twelve weeks, second recording session was held and the same parameters were reassessed in all the subjects. Twelve weeks of relaxation training had caused significant decline in heart rate reactivity, reactivity values of total power, LF power, reactivity as well as recovery of diastolic pressure. The study concluded that twelve weeks of progressive muscle relaxation training significantly reduced the cardiovascular autonomic excitatory response to mental stress in offspring of hypertensive parents.

Keywords: *Progressive muscle relaxation, cardiovascular autonomic response, mental stressor, Offspring of hypertensives.*

INTRODUCTION

Evolutionary pressures over millions of years have adapted the sympathetic nervous system as a major mediator of the fight or flight response. When sympathetic system is used in emergency settings, it improves the individual's chance of survival and increases the likelihood that his genes will be passed on to the next generation. Increase in the frequency of activation of sympathetic system would exact a toll on the integrity of the functioning of cardiovascular system, more often leading to adverse cardiovascular events.

The role of mental stress, in the development of hypertension, is likely to depend on an interaction of at least three factors: the nature of the stressor, its perception by the individual, and the individual's physiological susceptibility[1]. People may become hypertensive not just because they are more stressed but because they respond differently to the stress[2,3]. Studies have shown that the heightened reactivity, lack of adaptation, and delayed recovery occur in the sympathetic system of normotensive subjects at genetic risk of hypertension, in response to repeated mental stress. These recovery impairments may be among the earliest precursors to the development of essential hypertension in this population[4]. Since the environment of the subject causing the stress could hardly be changed, an attempt was made to change the perception of the events and hence the reaction of the subject to the particular stimulus. Progressive muscular relaxation training is such an effort. Edmund Jacobson found that an individual trained in voluntary relaxation was able to achieve a neuromuscular tonus while awake that is lower than that of light sleep, and that this tonus was representative not merely of the muscles but of the nervous system as a whole [5,6].

The physical and mental relaxation, as achieved through practice, has reproducible physiological effects

Corresponding author:-
Dr. K Ganesh,
Assistant Professor in Physiology, Govt Theni Medical College, Andipatti, Tamilnadu 625512.
Email ID – kandasamyganesh@gmail.com
Phone - 8508994707

such as increase in skin resistance, reduction in respiratory rate, heart rate, blood pressure, oxygen consumption, arterial lactate levels and sympathetic activity and this is termed as relaxation response[7]. The relaxation response activates areas in the brain responsible for emotion, attention, motivation, and memory (e.g., anterior cingulate, hippocampal formation, amygdala) and the anxiolytic effects may occur by promotion of an inhibitory (GABAergic) tone in specific areas of the brain[8]. Studies have shown that practice of progressive muscle relaxation for three months had significantly reduced Perceived Stress Scale levels[9]. We hypothesized that twelve weeks of progressive muscle relaxation training significantly reduces the cardiovascular excitatory autonomic response to mental stress in normotensive male offspring of hypertensive parents.

MATERIALS AND METHOD

Ethical clearance was obtained from ethical committee of Bangalore Medical College, Bengaluru. A total of 40 subjects in the age group of 18 to 30 years, were recruited from a premiere relaxation training centre situated in Bengaluru. The pre set questionnaire was given to the subjects and based on the reply, they were recruited for the study. The following criteria were stipulated for selection of subjects.

Inclusion criteria:

Healthy male subjects in the age group of 18 – 30 years with systolic blood pressure <140mmHg and diastolic blood pressure <90mmHg were included in the study[10]. Their parents should have been diagnosed as having essential hypertension, before the age of 60 years, from a physician.

Exclusion criteria:

Those who had practiced yoga/meditation earlier, highly trained athletes, those who are on chronic medication that affects heart rate or blood pressure, chronic nicotine or alcohol use and those with diabetes mellitus, obesity and other chronic systemic diseases were excluded from the study.

The subjects (n=40) were allocated into study (n=20) and control group (n=20) by simple randomization method using random number table. Purpose and the nature of the proposed study were explained to the subjects and written consent was obtained from each of them. Detailed medical and personal history was taken. Thorough physical examination was conducted. Parental history of hypertension was confirmed by verification of the prescription from the physician.

Experimental Protocol

The tests were carried out in the training centre between 5.00 pm and 7.00 pm. The standards of task force of European society of cardiology were followed during the recording procedure[11]. The ECG was recorded at rest in the sitting position along with quiet respiratory movements for each subject for the period of 5 minutes using RMS polyrite D hardware 2.5 equipment. The blood pressure was measured at the end of 5 minutes using mercury sphygmomanometer.

After 5 minutes of baseline recording, the serial subtraction mental arithmetic task was applied to the subjects for the next 5 minutes, while the ECG was recorded continuously. The mental serial subtraction task has been shown to cause sharp increases in cardiovascular parameters[12]. The current study used a serial subtraction task adopted from Cacioppo et al[13]. No consideration was given to participant's math ability. Participants were instructed to respond in pace with a metronome set at 40 beats per minute. When participants did not respond in the allotted time, they were told to keep pace with the metronome. When an incorrect response was given, participants were told wrong and were given their last correct number and to continue subtracting from the correct number. The blood pressure was recorded at the end of 5 minutes. After 5 minutes of mental arithmetic task, the subjects were told that the task was over and to relax. The ECG was recorded continuously for another 5 minutes and the blood pressure was recorded at the end of 5 minutes.

After the initial recording session, the study group attended progressive muscle relaxation training programme. The programme consisted of oriental classes explaining the scientific basis and benefits of practicing relaxation techniques, followed by training sessions for the period of twelve weeks. During the training period, the subjects were taught progressive muscular relaxation by the experts in training centre, for the period of 30 minutes per day, 5 days in a week for twelve weeks. They were asked to impart these practices in their daily activities since the goal of relaxation technique is to diminish the distinction between formal relaxation

practice and everyday life. The Controls were told about benefits of mental relaxation and they were asked follow their own way of relaxing methods like reading books, listening music for 30 minutes daily for 3 months.

After the period of twelve weeks, both study group and control group underwent final recording session. The procedures were same as that of initial recording session consisting of baseline recording of BP, HR, and HRV at rest in the sitting position, recording during mental arithmetic task and during recovery from mental arithmetic task.

Statistical analysis of data

Frequency domain analysis of RR interval was done by HRV analysis V 1.1 software (biomedical signal analysis group, Finland). Data was expressed as mean ± SD. Students paired 't' test and repeated measures analysis of variance were used to compare the means before and after relaxation training. Friedman test was used to find significance in repeated measurements of non-normal distributions within each group. Chi square test and Fischer's exact test were used to analyze parameters on categorical scale. For all comparisons, $P<0.05$ was considered statistically significant[14].

RESULTS

There was no statistically significant differences seen in age (p=0.852) and BMI (p=0.929) between study and control group. The laboratory mental stressor raised all the parameters significantly (p<0.001) from their baseline values in both study and control groups except HFnu. HFnu decreased significantly during mental stress (p<0.001). Following twelve weeks of relaxation training, the heart rate response during mental stress decreased significantly (p<0.001). The Total Power in the power spectral analysis of HRV decreased significantly during mental stress (p=0.003). LF power decreased in the study group (p=0.043). No significant difference was observed with HF, LFnu, HFnu and LF/HF. The baseline systolic blood pressure was not significantly reduced after relaxation training while the reactivity and recovery values decreased significantly in the study group (p=0.001 and 0.005 respectively) as well as control group (p=0.017 and 0.011 respectively).The reactivity and recovery values of diastolic pressure also decreased significantly (p=0.001) following relaxation training. No significant change was observed in control group.

Table no 1: Comparison of Heart rate, Heart rate variability and Blood pressure values between pre and post study period in both study and control groups (Expressed as Mean ± SD).

Parameter		Study group		Control group		Training effect	
		Pre	Post	Pre	Post	Study	Control
Mean HR (beats /min)	A	75.1±3.5	74.3±3.3	72.1±4.1	71.3±4	0.213	0.110
	B	82.4±3.9	76.4±3	79.6±3.9	78.7±3.5	<0.001	0.772
	C	76.30±5	74.1±3.2	72.9±4.5	71.8±4	0.187	0.569
TP (ms^2)	A	904.7±289.1	886.3±191.4	924.7±180.9	812.5±238.3	0.365	0.679
	B	1652.5±494.3	1306.5±333.7	1455.1±440.2	1565±387.8	0.003	0.104
	C	941.9±218.2	779.7±225.5	937.7±275.8	845.1±199.4	0.204	0.763
HF (ms^2)	A	177.6±54.9	131.3±33.8	161.9±49.2	140.7±35.1	0.584	0.611
	B	216.4±73.4	167.6±41.8	223.6±69	245.7±63.9	0.909	0.239
	C	178.9±77.6	124.9±34.9	166.3±64.2	153.8±43	0.697	0.481
LF (ms^2)	A	492.5±153.7	512.6±149	497.5±150.3	426.5±180	0.273	0.123
	B	945.6±398.8	802.2±262.2	823.6±347.7	959.2±218.3	0.043	0.079
	C	479±193.6	417.3±107.7	473.7±140.9	444.3±123.4	0.241	0.459

Cont... **Table no 1: Comparison of Heart rate, Heart rate variability and Blood pressure values between pre and post study period in both study and control groups (Expressed as Mean ± SD).**

HFnu	A	28.3±9.8	20.9±4.4	25.2±8.1	26.4±7.6	0.146	0.678
	B	19.1±5	17.9±4.2	22.3±6.8	20.6±5.1	0.223	0.664
	C	28.3±7	23.3±5.8	26.1±7.5	26.4±6	0.506	0.705
LFnu	A	71.7±9.8	79.1±4.4	74.8±8.1	73.6±7.6	0.146	0.678
	B	80.9±5	82.1±4.2	77.7±6.8	79.4±5.1	0.223	0.664
	C	71.7±7	76.7±5.8	73.9±7.5	73.6±6	0.506	0.705
LF/HF	A	2.9±1.2	4±1	3.2±1	3.1±1.3	0.341	0.638
	B	4.7±1.9	4.8±1.1	3.9±1.4	4.1±1.2	0.172	0.236
	C	2.7±0.8	3.5±1	3.2±1.3	3±0.9	0.531	0.888
SBP (mmHg)	A	115.1±6.9	113.2±4.7	114.3±6.1	114.4±5.8	0.565	0.155
	B	121.2±7.7	116.4±4.6	120.1±7.4	118±4.9	0.001	0.017
	C	120.5±7.7	115.5±5.1	120.7±7.1	116.9±5.2	0.005	0.011
DBP (mmHg)	A	76.2±5.3	74.4±3.8	77.6±5.7	75.4±4.3	0.267	0.126
	B	79.9±5.6	75.9±4.5	80.2±5.5	79.7±4.6	<0.001	0.591
	C	80.2±5.3	75.4±4.5	79.4±5.3	78.4±4.7	<0.001	0.255

HR, heart rate;SBP, systolic blood pressure; TP, total power; DBP, diastolic blood pressure; HF, high frequency power; HFnu, high frequency power in normalized units; LF nu, low frequency power in normalized units;A, baseline values; B, reactivity to mental stressor; C, recovery from mental stressor;

DISCUSSION

Effect of laboratory mental stressor on HR, HRV and BP

The mean heart rate is significantly increased during mental stress in both groups. This is attributed to increased sympathetic drive coupled with parasympathetic withdrawal that occur during stress. Total power is increased significantly during stress in both groups. Total power in the power spectral analysis of HRV is indicative of overall HRV. High HRV is a sign of good adaptation to the stressor. High variability in offspring of hypertensive parents shows that they adapt to the given stress by bringing about necessary modulation in the autonomic nervous system[15]. Autonomic modulation of cardiovascular system in normotensive people with hypertensive family members and that of hypertensives is a continuum. Studies have shown that the hypertensives have low TP in response to mental stress. The transition occurs over a period of time, from high HRV to low HRV that is, from high to low autonomic modulation favoring the hypertensive state. LF power increased significantly during stress in both groups. Increase in LF is a sufficiently reliable index of increased sympathetic activity[16]. LFnu is increased during mental stress showing increased sympathetic activity. HF power indicates vagal modulation at SA node. In the present study, HF is increased during mental stress. Levy MN studied peripheral interactions of sympathetic and parasympathetic systems in the heart and also found that the sympathetic nerve activity could excite parasympathetic fibres thus increasing the vagal activity. He termed this as reciprocal excitation[17]. This could explain increase in HF during stress, observed in the present study. HFnu is decreased during stress in both groups, indicating the dominant sympathetic activity during the stressful situation. LF/HF is an indicator of sympathovagal balance. Increase in this ratio during stress shows that the balance is shifted towards sympathetic activity. Systolic and diastolic blood pressure increased significantly during stress in both groups. Widgren BR et al speculated that such increased systolic and diastolic blood pressure responses to stress seen in offsprings of hypertensives could be related to subsequent development of high blood pressure in future[18]

Effect of progressive muscle relaxation on cardiovascular autonomic response

The total power decreased significantly after relaxation training reflecting preservation of high autonomic reserve in the study group. The decrease in LF seen in the present study is concurrent with the observation made by Lucini et al which indicates that the sympathetic activity is decreased after relaxation training[15]. No significant changes could be observed with LFnu, HF, HFnu, HF/LF values. Probably, the duration of training might not be sufficient enough to cause significant changes in these values. The heart rate reactivity reduced significantly following relaxation training. The baseline systolic blood pressure is not significantly reduced after relaxation training while the reactivity and recovery values decreased significantly. Even in control group, significant decrease in systolic pressure could be noted during follow up recording. This could be due to familiarization of the subject with the environment. Schneider GM et al found that impairment of recovery of diastolic pressure might be among the earliest precursors to the development of essential hypertension in such population[4]. In the present study, we found that the relaxation training has significantly reduced the diastolic blood pressure during recovery from mental stress test. These findings indicate that the relaxation training significantly reduced the cardiovascular autonomic excitatory responses to mental stress.

CONCLUSION

The present study has shown that the progressive muscle relaxation training significantly reduced heart rate reactivity, TP and LF power in HRV analysis, reactivity and recovery values of diastolic blood pressure, in response to mental stress. All these observations indicate that cardiovascular autonomic excitatory response is significantly reduced in offspring of hypertensive parents. This reduction in excitation of autonomic nervous system might offset the development of hypertension in offspring of hypertensive parents. Long term studies are warranted to prove this benefit.

"Mental calmness is the natural result of physical relaxation" – Edmund Jacobson.

Conflicts of Interest - None

Source of Funding – Self

REFERENCES

1. VikrantS, Tiwari SC. Essential hypertension – pathogenesis and pathophysiology. J Indian AcadClin Med 2001; 2(3): 140-59.
2. Sparrenberger F, Cichelero FT, Ascoli AM, Fonseca FP, Weis G, Berwanger O et al. Does Psychosocial stress cause hypertension? A systematic review of observational studies. J Hum Hypertens 2009; 23: 12-19.
3. Footman K, Roberts B, Tumanov S, McKee M. The Comorbidity of Hypertension and Psychological distress: a study of nine countries in Soviet Union. J Public Health 2013; 35(4):548-57.
4. Schneider GM, Jacobs DW, Gevirtz RN, O'Connor DT. Cardiovascular hemodynamic response to repeated mental stress in normotensive subjects at genetic risk of hypertension: evidence of enhanced reactivity, blunted adaption, and delayed recovery. J Hum Hypertens 2003; 17: 829-40.
5. Jacobson E. Progressive relaxation. Chicago: University of Chicago Press; 1938.
6. Gessel AH,Jacobson E: The Founder of Scientific Relaxation. Int J of Psychosom 1989; 36:1-4.
7. BensonH. The Relaxation response. New York: WilliamMarrow; 1975.
8. Lazar S, Bush G, Gollub R, Fricchione GL, Khalsa G, Benson H. Functional brain mapping of the relaxation response and meditation. Neuroreport 2000; 11: 1585.
9. Chaudhuri A, Ray M, Saldanha D, Bandopadhyay AK. Effect of progressive Muscle Relaxation in female health professionals. Ann Med Health Sci Res 2014; 4(5): 791-5.
10. Evans JM, Ziegler MG, Patwardhan AR, Ott JB, Kim CS, Leonelli FM et al. Gender differences in autonomic cardiovascular regulation: spectral, hormonal, and hemodynamic indexes. J ApplPhysiol 2001; 91: 2611-18.
11. Task Force of the European Society of Cardiology the North American Society of Pacing Electrophysiology.Heart Rate Variability: Standards of Measurement, Physiological Interpretation, and Clinical Use. *Circulation* 1996; 93: 1043-65.
12. Williams RD, Riels AG, Roper KA. Optimism and distractibility in cardiovascular reactivity. Psychological record 1990; 40(3): 451-7.

13. Cacioppo J T, Malarkey W B, Kiecolt-Glaser J K, Uchino B N, Sgoutas-Emch S A, Sheridan J F, et al. Cardiac autonomic substrates as a novel approach to explore heterogeneity in neuroendocrine and immune responses to brief psychological stressors. Psychosom Med 1995;57:154–64.
14. Rosner B. Fundamentals of Biostatistics, 5th ed. Duxbury 2000; 80-240.
15. Lucini D, Covacci G, Milani R, Mela GS, Malliani A, Pagani M. A Controlled Study of the Effects of Mental Relaxation on Autonomic Excitatory Responses in Healthy Subjects. Psychosom Med 1997; 59:541-52.
16. Piccirillo G, Viola E, Nocco M, Durante M, Tarantini S, Marigliano V. Autonomic modulation of heart rate and blood pressure in normotensive offspring of hypertensive subjects. J Lab Clin Med 2000;135:145-52.
17. LevyMN. Sympathetic-Parasympathetic interactions in the heart. Circulation Research 1971;29:437-45. 11.
18. Widgren BR, Wikstrand J, Berglund G, Andersson OK. Increased response to physical and mental stress in men with hypertensive parents. Hypertension 1992;20:606-11.

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A Prospective Study on Haematological and Biochemical Profiles in Alcoholic Liver Disease Patients Attending KIMS Hospital Out Patient Department (OPD) Hubballi

Hanchinamani Geeta B[1], V S Baljoshi[2]

[1]Post Graduate, [2]Associate Professor, Department of Physiology, KIMS, Hubballi

ABSTRACT

Background:- Alcoholic Liver Disease(ALD) is one of the leading social problem arising in the young individuals of India.It has a negative impact on both the physical,mental and economic aspects of individuals' life.

Objectives:- To study the Haematological and Biochemical profiles in 30 ALD patients and 30 controls attending KIMS Hospital, Hubballi.

Materials and Method:- The present study was undertaken in ALD patients attending KIMS Hospital Medicine OPD No. 40,Hubballi.

Statistical Analysis was done.

Results:- The mean Hb, RBC count, Platelet count, PCV, MCHC, Total Protein and Albumin were significantly decreased while the mean MCV, TLC, Absolute neutrophil and lymphocyte count, Total and Direct Bilirubin, Liver enzymes and Derritis ratio were significantly increased in ALD patients ('P' value < 0.05). There were no significant changes in Lipid profile and Renal Function Test parameters.There were no significant differences ('P' > 0.05) in the parameters in relation to the duration they taking alcohol.

There was a highly significant correlation between duration of the cases' alcohol intake and their CAGE questionnaire score ('P' value < 0.01).

Conclusion:-ALD is one of the leading causes of deaths,more prevalent in the males.ALD damages the liver parenchyma and deranges the blood parameters.

Keywords:- *alcoholic liver disease;haematological parameters;total protein and albumin;total and direct biliru bin;aminotransferases;derritis ratio;alkaline phosphatase;CAGE questionnaire.*

INTRODUCTION

Alcohol consumption is well entrenched in the social fabric of many adult populations, virtually constituting a behavioural norm.Sustained excessive alcohol consumption is a brain-centred addictive behavioural disorder that crosses all boundaries of gender,race,age, economic strata and in many patients,might lead to alcoholic liver disease (ALD).[1,2,3]

The major health risk of alcoholism includes liver disease,heart disease,pancreatitis, central nervous system disorders and certain forms of cancer.[4]

Liver function tests (LFTs) are a group of clinical laboratory tests performed to get information about the state of patient's liver.[5]The assay of liver enzymes indicates the intactness of liver and analysis of liver metabolites indicates the normal functionality of liver. A biochemical clue is the ratio of AST to ALT (2:1 at least), reflecting the low level of activity of ALT in people with alcoholic liver disease.[6] The liver plays a crucial role in the synthesis, secretion, catabolism, and storage of lipids and lipoproteins.Therefore, the serum lipids and lipoproteins concentrations in liver diseases could be changed.[7-10]Generally, the level of plasma lipids and lipoproteins tends to decrease with the severity of liver disease.[11,12] The Haematological tests namely,RBC counts,WBC counts,Haemoglobin levels and MCV are strong indicators of ALD as reported by several researchers.[13]

The aim of our present study is to individually study the haematolgical and biochemical profiles of all patients with ALD and to find out changes in the parameters in relation to the duration of their alcohol intake and the correlation between the duration of alcohol intake with their CAGE scoring.

MATERIALS AND METHOD

The present study was undertaken in 30 ALD patients. Ethical approval was taken.

i. Inclusion Criteria :-

• Male patients,Age > 20 years,History of alcohol intake for more than five years duration

iv. Exclusion Criteria :-

• Female patients,Age < 20 years,History of alcohol intake since less than five years duration,Known case of Diabetes Mellitus, Hypertension, Cirrhosis or non alcoholic liver disease (NALD) ,Asthma, Epilepsy or any other chronic diseases

The Statistical analysis was done between cases and controls using **Unpaired Students` t-test**.The analysis between the groups was done using **ANOVA**. Lastly, the correlation between the duration of alcohol intake and CAGE score was found using **Pearsons` coefficient**.

FINDINGS

The following study is conducted with 30 cases(Group 0) and 30 controls(Group 1).

ANALYSIS OF PARAMETERS BETWEEN CASES AND CONTROLS (GROUP 0 AND GROUP 1 RESPECTIVELY)

Table 1 :- The mean, S.D. and 'P' value for Hb levels, RBC counts, PCV, MCV,MCH and MCHC :-

Variable	Group 0 (n = 30) Mean±S.D.	Group 1 (n = 30) Mean±S.D.	'P' value	Significance
Hb(g / dL)	8.23±2.712	13.13± 1.167	0.000	VHS
RBC count(millions / µL blood)	3.03 ± 0.850	5.37 ± 0.669	0.000	VHS
PCV(%)	27.23 ± 6.436	44.17 ± 2.653	0.000	VHS
MCV(fl)	107.17 ± 6.131	84.57 ± 2.459	0.000	VHS
MCH(pg)	29.47 ± 4.257	27.77 ± 2.459	0.063	NS
MCHC(%)	30.33 ± 2.682	32.37 ± 0.964	0.000	VHS

Table 2:- The mean, S.D. and 'P' value for Absolute Leukocyte Count (Equal variances not assumed are used for 'P' value) :-

Variable	Group 0 (n = 30) Mean±S.D.	Group 1 (n = 30) Mean±S.D.	'P' value	Significance
Neutrophils (cells/ µL blood)	7461.23 ± 1510.591	4679.00 ± 1218.169	0.000	VHS
Lymphocytes (cells/ µL blood)	3697.63 ± 1338.624	1718.83 ± 419.185	.000	VHS

Table 3 :- The mean, S.D. and 'P' value for Total protein, Albumin and Bilirubin (Total and Direct) :-

Variable	Group 0 (n = 30) Mean±S.D.	Group 1 (n = 30) Mean±S.D.	'P' value	Significance
Total Protein (g / dL)	6.30 ± 1.291	6.83 ± 0.648	0.048	S
Albumin (g / dL)	2.67 ± 0.844	4.43 ± 0.504	0.000	VHS
Total Bilirubin (mg / dL)	6.63 ± 8.168	0.63 ± 0.4900	0.000	VHS
Direct Bilirubin (mg / dL)	3 ± 4.495	0.3367 ± 0.0718	0.001	HS

Table 4 :- The mean, S.D. and 'P' value for Liver Enzymes :-

Variable	Group 0 (n = 30) Mean±S.D.	Group 1 (n = 30) Mean±S.D.	'P' value	Significance
AST (U /L)	145.80 ± 17.515	26.70 ± 5.497	0.000	VHS
ALT (U / L)	54.50 ± 8.476	23.83 ± 4.035	0.000	VHS
Derritis ratio (AST : ALT)	2.7294 ± 0.4864	1.1333 ± 0.3457	0.000	VHS
ALP (U / L)	120.93 ± 47.914	58.53 ± 16.423	0.000	VHS

Table 5 :- The mean, S.D. and 'P' value for Lipid Profile :-Nothing Significant

Variable	Group 0 (n = 30) Mean±S.D.	Group 1 (n = 30) Mean±S.D.	'P' value
Total Cholesterol (mg / dL)	148 ± 14.692	150.63 ± 16.992	0.523
Triglycerides (mg / dL)	154.60 ± 20.767	148.90 ± 21.728	0.303
HDL (mg / dL)	27.43 ± 5.494	27.83 ± 5.318	0.775
LDL (mg / dL)	77.63 ± 12.686	78.27 ± 9.120	0.825

Table 6:-The mean, S.D. and 'P' value for Renal Function tests:-Nothing Significant

Variable	Group 0 (n = 30) Mean±S.D.	Group 1 (n = 30) Mean±S.D.	'P' value
RBS (mg / dL)	85.90 ± 23.453	80.13 ± 5.888	0.197
Urea (mg / dL)	23.50 ± 20.577	25.97 ± 4.687	0.525
Creatinine (mg / dL)	1±0.455	1 ± 0.000	1.000

The 30 cases are divided into three groups (Group A, B and C) on the basis of the number of years they have been taking alcohol.The Mean and Standard Deviation (S.D.) are calculated for all the parameters in all groups.

NONE OF THE PARAMETERS SHOWED ANY STATISTICAL SIGNIFICANCE WITH RESPECT TO THE DURATION OF THEIR ALCOHOL INTAKE

CORRELATION BETWEEN THE HAEMATOLOGICAL AND BIOCHEMICAL PARAMETERS AND DURATION OF THE ALCOHOL INTAKE USING ANOVA

CORRELATION BETWEEN DURATION OF ALCOHOL INTAKE AND CAGE QUESTIONNAIRE SCORE

Table 7 :- Cross Tables

	Group A	Group B	Group C	Total
CAGE Score 1	5	0	0	5
CAGE Score 2	4	0	0	4
CAGE Score 3	1	5	3	9
CAGE Score 4	4	2	6	12
Total	**14**	**7**	**9**	**30**

CONCLUSION

During one year study period from 01- 01- 2014 to 31- 12- 2014 , 30 cases and 30 controls were studied and various parameters were analyzed. Also the cases were divided into three groups and the parameters were analyzed between the formed groups. Also the correlation was found between duration of alcohol intake and the CAGE Questionnaire Score of the cases.

A. **Haematological Parameters :-**

1) Haemoglobin and RBC count :-

In the present study the mean Hb value of cases and controls was 8.23 g / dL and 13.13 g / dL respectively. The difference between the groups was very highly significant. ('P' value < 0.001).

The mean RBC count in the present study was 3.03 million cells / µL blood for cases while for control the value was 5.37 million cells / µL blood , the difference being very highly significant. ('P' value < 0.001).

Similar observations were made by Neelesh Deshpande et al.,[14] in a study where they concluded depleted Hb and RBC counts between controls and compensated cases. However , a study by Luis Costa Matos et al.,[15] showed no significant difference between cases and controls. There was no significant difference found in Haemoglobin percentage by a study done by Shivam Khare et al.[16]

PCV and Blood Indices (MCV, MCH and MCHC) :-

The mean PCV values were 27.23 % and 44.17 % for cases and controls respectively with a very high significant difference ('P' value < 0.001). The MCV values` difference was also very highly significant and was increased in cases (107.17 fl), a condition called MACROCYTOSIS with 'P' value < 0.001. The MCH values were not significant while the MCHC values also showed a very highly significantly difference being decreased in cases (30.33 %), a condition called HYPOCHROMICITY with 'P' value < 0.001.

The observations were concurrent with the findings of the study done by Adolf Pfeffrebaum, M.D. et al.,[17] who found significant difference in PCV values of cases and controls ('P' value < 0.05).

TLC, Platelet count and Absolute Leukocyte Count :-

The present study showed leukocytosis in cases with TLC count being 11382.30 cells / µL blood. Also there was thrombocytopenia in cases with platelet count 77151.83 cells / µL blood. The cases showed increased absolute count of neutrophils and lymphocyte. All the differences were statistically very highly significant wit 'P' value < 0.001. TLC was also elevated in a study by Aswad Al.Obeidy[18] concluded leukocytosis is a frequent and important abnormality in alcoholic hepatitis. In a study by Oke Oluesegun Taiwo et al.,[19] the platelet count was significantly decreased in cases. Weed and Reed [20] commented that alcohol inhibits platelet production from the bone marrow and thus reduce their number.

The possible explanation for above parameters is the fact that alcohol has a variety of pathologic effects to the bone marrow resulting in vacuolization of the marrow precursor cells causing anemia , leukemia and thrombocytopenia. The MCV is frequently elevated in alcoholics which may be due to the fact that vitamin B_{12} and folate are poorly absorbed and / or utilized in alcoholism during erythropoiesis and hence results in defects in RBC maturation with subsequent increase in the size of RBC (macrocytosis).[21] Also , the ALD patients are very susceptible for acute and acute on chronic infection and thus absolute counts of neutrophils and lymphocytes are increased.

B. Biochemical Parameters :-

1) **Liver Function Tests :- (Protein and Bilirubin) :-**

The present study showed hypoproteinemia and hypoalbuminemia amongst cases with a mean total protein value of 6.3 g / dL and total albumin value of 2.67 g /dL. There was hyperbilirubinemia in cases and the mean total bilirubin was 6.63 mg / dL and direct bilirubin was 3 mg / dL. The differences were statistically significant with 'P' value < 0.05 for total protein ; 'P' value < 0.001 for albumin and total bilirubin and 'P' value < 0.01 for direct bilirubin. The abnormalities can be explained with regards to defects in synthesizing , uptake and excretory function of liver.

Similar observations were made by M Adak et al.,[22] where the differences were statistically significant ('P' value < 0.001 for total protein, total and direct bilirubin

and 'P' value < 0.01 for albumin).

Liver Enzymes and Derritis Ratio :-

The presnt study showed mean values of AST, ALT and ALP as 60.07 U/L, 56.37 U/L and 120.93 U/L respectively for cases and the difference was very highly significant with 'P' value < 0.001. The Derritis ratio (AST : ALT) ratio was 2.72 for cases and the 'P' value was < 0.001.

In a study by Prasad P. Torkadi et al.,[23] similar observations for found with regards to the three enzymes. In a study by Manisha Arora et al.,[24] the AST , ALT and their ratio showed similar findings with 'P' value < 0.001. The elevation in ALT was not as high as AST. They concluded that this reflected the diminished hepatic activity of these enzymes which made them to leak into the serum from the damaged hepatocytes.[25]

There were no studies in regards to negative correlation with the above findings.

Lipid profile:- The present study showed no significant changes in the Lipid profile parameters ('P' value > 0.05) and they were within normal limits in both cases and controls.The probability might be the lesser duration of alcohol intake of five years considered here which might not have resulted in damaging liver cells extensively so that there could be derangement in the lipid profile.

In the present study there was no significant correlation between changes in lipid profile parameters and duration of their alcohol intake and no studies found in supporting it.

4) Renal Function Tests (RFT) :-

The present study showed no significant changes in the Renal Function Test (RFT) parameters ('P' value > 0.05) and they were within normal limits in both cases and controls.

The present study showed no significant correlation between changes in RFT parameters and duration of the alcohol intake of the cases and no studies were found for the same.

C. Correlation between Duration of Alcohol Intake and the CAGE questionnaire score :-

In the present study, the 30 cases were divided on the basis of the duration of their alcohol intake and their CAGE questionnaire score and the cross tables drawn. On applying Chi – Square analysis, it was found that the 'r' value was 0.556 and there exists a highly significant correlation between the two parameters ('P' value < 0.01).

Conflict of Interest :- Nil

Source of Funding :- Self

Ethical Clearance :- Taken

REFERENCES

1. Lelbach, W.K. Cirrhosis in the alcoholic and its relation to the volume of alcohol abuse. Ann N Y Acad. Sci.1975, 252: 85–105.
2. Becker, U., Deis, A., Sorensen, T.I. Prediction of risk of liver disease by alcohol intake, sex, and age: a prospective population study. Hepatology. 1996,23: 1025–1029.
3. Tome, S. and Lucey, M. R.Review article: current management of alcoholic liver disease. Aliment Pharmacol Ther . 2004, 19: 707–714.
4. B. Usharani, R. Vennila and N. Nalini Biochemical changes in Alcoholics – A case control study, B. Usharani, R. Vennila and N. Nalini. Biochemical changes in Alcoholics – A case control study. 2012, 3 (1): 201-205.
5. Johnston DE. Special considerations in interpreting liver function tests. Am Fam Physician 1999; 59(8): 2223-30.
6. Limdi JK, Hyde GM. Evaluation of abnormal liver function tests. Postgrad Med J 2003;79:307-312.
7. Seidel D (1987) Lipoproteins in liver disease. J Clin Chem Clin Biochem 25:541–551.
8. Cicognani C, Malavolti M, Marselli-Labate AM, Zamboni L, Sama C, Barbara L (1997) Serum lipid and lipoprotein patterns in patients with liver cirrhosis and chronic viral hepatitis. Arch Intern Med 157:792–796.
9. Makarov VK, Khomeriki SG (2007) Serum lipids as biochemical manifestations of hepatic alcoholic, viral, and mixed viral-and alcoholic lesion. Klin Lab Diagn 5:17–19.
10. McIntyre N (1978) Plasma lipids and lipoproteins in liver disease. Gut 19:526–530.

11. Ooi K, Shiraki K, Morishita Y, Nobori T (2005) Clinical significance of abnormal lipoprotein patterns in liver diseases. Int J Mol Med 15:655–660.

12. Selimoglu MA, Aydogdu S, Yagci RV (2002) Lipid parameters in childhood cirrhosis and chronic liver disease. Pediatr Int 44:400–403.

13. Ryback SR,Eckardt JM,Felsher B,Raw RR.J Am Med Assoc 1982;248:2261-2265.

14. Neelesh Deshpande, Sabitha Kandi, Manohar Muddeshwar, Rajkumar Das, K V Ramana. A Study of Biochemical and Haematological Markers in Alcoholic Liver Cirrhosis; World Journal of Nutrition and Health, 2014, Vol. 2, No. 2, 2 4-27.

15. Luis Costa Matos, Paulo Batista, Nuno Monteiro, Joao Ribeira, Maria A Cipriano, Pedro Henriques, Fernando Girao, Armando Carvalho. Lymphocyte subsets in alcoholic liver disease; World J Hepatol 2013 February 24; 5(2): 46- 55.

16. Shivam Khare, Vijay Kumar Garg, Hemant Kumar Jain, Omprakash Jatav. To study haematological profile in patients of chronic liver disease; International Journal of Multidisciplinary Research and Development; Volume: 2, Issue: 8, 378-381; Aug 2015.

17. Adolf Pfefferbaum, M.D., Margaret J. Rosenbloom, M.A., Kathleen L.Serventi, M.D., Edith V. Sullivan, Ph.D. . Brain Volumes, RBC Status, and hepatic Function in Alcoholics After 1 and 4 Weeks of Sobriety: Predictors of Outcome; Am J Psychiatry 161:7, July 2004.

18. Aswad Al.Obeidy (FICMS).(FICMS GE and Hep). Alcoholic Liver Disease: Alfa Fetoprotein Alteration, Haematological and Biochemical Characteristics; J Fac Med Baghdad 2006; Vol. 48, No. 3, 242-245.

19. Oke Olusegun Taiwo, Adeyanju Oluwaseyi Adeteju, Oyedeji Samuel Oyewole, Adedire Olusoji Aderemi, Adewuyi issac Kayode, Grace Oludayo. Effect of Alcohol Consumption on Platelets Count, Intrinsic and Extrinsic Pathways of Blood Coagulation; Greener Journal of Medical Sciences, ISSN: 2276-7797, Vol. 3(8), pp. 289-293, October 2013.

20. Weed R.I., and Reed M. (1983). Membranes alteration and red blood cell destruction. Am J Med. 41:681.

21. Fantozzi R., Caramelli L, Ledda F, Moroni F, Masini E, Blandina P, Bolli P, Pcruzzi S, Zorn AM, Mannai-oni PF. Biological Markers and Therapeutic Outcome in Alcoholic disease: A Twelve-year Survey. Department of preclinical and Clinical Pharmarcology, University of Florence, Italy, Toxicological unit, Florence University, School of medicine, Italy. Klin Wochensche. 1986: 7-33.

22. M Adak, AN Thakur, K Adhikari. Study of Biochemical Markers in Alcoholic liver Disease: Hospital-Based Case Control Study; RJPBCS, July – September 2012; Volume 3; Issue 3; Page No. 987 – 995.

23. Prasad P. Torkadi, I.C. Apte, A.K. Bhute. Biochemical Evaluation of Patients of Alcoholic Liver Disease and Non-alcoholic Liver Disease; Ind J Clin Biochem (Jan-Mar 2014) 29 (1): 79-83.

24. Manisha Arora, Roshan Kumar Mahat, Sudeep Kumar, Anita Sharma, Jyoti Batra. Evaluation Of AST/ALT Ratio In Patients Of Alcoholic Liver Disease; Bulletin of Pharmaceutical and Medical Sciences, Vol. 3. Issue.1.,2015.

25. Sharpe PC, McBride R, Archbold GP. Biochemical markers of alcohol abuse. QJM 1996:89: 137-44.

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Effect of Body Mass Index on Audiovisual Reaction Time in Healthy Young Males

Brajpal Singh Tanwar[1], Shikha Mathur[2], Mamta[2], Aparna Garg[2]

[1]Assistant Professor, [2]Associate Professor, Department of Physiology, M.G. Medical College & Hospital, Jaipur,(Raj.)

ABSTRACT

Background: Reaction time is the time taken by an individual to react to a stimulus. It is an indirect index of processing capabilities of the Central Nervous System and is affected by various factors.

Aims & Objective: The present study was conducted to assess the effect of Body Mass Index on Auditory and Visual reaction time in healthy young males (17 - 25 yrs.) with the help of Audiovisual reaction time by standard machine.

Method:- 120 healthy young male subjects were randomly selected.Subjects were divided into 3 groups according to their body mass index:-

Group 1:- Normal (BMI 18.5 – 24.99 kg/m^2)

Group 2:- Underweight (BMI < 18.5 kg/m^2)

Group 3:- Overweight (BMI > 25 kg/m^2)

Results:- Auditory Reaction Time (ART) and Visual Reaction Time (VRT) assessed by using one – way ANOVA with post – hoc Tukey's HSD test. Both Auditory Reaction Time and Visual Reaction Time were prolonged and highly significant ($p<0.0001$) in group 2 and group 3 in comparison to group 1.

Conclusion:-Overweight & obesity both play a significant role in ones Audiovisual reaction time.

Keywords:- *Auditory Reaction Time, Body Mass Index, Visual Reaction Time.*

INTRODUCTION

In the present day scenario humans have developed fast response to stimuli due to excessive use of video games ,mobiles screen.

Audiovisual reaction time is the speed, with which a person can respond to an auditory stimulus and visual stimulus respectively[8]. It provides an indirect index of the processing capability of the central nervous system and also a simple means of determining sensory – motor performance[4].It determines the alertness of a person because how quickly a person responds to a stimulus depends on his reaction time.

Reaction time has physiological significance and is a simple and non invasive test for peripheral as well as central neural structures. Reaction time becomes crucial for survival during driving, adventurous sports,etc. and is an important quality of a sportsperson. Reaction time measurement includes the latency in sensory neural code traversing peripheral and central pathways, perceptive and cognitive processing, a motor signal traversing both central and peripheral neuronal structures and finally the latency in the end effector activation (i.e. muscle activation). So any change in reaction time indicates presence of a peripheral and/or central disturbance.

Reaction time is affected by number of factors such as Age, Gender, Exercise, Left v/s Right Hand,

Author for Correspondence:
Dr. Brajpal Singh Tanwar
Assistant Professor, Department of Physiology,
M.G.Medical College & Hospital, Jaipur,(Raj.)
E-mail: brajpalsingh@yahoo.co.in

Fatigue etc. Studies have shown that Body Mass Index (BMI) calculated as Weight (Kg) divided by square of Height (m^2) influences cognitive functions, attention and memory[3] Therefore present study was designed to find out whether BMI affects auditory and visual reaction time.

MATERIAL AND METHOD

The present study was conducted in the Department of Physiology, MG Medical College& Hospital, Jaipur after getting approval from institutional ethical committee. For the study, 120 normal, healthy males (17 – 25 yrs.) were taken and categorized into 3 groups according to their Body Mass Index (BMI). 40 subjects were taken in each group.

BMI is calculated by Weight (Kg) / Height (m^2). Height was measured with subject standing barefoot, feet together, eyes looking straight ahead and back in contact with measuring bar of stadiometer. Body weight recorded by a digital weight scale barefoot and with light clothes. Then the subjects were divided into 3 groups according to WHO criteria of BMI:-

Group 1:- Normal (BMI 18.5 – 24.99 kg/m^2)

Group 2:- Underweight (BMI < 18.5 kg/m^2)

Group 3:- Overweight (BMI > 25 kg/m^2)

Inclusion Criteria:The present study included healthy males free of any systemic ailments. Age: 17-25 years.

Exclusion Criteria:-Subjects having history of any kind of systemic disorders, untreated visual & auditory disease, any neuromuscular disorder, sleep disorder, excessive fatigue & fasting ,any kind of alcohol addiction.Also the subjects which are on any kind of medications which may affect reaction time.

Reaction time was recorded with the help of Audiovisual Reaction Time Apparatus, supplied by Medisystem,Yamunanagar , Haryana. It had a display accuracy of 100%. The apparatus has two modes of providing stimulus – Auditory and Visual. Auditory reaction time was recorded for low frequency sound stimuli and Visual reaction time recorded for Red light. Subjects were asked to have adequate sleep at night, to avoid any kind of medication during study period and to come in the department between 8 AM to 10 AM after having light breakfast.

Subjects were asked to respond the stimuli by pressing the response key with the index finger of their dominant hand. The display indicated the reaction time. After familiarizing the subjects with the instrument and after repeated practices, three readings for each stimuli were taken. The interval between the two successive stimuli was randomly varied from 2 to 5 seconds. The least reading of the three was taken as the value for reaction time task. The results expressed as mean ± standard deviation. Data was analyzed using one way ANOVA with post –hoc Tukey's HSD test. $p< 0.05$ was taken as cut off for the measure of significance.

RESULTS

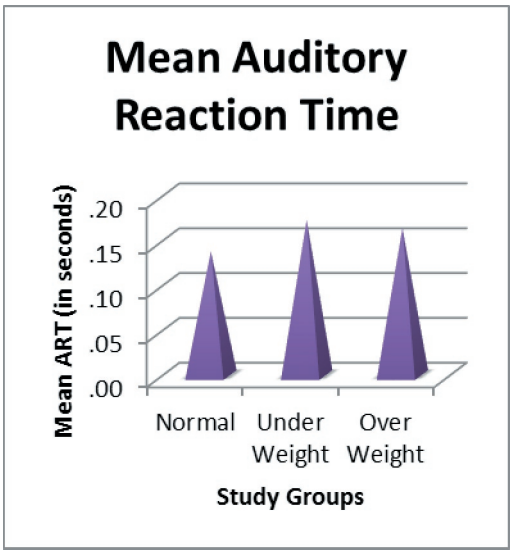
In the present study, BMI was significantly ($p < 0.0001$) different among the three study groups (Table-1). There was prolongation of ART and VRT in underweight as well as overweight groupswhen compared to normal group. Results were significant ($p < 0.0001$) for both ART and VRT.

Table -1: Anthropometric parameters, Auditory Reaction Time and Visual Reaction Time of study subjects.

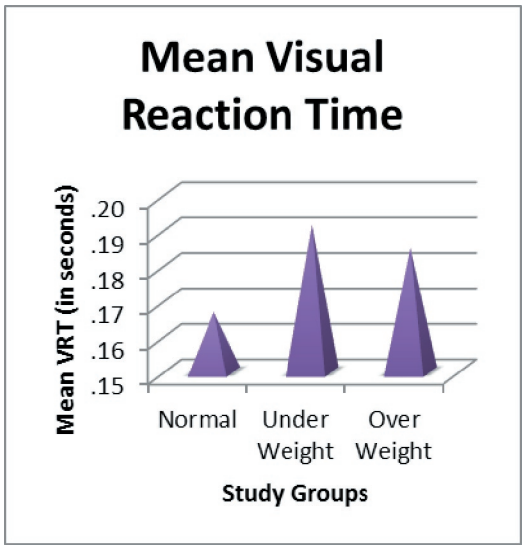
PARAMETER	GROUP 1 Normal (n=40)	GROUP 2 Underweight (n=40)	GROUP 3 Overweight (n=40)	p -value
HEIGHT (m)	1.73 ± 0.070	1.66 ± 0.049	1.74 ± 0.055	< 0.0001*
WEIGHT (Kg)	64.76 ± 8.21	45.72 ± 3.13	83.59 ± 10.25	< 0.0001*
BMI (Kg/m^2)	21.41 ± 1.71	16.59 ± 0.84	27.68 ± 2.52	< 0.0001*
ART (Seconds)	0.138 ± 0.01	0.173 ± 0.02	0.164 ± 0.02	< 0.0001*
VRT (Seconds)	0.167 ± 0.01	0.191 ± 0.02	0.185 ± 0.03	< 0.0001*

* Highly Significant

VRT: Visual Reaction Time; ART: Auditory Reaction Time.



Graph 1



Graph 2

DISCUSSION

Reaction Time is the interval between the onset of a stimulus and the commencement of a movement response [9]. Reaction time can be further broken down into three parts. The first part is perception time – the time for the application and perception of the stimulus and giving the essential reaction to it. The second part is decision time, which signifies the time for giving a suitable response to the stimulus. The third part is motor time, which is the time for compliance to the order received[15].Reaction time as being composed of four stages, namely: the start of eye movements, eye movement time, decision time and muscle contraction time[12].

In present study, the reaction times were longer for the responses to the visual stimuli than for the responses the auditory stimuli. The cause of the visual reaction time being greater than auditory reaction time was not very clear, although almost all of the researches which were done on reaction time had reached the same conclusion[10].

Most likely it was due to the fact that the visual reaction time involved chemical changes in its occurrence. Also, the visual pathway involved many collateral pathways to various association areas and hence, a greater delay in the comprehension of the visual stimulus, as it was interpreted in a more complex and an elaborate fashion. There could have some degree of difference in the type of receptor and the manner in which the receptor got stimulated i.e. the retina versus the organ of corti.

In contrast,another study found that the auditory reaction time was greater than visual reaction time and they rationalized that the auditory pathway must be more polysynaptic as compared to visual pathway[11]. The reaction time is an important component of the motor movements. In the present study, both ART and VRT were increased and statistically significant in underweight and overweight individuals when they were compared to the normal BMI group.

Overweight and obesity, indicated by Body Mass Index have been found to be associated with a host of medical conditions. Neurophysiological studies have shown brain regions involved in cognition, memory, vocabulary, speed processing and reasoning are influenced by BMI[4]

The vascular disease is likely to underlie the association between obesity and cognition, because obesity is a risk factor for the vascular disease, which in turn, is related to a higher risk of the cognitive impairment. Other hypotheses which have been made on the underlying mechanisms concern the secretions of the adipose tissue such as hormones, cytokines and growth factors that can cross the blood-brain barrier and affect the brain health.

Similar study by[13] showed longer reaction time in overweight subjects. Different neurophysiological studies have shown influence of obesity and elevated body mass index on cognitive functions, memory deficits and executive dysfunction in young as well as

middle aged individuals. Theyobserved that in elderly, the association between underweight and the cognitive functions was likely to be the result of a preclinical dementia[5].

Our results on the cross sectional associations between underweight and cognition in the early midlife were consistent with this hypothesis. Underweight could be a result of poor health. A further possibility is that the underweight persons experience a dysregulation in the hormone secretion which corresponds to that in anorexia, that results in cognitive disorders[6].

Some studies have shown that Psychiatric disorders such as Obsessive-Compulsive disorder, Schizoid Personality disorder and Asperger's disorder are associated with a low body mass index, which may be the result of neuroendocrine dysfunction and/or disturbed eating behaviours.[7]

CONCLUSION

This study reveals about different duration of ART & VRT in relation to body mass index.Both the reaction time were prolonged in obese & underweight group compared to normal BMI group.Statistically significant difference was observed among the three groups.

Further studies on the larger group may help us to unleash the underlying mechanism for the difference in values of ART & VRT.

Conflict of Interest- Nil

Source of Funding- Self

REFERENCES

1. Asmita SN, Pushpa AP, Karun DS. A study of relation between body mass index and simple reaction time in healthy young females. Indian J Physiol Pharmacol 2011; 55(3) : 288- 291.
2. Cournot M, Marquie JC, Ansiau D. Relation between body mass index and cognitive function in healthy middle aged men and women. Neurology 2006; 67: 1208–1214.
3. EIias M, Elias P, Sullivan L, Wolf P, Agostino DR. Lower cognitive function in the presence of obesity and hypertension: the Framingham heart study. Int J Obes 2003; 27: 260–268.
4. Gunstad J, Paul RH, Cohaen RA, Tate DF, Gordon E. Elevated body mass index is associated with executive dysfunction in otherwise healthy adults. Compar Psychiatry 2007; 48: 57–61.
5. Gustafson D. The adiposity indices and dementia. Lancet Neuro 2006; 5: 713-720.
6. Hebebrand J, Henninghausen K, Nau S, Himmelmann GW, Schulz E, Schafer H et al. Low body weight in male children and adolescents with schizoid personality disorder or Asperger's disorder. Acta Psychiatr Scand 1997; 96 (1): 64-67.
7. Henninghausen K, Rischmuller B, Heseker H, Remschmidt H, Hebebrand J. Low body mass indices in adolescents with obsessive-compulsive disorder. Acta Psychiatr Scand 1999; 99(4): 267-273.
8. Luchies CW, Shiffman, Richards LG, Thompson MR, Bazzium D and Der AJ. Effect of age, step direction and reaction condition on the ability to step quickly. JGerontol, 2002; Series A 57 (4) : M246
9. Magill RA. Motor Learning Concepts and applications, 5th edition. Boston, USA: McGraw-Hill 1998, p 19.
10. Namita DP, Shenvi DN. The effect of shift working on the reaction time in hospital employees. Indian J Physiol Pharmacol 2010; 54 (3): 289-293.
11. Shenvi D, Blasubramanian PA. Comparative study of the visual and the auditory reaction times in males and females. Ind J Physiol Pharmacol 1994; 38: 229-31.
12. Singer RN, Murphey M, Temant LK. Handbook of Research on sport Psychology. New York, USA: Mammilian Publishing 1993; 54.
13. Skurvydas A, Gutnik B, Zuoza AK, Nash D, Zuoziene IJ, Mickeviciene D. Relationship between simple reaction time and body mass index. J of Comparative Human Biology 2009; 60: 77–85.
14. Ta M, Olga S, Akyuz O, Ta R. Determination of the physical fitness profiles of the female basketball players in the universities super league and associating the profiles with the body compositions. International Journal Of human Sciences 2011; 8 (2).
15. Tripo RS. How fast can you react? Sci Dig 1965; 57: 50.

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Correlation of Changes of Heart Rate and Intra Ocular Pressure after Isometric Leg Press Exercise Test in Young Adults

Priya Rao[1], Chethan H A[2]

[1]Assistant Professor, [2]Associate Professor, Subbaiah Institute of Medical Sciences, Purale, Shimoga

ABSTRACT

Objective: To correlate the heart rate changes to intraocular pressure before and after leg press exercise

Method: Healthy young male adults in the age group of 18-22 years were selected among general population. Sample size was 40. Heart rate and intra ocular pressure (IOP) were recorded at rest and after isometric leg press test.

Results: Leg press predictably raised Heart rate(from74±8.9 to 89.5±7.4;$p<0.05$) and reduced IOP (from 15.1±1.91 to11.6±1.95;$p<0.05$)Heart rate is significantly and negatively correlated with IOP(Pearson's correlation coefficient, **r= -0.352**).

Conclusion: Isometric leg press exercise induces raise in heart rate and simultaneously lowers IOP which were significant. Hence may prove useful in normotensive glaucomatous patients

Keywords: *Heart rate, Intraocular pressure, Leg press dynamometer.*

INTRODUCTION

Glaucoma is chronic progressive optic neuropathy caused by a group of ocular conditions which lead to damage to optic nerve with loss of visual function.Most common risk factor is raised intraocular pressure[1,4,5]. Relationship between isokinetic exercise & IOP showed significant lowering of IOP after exercise.[2,3]

Study of IOP after isometric exercise of large bulky muscles of leg has not yet been carried out.

AIMS & OBJECTIVE

To correlate the heart rate changes to intraocular pressure before and after leg press exercise.

MATERIALS AND METHOD

Fourty healthy young male adults in the age group of 18-22 years with BMI of 18-22.9kg/m^2 were selected fromgeneral population. Heart rate and IOP were recorded at rest and after isometric leg press test. Subjects withpre-existing refractive error, acute and chronicconjunctivitis, glaucoma, migraine were excluded from study.[7]

Materials: • Schiotz tonometer

• Back - Leg lift dynamometer

• Power lab ECG.

Parameters

Study was carried out in physiology department

• Intraocular pressure in mm hg in supine position using standard steps.

• Weight in kilogram & height in meters were measured. BMI=Weight in kg/height in meter^2 was calculated to group them as normal weight.

• Heart rate

• Maximum voluntary contractions(MVC) was assessed and subjects were asked to carry out endurance isometric exercise at 40% of their MVC

Study method –It is a prospective study.

Ethical clearance was obtained from institutionalethical committee. Prior to the procedure

written and informed consent was obtained from all the subjects.

The exercise was performed in a well-ventilated room. Participants were instructed not to consume beverages nor a heavy meal in previous 4 hours or participate in any vigorous activities 24 hour before test.

Isometric endurance contraction at 40% of the individuals MVC was executed with back-leg lift dynamometer.

In order to minimize the bias of diurnal variations of IOP and other parameters, the studies were conducted between 3pm to 4pm.

At the reporting time subjects were asked to relax in supine position for 5min. Baseline IOP was recorded. Subjects executed MVC contractions of 1second duration at 1 minute intervalfor3times.Maximum of these is considered as their MVC .Then endurance contraction at 40% of their MVC is made. Intraocular pressure and Heart rate were measured in supine position immediately (within 30 sec), at five, at ten, at fifteen minutes after exercise.

STATISTICAL ANALYSIS

Mean and Standard deviation was calculated for isometric leg press exercise test in young adults. Paired t-test was applied at 5% level to test the significance of changes in above parameters(Using Epi-Info) Microsoft Excel and EPI-INFO package were used for data entry and statistical analyses respectively.

Correlation was calculated using Pearson's correlation test.

RESULTS

Table 1: Changes in Heart rate ,Right &Left Intraocular pressure.

	Heart rate	Right eye IOP	Left eye IOP
Baseline	74.0500 ± 8.96989	15.1350 ± 1.91506	15.2150 ± 1.93941
Immediate	89.5000 ± 7.39369	11.6200 ± 1.95136	11.1900 ± 1.92791
After 5min	90.0250 ± 8.29423	13.1475 ± 2.24316	12.8525 ± 2.00985
10 min	83.2000 ± 7.89092	14.7025 ± 1.94719	14.4850 ± 1.74907
15min	76.5250 ± 8.92127	15.0350 ± 1.92388	15.1400 ± 1.84916
p value	<0.05	<0.05	<0.05

Leg press predictably raised Heart rate(from74±8.9 to 89.5±7.4;p<0.05)& reduced IOP (from 15.1±1.91 to11.6±1.95;p<0.05).Heart rate is significantly & negatively correlated with IOP(Pearson's correlation coefficient ,**r= -0.352.**

DISCUSSION

- Rise in heart rate has been suggested to be mediated primarily by the central command which is related to number of motor units activated and to reflex effects from active muscle mechanoreceptors. Inhibition of inhibitory cardiac vagal nerve activity also contributes. [8]

- Isometric leg press exercise stimulate ocular sympathetic nervous system to increase the facility of outflow and thus decreases IOP. Also epinephrine stimulates synthesis of cAMP. Activation of cAMP decreases IOP by decreasing aqueous humour production.[6,9]

- Also After leg press exercise there is rise in blood lactate levels. Increased Lactate levels causes outflux of water from eye which is responsible for fall in IOP.

CONCLUSION

Isometric leg press exercise induces raise inheart rate and simultaneously lowers IOP and both were significant. Hence may prove useful in normotensiveglaucomatous patients.

Conflict of Interest: Nil

Ethical Clearance: Ethical clearance was obtained from the institutional ethical clearance committee.

Funding: Self

REFERENCES

1. Qureshi IA. Effect of exercise on intraocular pressure in physically fitsubjects. Clinical and experimental pharmacology and physiology 1996; 23(8):648-652.
2. Avundak AM, Berna Y, Imaz, Nermin S. Comparison of intraocular pressure reductions after isometric and isokinetic exercise in normal individuals. International journal of ophthalmology 1999; 213: 290-294.
3. Conte M , Scarpi M J, Rossin RA., Beteli HR, Loopes RG. Intraocular pressure variation after submaximal strength test in resistance training. Arq Bras Ophthalmol 2009 ;72(3): 351-354.
4. Dennis BA, David MA, Beck. Ophthalmic arterial hemodynamics during isometric exercise. Journal of glaucoma 1995;4:317-321.
5. Geraldo MV, Hildeamo B, Oliveira MS, Daniel T. Intraocular pressure variations during weight lifting. Archives of ophthalmology 2006; 124(9):1251-1254.
6. Risner et al. Effects of Exercise on Intraocular Pressure and Ocular Blood Flow: A Review. Journal of Glaucoma: Aug 2009; 18(6) :429-436.
7. Klein BEK, Klein R, Knudtson MD. Intraocular pressure and systemic Blood Pressure: longitudinal perspective: the Beaver Dam Eye Study. Br J Ophthalmol. 2005; 89: 284-287.
8. Hultman E, Sjoholm H. Blood pressure and heart rate response to voluntary andnon-voluntary static exercise in man. Acta Physiol Scand. 1982; 115: 499-501.
9. Passo MS, Goldberg L, Elliot D, Van Buskirk EM. Exercise conditioning and Intraocular pressure.Am J Ophthal. 1987; 103(6):754-757.

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An Evaluation of Breath Holding Time between Male and Female in Elderly Population from India

Ramita Raheja[1], Mohan Lal Arora[2], Rajkumar[3], Vikram Singh[4]

[1]Associate Professor, Physiology Department, Glocal Medical College Sup. Hospital & Research Centre, Mirzapure, (Saharanpur), [2]Associate Professor, Physiology Department, Govt. Medical College, Orai, [3]Assistant Professor, Anatomy Department, Glocal Medical College Sup. Hospital & Research Centre, Mirzapure, (Saharanpur), [4]Associate Professor, ECE-Department, Glocal University, Saharanpur, U.P.

ABSTRACT

Aims and Objectives:- To collect substantial amount of data relating to physical fitness in elderly peoples.

Materials and Method:- The total sample size was conducted on a randomly selected 110 (84 male and 26 female) apparently healthy subjects of 60 years and above age group belonging to both the sexes. The sample conducted by Department of Physiology and Department of Cardiology, S.N. Medical College, Agra. Breath Holding Time is measured by stop watch. The subject was asked to take a quiet inspiration, and hold it as long as possible. Duration of breath holding was measured by stop watch.

Result:- In elderly men (60+) the average breath holding time (BHT) was 28.20 ± 8.51/sec and in elderly women (60+) 26.11 ± 6.63 sec.

Conclusion:-Breath holding time shows a declining pattern with age in all the age groups of men which is statistically significant ($p < 0.5$). However, in women although the BHT also shows an apparent declining pattern with age in all age groups but the relationship is statistically insignificant ($p > 0.05$). These findings may be helpful for cardiologist with maximum safety and minimum mortality and morbidity or clinicians in reaching the appropriate diagnosis and data relating to physical fitness in elderly peoples.

Keyword:- *Stop watch, Indian population.*

INTRODUCTION

Breath holding is advised to be practised with clotting nostrils by pinching them index finger and ring fingers andapplying three bandhous of jalandhara (fiding chain in jugulas notch, uddiyan (diaphragm control) and nvla (contraction of perinicum). Such elaborate empirical directions seem to indicate that these practices should result in some cardio respiratory parameters. Similarly, the beneficial effect of negative breath holding is expounded by Dr, Brena in his excellent book 'yoga and medicine claim is made but strength of an elephant can be developed by practice of pranayam[1] (Steven F.Brena, 1972).

It is likely that heart rate and blood Pressure change during abdominal exercise because large muscle Co contractions are involved, that the exercises are expected to increase intra-abdominal pressure (IAP), and that some individuals may breathe hold during the exercises[3.5]. Prior research [4,5] has reported potentially injurious blood pressure elevations of up to 345/245 during traditional weight-resistance exercises such as the squat. Consequently, it is of clinical importance to determine the hemodynamic response to common abdominal exercises during the actual exercises

Controlling the breath cannot come easily unless one practices and develop capacities for full utilisation of available oxygen in each breath. By practicing breath control one may develop greater tolerance by checking respiratory stimulation as well as developing capacities for fuller utilisation of available oxygen in each breath[2] (Derikachan,1980).

Breathing techniques are very specialized, because even athletes within the same sport, but competing in different events, have different breathing requirements.

Unlike distance runners, sprinters aren't aiming for aerobic fitness. "Someone who runs the 100 meter dash may want to take one breath and go (Bill Dellinger, 1964).

MATERIAL AND METHOD

The present study sample size was conducted on a randomly selected 110 (86 male,26 female) apparently healthy subjects of 60 years and above age group belonging to both the sexes. The sample size conducted by Department of Physiology and Department of Cardiology, S.N. Medical College, Agra. Breath Holding Time measured by the stop watch in seconds. The subject was asked to take a quiet inspiration, and hold it as long as possible. Duration of breath holding was measured by stop watch. Three readings were taken. Best of the three was taken for record.

1. The survey was conducted at Sheesh Mahal Teela, Taj Garden, Motilal Nehru Garden and Company Garden in Agra. Before assessment of various cardiorespiratory function tests a careful record of both sex and history of any cardiorespiratory distress of each subject was made on a predesigned preformat. At the same time their chest and heart were thoroughly auscultated for any apparent cardiorespiratory distress.

2. Those subjects on whom any suspicion of cardiorespiratory pathology was suspected, or were on any antihypertensive medicine, of any chronic respiratory disease, were not included in the survey study.

OBSERVATION

The present study of evaluation of cardio-respiratory functional ability in elderly age group was conducted with the objective to determine the effect of male and female in elderly population, affect these parameters. Under this endeavor, very simple multidimensional group of various cardiorespiratory function tests comprising of breath holding time, was carried out and studied compare with male and female in elderly population, showing tableno.1

The above outcome of respiratory function tests of the present study happen to be consistent with the findings of earlier studies (Bhargava et al 1973[6] ; Kannel, Helen Hubert and Lew, 1982[7]; Lam et-al., 1983[8] Meenakshi, 1984[9]; Douglas et al.,1985) but the findings are at variance with the findings of Ayub, Zaidi and Burki (1987)[10] and Pathak and Mehrotra (1989)[11]. Ayub, Zaidi and Burki (1973)[10] in their similar study concluded that in Pakistani men maximal respiratory flow rates did not correlate with age, however, in Pakistani women there was a significant correlation of maximal flow rates with age. Pathak and Mehrotra et al. (1989)[11] in their study "Pulmonary Functions of Elderly Indian Subjects" concluded a declining pattern of vital capacity with age but the decline was not uniform.

Though a number of workers have reported the respiratory parameters on Indians, most of the data are on much younger age groups and especially on students. Amongst the reported data available on elderly population, our values are much closer to the values obtained by Pathak and Mehrotra et al. (1989)[11] who studied the respiratory function tests in elderly population of Bombay and Bhargava et al. (1973)[6] who conducted the respiratory function tests in elderly subjects in Bhopal.

The findings of our study are much lower as compared to European contemporary subjects reported by Dreyer et al[12].

Deterioration of respiratory function tests with age might be the resultant effect of a number of factors including the deterioration in the lung tissue; a reduction in the strength of the respirator muscles and an increase in stiffness of the thoracic cage. The intrapulmonary changes are probably partly due to an impairment of the nutrient blood supply from the bronchial arteries; a diminished permeability of cell membrane and an alteration in the molecular structure of the collagen and other tissue, collagen fibers increase in number and change in quality with age.

The changes are likely to have the effect of increasing the rigidity and reducing the tensile strength of the tissue as well as of reducing both the viability of the cells and their recuperative powers. The time course of these manifestations of the process of ageing varies from one individual to another and also in male and female sexes. The ethnic difference between the Indians and others may be aggravated by damages caused by exposure to polluted atmosphere, low socio-economic status, genetic differences, body built and other climatic variables.

Greater decline in respiratory function tests in

tobacco addicts again enjoys a massive support from other workers (Donald I. Peterson et al., 1968[13]; George W. Gomstock et al., 1970[14]; Lower and Khosla, 1972[15]), In their separate work on effect of smoking and respiratory function tests, these workers have also reported a declining pattern in respiratory function tests in tobacco addict. Similar studies were conducted by Carl C, Seltzer et al. (1974)[16], Manfeda et al. (1982)[17], Damodar et al. (1983)[18], Douglas et al. (1985)[19] and they also reported a declining lung function tests in chronic smokers.

RESULTS

In elderly men (60+) the average breath holding time (BHT) was 28.20 ± 8.51/sec and in elderly women (60+) 26.11 ± 6.63 sec. Breath holding time shows a declining pattern with age in all the age groups of men which is statistically significant ($p < 0.5$). However, in women although the BHT also shows an apparent declining pattern with age in all age groups but the relationship is statistically insignificant ($p > 0.05$).

Table-1: Comparative evaluation of breath holding time of total number of male and female subjects studied (N = 110)

Sex	No.	Mean± S.D.
Male	84	28.20 ± 6.63
Female	26	26.11 ± 6.63
	t = 1.39	P >0.05

CONCLUSION

Breath holding time shows a declining pattern with age in all the age groups of men which is statistically significant ($p < 0.5$). However, in women although the BHT also shows an apparent declining pattern with age in all age groups but the relationship is statistically insignificant ($p > 0.05$). These findings may be helpful for cardiologist with maximum safety and minimum mortality and morbidity or clinicians in reaching the appropriate diagnosis and data relating to physical fitness in elderly peoples.

Ethical Clearance - Approved

Source of Funding- Self

Conflict of Interest- Nill

REFERENCES

1. Brena, Steven F. (1972).”Yoga and Medicine” (New York: The Jullian Press, inc,1972)
2. Derikachan, T.K.V. (1980).”Religiousness in Yoga” Lecture on Theory and Practice (Washington), D.C.; University Press of America, Inc., 1980
3. Rao S, Bellare B. Cardiovascular responses to abdominal exercises in females between 35 and 45 years of age. J Postgrad Med., 1993; 39: 79-81.
4. Palatini P, Mos L, Munari L, et al. Blood pressure changes during heavy-resistance exercise. J Hypertens., 1989; 7(Suppl): S723.
5. MacDougall J, McKelvie RS, Moroz DE, Sale DG, McCartney N, Buick F. Factors affecting blood pressure during heavy weight lifting and static contractions. J Appl Physiol., 1992; 73: 1590-7.
6. Bhargava, R.P., Mishra, S.M., Gupta, N.K. Ventilatory tests and lung volumes in M.P. Ind. J. Physiol. & Pharm. 1973, 17:266-272.
7. Kannel, W.B., Helen Hubert and E.A. Lew. Vital capacity as a predictor of cardiovascular disease. The Framingham Study. Am. Heart J. Feb. 1982; 311-315
8. Lam, K.K. & S.C. Lang; W.G.L. Allan, L.E. Hill et al. Predictive Nomograms for forced expiratory volume; forced vital capacity and peak expiratory flow rate in Chinese adults and children* Br. J. Dis. Chest, 1983; 77:390-393.
9. Meenakshi, S. Spiro Data in South Indian subjects60-80 yrs. Ind.J.Physiol.Pharmacol. 1984; 28:58-62.
10. Ayub, M., S.H. Zaidi and N.K. Burki. Spirometry and Flow Volume Curves in Healthy Normal Pakistanis. Br. J. Dis. Chest, 1987; 81:35-43.
11. Mehrotra, P.P.,Pathak, J.D., Joshi, S.D., Shah, P.H.: Pulmonary functions of elderly Indian subjects. Trends of decline with age. Ind.J.Physiol. Phanaacol. 1989; 33:3, 157-162.
12. Dreyer, G. : Lancet 2:227, quoted from Ind. J. Physiol. & Pharmac. 1989; 33:3.
13. Donald, I., Peterson, M.D., Lester, H. et al. Smoking and Pulmonary Functions. Arc. Env. Health, 1968; Feb. 16, 215-218.

14. George, W. Comstock, M.D., Wilpred, J., Brownlow, M.D., Baltimore, Richard, W., Stone, M.D., Philip, E., Startwell, M.D. Cigarette smoking and changes in respiratory findings. Arch. Env. Health, 1970; July, Vol. 21:50.

15. Lower, C.R. and Khosla, T. Chronic Bronchitis in Ex-coal miners working in the steel industry. Br. J. Indust. Dis. 1972; 29:45-49.

16. Carl, C., Seltzer, A.B., Slegelaub et al. : Difference in pulmonary function related to smoking babbits and race. Am. Rev. Resp. Dis. 1974; 110:598.

17. Manffcedg, J. Sidwall, Mami, K., West, P. and Charmick, R.M.: Respiratory abnormalities in employees of hard rock mining industry. Am. Rev. Resp. Dis. 1982; 126(4):629-634.

18. Damodar, Agarwal, D. and Sharma, P.M. : Changes in ventilatory capacities due to exposure to talk dust. Ind. J. Chest Dis. & Allied Sc. 1983; 25:21-24.

19. Douglas, D.B., Douglas, R.B., Okes, D. and Scott, G. Pulmonary functions in London Firemen. Br.J.Indust.Med. 1985; 42:55-58.

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To Study the Relation between Body Mass Index and Audiovisual Reaction Time in Healthy Young Individuals

Manu Saini[1], Mamta[2], Brajpal Singh Tanwar[3], R C Gupta[4]

[1]2nd Year Postgraduate Student, [2]Associate Professor, [3]Assistant Professor, [4]Head of Department, Department of Physiology, Mahatma Gandhi Medical College, Jaipur

ABSTRACT

Background:- Audiovisual reaction time is time taken by individual to react to auditory and visual stimulus. Body Mass Index influences cognitive functions, attention and memory and hence the reaction time.

Objectives:- To find out the Relation between low body mass index (< 18.5 kg/m2) and Audiovisual reaction time and high body mass index (>25 kg/m2) and audiovisual reaction time.

Method:- Study was conducted in department of Physiology, Mahatma Gandhi Medical College , Jaipur. 40 subjects of normal Body Mass Index (18-24.99KG/M2) were control, 40 subjects with Body Mass Index (BMI) lower than 18kg/m2 and 40 subjects with Body Mass Index higher than 25kg/m2, were cases. Audio visual reaction times were recorded with the help of audiovisual reaction time apparatus supplied by Medisystem, Yamunanagar. Time taken by subjects to respond to both stimuli was noted in each of the three groups.

Result:- In high BMI group, p value for Audio Reaction Time was <0.01 and Visual reaction time, p valve <0.001 .In low BMI group, Audio Reaction Time p valve was <0.001 and for Visual Reaction Time p valve was <0.001.

Conclusion:- • Visual reaction time is longer than Audio reaction time in each group,

• Audio reaction time and Visual reaction time both were prolonged and statistically significant in groups with high BMI and low BMI in comparison to group with Normal BMI.

Keywords:- *Auditory Reaction Time, Body Mass Index, Visual Reaction Time.*

INTRODUCTION

Audiovisual reaction time is the speed, with which a person can respond to an auditory stimulus and visual stimulus respectively[1]. It provides an indirect index of the processing capability of the central nervous system and also a simple means of determining sensori – motor performance[2]. It determines the alertness of a person because how quickly a person responds to a stimulus depends on his reaction time.

Reaction time has physiological significance and is a simple and non invasive test for peripheral as well as central neural structures. Reaction time can be a crucial value in activities like driving and is an important quality of a sportsperson. Reaction time measurement includes the latency in sensory neural code traversing peripheral and central pathways, perceptive and cognitive processing, a motor signal traversing both central and peripheral neuronal structures and finally the latency in the end effector activation (i.e. muscle activation). So any change in reaction time indicates presence of a peripheral and/or central disturbance.

Reaction time is affected by various factors such as Age, Gender, Exercise, Left v/s Right Hand, Fatigue etc. Studies have shown that Body Mass Index (BMI) calculated as Weight (Kg) divided by square of Height (m^2) influences cognitive functions, attention and memory[3,4,5]. Therefore present study was designed to find out whether BMI affects auditory and visual

Author for Correspondence:-
Manu Saini, Mamta,
E-mail: manusaini197674@gmail.com

reaction time.

MATERIAL AND METHOD

The present study was conducted in the Department of Physiology, Mahatma Gandhi Medical College, Jaipur after getting approval from institutional human ethical committee. For the study, 120 normal, healthy volunteers (17 – 25 yrs.) were taken and categorized into 3 groups according to their Body Mass Index (BMI). 40 subjects were taken in each group.

BMI is calculated by Weight (Kg) / Height (m^2). Height was measured with subject standing without shoes, feet together, eyes looking straight ahead and back in contact with measuring bar of stadiometer. Body weight recorded by a digital weight scale without shoes and with light clothes. Then the subjects were divided into 3 groups according to WHO criteria of BMI:-

Group 1:- Normal (BMI 18.5 – 24.99 kg/m^2)

Group 2:- Underweight (BMI < 18.5 kg/m^2)

Group 3:- Overweight (BMI > 25 kg/m^2)

Inclusion Criteria:

- Age: 17-25 years, healthy Individuals who volunteered for the study after written consent.

Exclusion Criteria:-

- Any acute and chronic illness ,for example hormonal disorders , diabetes , cardiovascular disorders etc.
- Any untreated visual or auditory problems.
- Any neuromuscular disorders.
- Taking any drugs which affect reaction time, for example physcotropic drugs, sedatives etc.
- Sleep disorders.
- Excessive Fatigue/Fasting.
- Smoking/Alcohol.

Reaction time was recorded with the help of Audiovisual Reaction Time Apparatus, supplied by Medisystem ,Yamunanagar , Haryana. It had a display accuracy of 100%. The apparatus has two modes of providing stimulus – Auditory and Visual. Auditory reaction time was recorded for low frequency sound stimuli and Visual reaction time recorded for Red light. Subjects were asked to have 8 hrs sleep at night, to avoid any kind of medication during study period and to come in the department between 8 AM to 10 AM after having light breakfast.

Subjects were asked to respond to the stimuli by pressing the response key with the index finger of their dominant hand. The display indicated the reaction time. After familiarizing the subjects with the instrument and after repeated practices, three readings for each stimuli were taken. The least reading of the three was taken as the value for reaction time task. The results expressed as mean ± standard deviation. Data was analyzed using one way ANOVA with post –hoc Tukey's HSD test. $p < 0.05$ was taken as cut off for the measure of significance.

RESULTS

In the present study, BMI was significantly ($p < 0.0001$) different among the three study groups (Table-1). There was prolongation of ART and VRT in underweight as well as overweight groups when compared to normal group. Results were significant ($p < 0.0001$) for both ART and VRT.

Table -1: Anthropometric parameters, Auditory Reaction Time and Visual Reaction Time of study subjects.

PARAMETER	GROUP 1 Normal (n=40)	GROUP 2 Underweight (n=40)	GROUP 3 Overweight (n=40)	p –value
HEIGHT (m)	1.73 ± 0.070	1.66 ± 0.049	1.74 ± 0.055	< 0.0001*
WEIGHT (Kg)	64.76 ± 8.21	45.72 ± 3.13	83.59 ± 10.25	< 0.0001*
BMI (Kg/m^2)	21.41 ± 1.71	16.59 ± 0.84	27.68 ± 2.52	< 0.0001*
ART (Seconds)	0.138 ± 0.01	0.173 ± 0.02	0.164 ± 0.02	< 0.0001*
VRT (Seconds)	0.167 ± 0.01	0.191 ± 0.02	0.185 ± 0.03	< 0.0001*

*Highly Significant

VRT: Visual Reaction Time; ART: Auditory Reaction Time.

DISCUSSION

Reaction Time is the interval between the onset of a stimulus and the commencement of a movement response [6]. Reaction time can be further broken down into three parts. The first part is perception time – the time for the application and perception of the stimulus and giving the essential reaction to it. The second part is decision time, which signifies the time for giving a suitable response to the stimulus. The third part is motor time, which is the time for compliance to the order received[7]. Singer et al [8] defined reaction time as being composed of four stages, namely: the start of eye movements, eye movement time, decision time and muscle contraction time.

In our study, the reaction times were longer for the

responses to the visual stimuli than for the responses the auditory stimuli. The cause of the visual reaction time being greater than auditory reaction time was not very clear, although almost all of the researches which were done on reaction time had reached the same conclusion[9,10].

Most likely it was due to the fact that the visual reaction time involved chemical changes in its occurrence. Also, the visual pathway involved many collateral pathways to various association areas and hence, a greater delay in the comprehension of the visual stimulus, as it was interpreted in a more complex and an elaborate fashion. There could have some degree of difference in the type of receptor and the manner in which the receptor got stimulated i.e. the retina versus the organ of corti.

In contrast, Shenvi et al[11]; found that the auditory reaction time was greater than visual reaction time and they rationalized that the auditory pathway must be more polysynaptic as compared to visual pathway. The reaction time is an important component of the motor movements. In the present study, both ART and VRT were increased and statistically significant in underweight and overweight individuals when they were compared to the normal BMI group.

Overweight and obesity, indicated by Body Mass Index have been found to be associated with a host of medical conditions. Neurophysiological studies have shown brain regions involved in cognition, memory, vocabulary, speed processing and reasoning are influenced by BMI[2].

Gunstad J et al[2] showed the relationship between the elevated BMI values and the reduced cognitive performance.

The vascular disease is likely to underlie the association between obesity and cognition, because obesity is a risk factor for the vascular disease, which in turn, is related to a higher risk of the cognitive impairment. Other hypotheses which have been made on the underlying mechanisms concern the secretions of the adipose tissue such as hormones, cytokines and growth factors that can cross the blood-brain barrier and affect the brain health.

Similar study by Skurvydas A. et al[12] showed longer reaction time in overweight subjects. Different neurophysiological studies have shown influence of obesity and elevated body mass index on cognitive functions, memory deficits and executive dysfunction in young as well as middle aged individuals[13,14].

Gustafson[14] observed that in the elderly, the association between underweight and the cognitive functions was likely to be the result of a preclinical dementia. Our results on the cross sectional associations between underweight and cognition in the early midlife were consistent with this hypothesis. Underweight could be a result of poor health[15]; a further possibility is that the underweight persons experience a dysregulation in the hormone secretion which corresponds to that in anorexia, that results in cognitive disorders[15].

Some studies have shown that Psychiatric disorders such as Obsessive-Compulsive disorder, Schizoid Personality disorder and Asperger's disorder are associated with a low body mass index, which may be the result of neuroendocrine dysfunction and/or disturbed eating behaviors[16].

Further investigations of the mechanisms which underlie the cumulative effects of underweight on the cognition, would be an important topic for future research.

Source of Funding :- Self

Conflict of Interest :- Nil

REFERENCES

1) Luchies CW, Shiffman, Richards LG, Thompson MR, Bazzium D and Der AJ. Effect of age, step direction and reaction condition on the ability to step quickly. J Gerontol, 2002; Series A 57 (4) : M246

2) Gunstad J, Paul RH, Cohaen RA, Tate DF, Gordon E. Elevated body mass index is associated with executive dysfunction in otherwise healthy adults. Compar Psychiatry 2007; 48: 57–61.

3) EIias M, Elias P, Sullivan L, Wolf P, Agostino DR. Lower cognitive function in the presence of obesity and hypertension: the Framingham heart study. Int J Obes 2003; 27: 260–268.

4) Cournot M, Marquie JC, Ansiau D. Relation between body mass index and cognitive function in healthy middle aged men and women. Neurology 2006; 67: 1208–1214.

5) Asmita SN, Pushpa AP, Karun DS. A study of relation between body mass index and simple reaction time in healthy young females. Indian J Physiol Pharmacol 2011; 55(3) : 288- 291.

6) Magill RA. Motor Learning Concepts and applications, 5th edition. Boston, USA: McGraw-Hill 1998, p 19.

7) Tripo RS. How fast can you react? Sci Dig 1965; 57: 50.

8) Singer RN, Murphey M, Temant LK. Handbook of Research on sport Psychology. New York, USA: Mammilian Publishing 1993; 54.

9) Namita DP, Shenvi DN. The effect of shift working on the reaction time in hospital employees. Indian J Physiol Pharmacol 2010; 54 (3): 289-293.

10) Ta M, Olga S, Akyuz O, Ta R. Determination of the physical fitness profiles of the female basketball players in the universities super league and associating the profiles with the body compositions. International Journal Of human Sciences 2011; 8 (2).

11) Shenvi D, Blasubramanian PA. Comparative study of the visual and the auditory reaction times in males and females. Ind J Physiol Pharmacol 1994; 38: 229-31.

12) Skurvydas A, Gutnik B, Zuoza AK, Nash D, Zuoziene IJ, Mickeviciene D. Relationship between simple reaction time and body mass index. J of Comparative Human Biology 2009; 60: 77–85.

13) Cournot M, Marquie JC, Ansiau D. Relation between body mass index and cognitive function in healthy middle aged men and women. Neurology 2006; 67: 1208–1214.

14) Gustafson D. The adiposity indices and dementia. Lancet Neuro 2006; 5: 713-720.

15) Hebebrand J, Henninghausen K, Nau S, Himmelmann GW, Schulz E, Schafer H et al. Low body weight in male children and adolescents with schizoid personality disorder or Asperger's disorder. Acta Psychiatr Scand 1997; 96 (1): 64-67.

16) Henninghausen K, Rischmuller B, Heseker H, Remschmidt H, Hebebrand J. Low body mass indices in adolescents with obsessive-compulsive disorder. Acta Psychiatr Scand 1999; 99(4): 267-273.

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Comparative Study of Waist Hip Ratio and Lipid Profile in Offspring of Coronary Heart Disease Patients and Controls

Pushpa K[1], Arun Kumar H P[2], Girija B[3]

[1]Assistant Professor, Department of Physiology, Shridevi Institute of Medical Sciences and Research Hospital, Tumkur, [2]Assistant professor, Department of Physiology, Travancore Medical College and Hospital, Kollam, [3]Professor and Head of the Department, Department of Physiology, Bangalore Medical College and Research Institute, Bangalore

ABSTRACT

Background: Coronary heart disease is becoming a major cause of mortality in India and the purpose of the study was to identify the risk factors already present in the offspring of CHD patients.

Objective: To study and compare the Waist hip ratio and lipid profile in offspring of coronary heart disease patients and controls.

Materials and method: Study was conducted between 50 subjects (18 – 30 yrs) with parental history of CHD and age and sex matched 50 controls (without the parental history of CHD). Serum lipid profile which included Total cholesterol, LDL, HDL, VLDL, TG levels and TC: HDL ratio was estimated and Waist hip ratio measured. The results were tabulated and statistically analyzed.

Results: Control group had excellent Waist hip ratio (M<0.85, F<0.75) (p=0.05), as compared to study group. Serum TC (p=0.004) and LDL (p=0.006) levels were significantly higher in study group and TC:HDL ratio or risk ratio (p=0.023) was low in control group.

Conclusion: Offspring of CHD patients should be advised to maintain their lipid levels in optimal range and inculcate changes in their lifestyle so as to prevent CHD in future. Intake of junk foods and saturated fat to be avoided and physical activity has to be increased to reduce the risk of CHD.

Keywords: *coronary heart disease; family history; lipid profile ; risk ratio; waist to hip ratio.*

BACKGROUND

Coronary heart disease (CHD) is becoming a major cause of mortality in India. The huge burden of CHD in India is the consequence of the large population and the high prevalence of cardiovascular disease risk factors. WHO reports that one fifths of the deaths in India are caused by CHD. In the year 2020, it would account for one third of all deaths and many of the Indians will be dying young. There are an estimated 45 million patients of CHD in India. [(1)]CHD occurs at a much younger age in Indians as compared to those in North America and Western Europe, as Indians have smaller coronary blood vessels compared to them.[(2)] Hence, ethnicity itself is a risk factor.

Modernization has resulted in a stressful and hectic urban lifestyle in rapidly growing cities like Bangalore. The increasing incidence of CHD is secondary to modernization which has resulted in increased levels of stress, affluence which in turn bring about changes in lifestyle. Obesity is increasing in younger generation due to consumption of calorie rich food and physical inactivity. Family screening of patients with CHD emerges both as an opportunity and challenge of cardiovascular health in 21st century.

CHD is a chronic process that begins during adolescence and slowly progresses throughout life. Independent risk factors include a family history of premature CHD, obesity, DM, Hypertension, hyperlipidemia, smoking and sedentary lifestyle. The first degree relatives of people who develop CHD at an

Corresponding author:
Dr. Pushpa K,
Assistant Professor, Department of Physiology,
Shridevi Institute of Medical Sciences and Research Hospital, Sira road, Tumkur, Karnataka-572106.
Email id- dr.pushpahalesh@gmail.com

early age are at a much higher risk for developing CHD than general population. [3,4] Identification of such people who are at risk of future CHD at a young age helps to prevent and delay the disease by altering lifestyle.

The aim of the study was to identify the risk factors already present in offspring of CHD patient and findings of this study would enlighten the importance of family history while considering CHD resulting from atherosclerosis and to prevent CHD in future.

MATERIALS AND METHOD

A comparative study was conducted in Bengaluru, to assess the influence of family history of CHD on Waist hip ratio (WHR) and lipid profile in 50 offspring (18-30yrs) of CHD patients, by comparing them with the age and gender matched 50 controls without the parental history of CHD. Ethical clearance was taken from Institutional Ethical committee of Bangalore Medical College and Research Institute.

Subjects having Diabetes mellitus, Hypertension. thyrotoxicosis, hypothyroidism and other endocrine disorders, hepatitis or any other liver pathology, musculo-skeletal disorders, smokers, alcoholics, pregnancy, any respiratory pathology, Subjects on medications such as – corticosteroids, hormones or oral contraceptives, beta blockers, diuretics, isotretinoin, antiepileptics, etc were excluded.

Subjects were explained about the study protocol and written informed consent was taken. Waist circumference measured at the midpoint between the iliac crest and the lower margin of the last palpable rib in the mid axillary line. [5] Hip girth measured around the largest circumference of the buttocks, over the minimal clothing, subject standing erect with weight evenly distributed on both feet and legs slightly apart [5] and WHR calculated. After an overnight fast, venous blood sample was collected and estimation of serum lipid profile was done at Central Research Laboratory, Victoria Hospital campus, Bangalore Medical College and Research Institute (BMCRI), Bangalore.

Statistical method[6,7,8]:

Descriptive and inferential statistical analysis has been carried out in the present study. Results on continuous measurements are presented on Mean ± SD (Min-Max) and results on categorical measurements are presented in Number (%). Significance is assessed at 5 % level of significance.

Student t test (two tailed, independent) has been used to find the significance of study parameters on continuous scale between two groups (Inter group analysis) on metric parameters. Leven1s test for homogeneity of variance has been performed to assess the homogeneity of variance. Chi-square/ Fisher Exact test has been used to find the significance of study parameters on categorical scale between two or more groups.

Statistical software: The statistical software namely SAS 9.2, SPSS 15.0, Stata 10.1,MedCalc 9.0.1 and Systat 12.0 and R environment ver.2.11.1 were used for the analysis of the data and Microsoft word and Excel were used.

FINDINGS

Present study is a comparative study consisting of 50 subjects with a family history of CHD (Study group) and 50 subjects without a family history of CHD (control group). Subjects in both the groups were well matched with respect to age (p=0.756) and gender (p=1.000). 44.2% of subjects in control group had excellent WHR (M<0.85, F<0.75) as compared to 20.0% of subjects in study group (p=0.05). 2% subjects in study group had extremely high WHR (M>1.00, F>0.90) and extremely high WHR is an independent risk factor of CHD. [9]

Table 1: Age distribution of two groups studied

Age in years	Group A (Study group)		Group B (Control group)	
	No	%	No	%
18-20	15	30.0	15	30.0
21-25	18	36.0	21	42.0
26-30	17	34.0	14	28.0
Total	50	100.0	50	100.0
Mean ± SD	**23.30±3.77**		**23.06±3.94**	

Samples are age matched with p=0.756

Table 2: Gender distribution of two groups studied

Gender	Group A		Group B	
	No	%	No	%
Male	30	60.0	30	60.0
Female	20	40.0	20	40.0
Total	**50**	**100.0**	**50**	**100.0**

Samples are gender matched with p=1.000

Table 3: Comparison of anthropometric parameters in two groups studied

	Group A (Study group)	Group B (Control group)	P value
Height (cm)	160.82±7.19	159.72±6.76	0.432
Weight (kg)	59.86±7.05	57.84±6.17	0.131
BMI (kg/m^2)	23.11±1.95	22.63±1.43	0.166
WC (cm)	73.90±3.22	72.68±5.85	0.200
HG(cm)	87.58±4.45	87.8±5.07	0.818
WHR	0.85±0.04	0.83±0.06	0.131

Table 4: Comparison of waist –hip ratio in two groups studied

Waist-hip ratio	Group A (Study group)	Group B (Control group)
Excellent (M<0.85, F<0.75)	10(20.0%)	22(44.0%)
Good (M: 0.85-0.90; F:0.75-0.80)	26(52.0%)	19(38.0%)
Average(M:0.90-0.95; F:080-0.85)	12(24.0%)	7(14.0%)
High (M:0.95-1.00; F:0.85-0.90)	1(2.0%)	2(4.0%)
Extreme(M>1.00, F>0.90)	1(2.0%)	0
Total	**50(100.0%)**	**50(100.0%)**
Inference	Excellent WHR is significantly more associated with Group B (44.00%) compared to Group A (20.0%) with P=0.050*	

Table 5: Comparison of serum lipid profile parameters in two groups studied

Lipid parameters	Group A (Study group)	Group B (Control group)	P value
Total cholesterol(mg/dl)	178.68±8.52	174.64±4.49	0.004**
LDL(mg/dl)	109.10±7.62	105.64±4.06	0.006**
HDL(mg/dl)	49.76±4.18	50.56±2.05	0.228
VLDL(mg/dl)	19.82±6.64	18.44±3.29	0.191
Triglycerides (mg/dl)	98.94±33.29	92.12±16.30	0.196
Tchol/HDL	3.63±0.49	3.46±0.16	0.023*

DISCUSSION

Coronary atherosclerosis is the major cause of CHD. The atherosclerotic process is an organised, active, lifelong process involving elements of chronic inflammation followed by repair in artery wall.[10]Atherosclerosis begins with the appearance of fatty streaks in the intima. The fatty streaks may evolve into fibrous plaques by accumulation of lipids, smooth muscle and connective tissue. These plaques undergo vascularisation, intraplaque haemorrhage, rupture, ulceration and calcification and can impede blood flow through an artery. A thrombosis superimposed on a lesion

can lead to myocardial infarction or sudden death.[11]

Abdominal or truncal obesity is accumulation of fat in abdominal viscera, is more associated with metabolic complications. Excess intra-abdominal fat is associated with greater risk of obesity related morbidity than overall adiposity. The WHR shows a graded and highly significant relationship with the risk for MI. Previous studies have shown that measurement of WHR has proved superior to the other indices of obesity in determining the future risk of CHD.[12]

Timothy A Welborn et al found that obesity, as measured by WHR, is a dominant, independent predictive variable for CHD in both men and women. This study showed that the WHR is better predictor for CHD than WC or BMI. [12] WHR may be a better predictor of cardiovascular risk than waist circumference or BMI, as it is less dependent on body size and height. Ideal WHR is <0.85 in men and <0.75 in women. WHR above 1.0 in men and above 0.9 in women is an independent risk factor for higher incidence of CHD.[12]

Grottol et al assessed that those with positive history of CHD in either parent had higher BMI and a greater risk of being obese than those who reported no parental history. Higher mean BMI and obesity (BMI>30Kg/m^2) were associated with paternal CHD history in both sexes and with maternal CHD history among men. [13]

Gupta R et al showed that there was a significant positive correlation of BMI, WHR with fasting blood glucose and LDL cholesterol and negative correlation with physical activity and HDL in both men and women with increasing BMI, waist circumference and WHR, the risk factors increased significantly in both men and women. [14]

M Hippe et al conducted a cross sectional study and found increased cholesterol level, low HDL/TC ratio in subjects with parental history of MI than in controls irrespective of age and sex. Maternal MI was more predictive for increased cholesterol and decrease in HDL/TC ratio than paternal MI, and risk of an increased cholesterol level was higher in subjects aged 20-39 yrs than in older subjects. [15]

Cross sectional study done by Munir Ahmed et al including 250 offspring of CHD patients as study group and 50 offspring without the family history of CHD as control group, where TC, LDL, TG (p<0.01) levels were increased in study group compared to control group. [16]

Saghafi H et al compared first degree relatives of patients with premature CHD with general population. TC and LDL-C levels were higher in 36.8% and 15.3% respectively. 14.6% had low HDL-C and 31.9% had high TG levels. Overall, 60.4% revealed at least one of the lipid abnormalities. [17]

Comparison of lipid profile parameters in both the groups showed TC (p=0.004) and LDL (p=0.006) levels are increased significantly in study group as compared to control group. HDL level is decreased in study group as compared to control group but it is not statistically significant. TG and VLDL levels are also higher in study group than the control group but not statistically significant.TC: HDL ratio is also more in study group than the control group (p=0.023).

Comparison of TC: HDL ratio[18] showed that in study group, 14% of subjects had low risk M [(4.0), F (3.8)] and 4% of subjects had average risk M [(5.0), F (4.5)]. Very low risk [M (<3.4), F (<3.3)] association with CHD was more in control group (98.0%) than the study group (82.0%). HDL is concerned with reverse transport of cholesterol towards liver and has inverse relationship with CHD risk. In our study, offspring of CHD patients have more risk of developing CHD in future.

Obesity leads to impairment of carbohydrate tolerance, elevation of cholesterol level in blood and elevation of body fat and thereby predisposes to atherosclerosis. Obesity is associated with increased basal lipolysis in adipose tissue, and elevated circulating free fatty acids. Families consuming diet rich in cholesterol e.g. eggs, milk, cheese, etc. are at higher risk of developing hypercholesterolemia. There is a linear relation between LDL levels and coronary events. LDL particle has been proved to be the main cause of CHD. [19] Familial hypercholesterolemia results from an absent or defective receptors responsible for internalization of LDL particle, particularly in hepatocytes, caused by LDL receptor gene mutations. High TC (>200mg/dl), high TG (>150mg/dl), high LDL (>130mg/dl) and low HDL (<40mg/dl) according to the criteria of Adult Treatment Panel III, are predominant risk factors for CHD.[17]

Elevation of TC, LDL, VLDL and TG levels and decreased HDL level in offspring with family history of CHD at a relatively young age indicates importance of

compulsory assessment of serum lipids in such children. Dietary cholesterol should be reduced to <200mg%, daily fat intake from 40% to <30% of total calories and intake of monounsaturated and polyunsaturated fats to be increased to reduce the risk of CHD. Inactivity is recognised as a risk factor for CHD. Regular aerobic exercise has been shown to play a major role in primary and secondary prevention of CHD. Exercise controls blood lipid abnormalities by stimulating an increase in plasma HDL concentration and decrease in TG levels. Besides favourable biochemical changes, regular exercise improves working capacity and myocardial oxygen consumption, reduces stress inducible myocardial ischemia and restores psychological balance.

Awareness has to be created in offspring of CHD regarding risk of having CHD in future and they must be advised measures to maintain their lipid levels in optimal range and also regarding weight management. Intake of junk foods and saturated fat to be avoided and physical activity has to be increased so as to prevent or lower the risk of CHD in future.

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REFERENCES

1. Adapted from WHO article; Move for Health: we in India need to do it faster: World Health Day 2002.
2. GYH Lip, VS Rathore, R Katira, RDS Watson, SP Singh. Do Indo-Asians have smaller coronary arteries? Postgrad Med J 1999; 75: p.463-6.
3. Kianoosh Hoseini, Saeed Sadaghian, Mehran Mahmoudian, Reza Hamidian and Ali Abbasi. Family history of cardiovascular disease as a risk factor for coronary artery disease in adult offspring. Monaldi Arch chest dis 2008; 70:p.84-87.
4. Scardi S, Mazzone C. Family screening of patients with premature coronary artery disease: opportunities and challenges premature coronary artery disease: opportunities and challenges of cardiovascular health in the 21st century. Ital Heart J Suppl 2004; 5(1): p.14-22.
5. Waist Circumference and Waist–Hip Ratio: Report of a WHO Expert Consultation; Geneva, 8–11 December 2008: p.20.
6. Suresh KP, Chandrasekhar S. Sample Size estimation and Power analysis for Clinical research studies. Journal Human Reproduction Science 2012; 5(1) : p.7-13.
7. Bernard Rosner. Fundamentals of Biostatistics. 5th ed. Duxbury: 2000. p 80-240.
8. Sunder Rao P S S, Richard J. An Introduction to Biostatistics, A manual for students in health sciences. 4th ed.New Delhi: Prentice hall of India ; 2006. P. 86-160.
9. Timothy A Welborn, Satvinder S Dhaliwal and Stanley A Bennett. Waist hip ratio is the dominant risk factor predicting cardiovascular death in Australia. MJA 2003;179 (11/12): p.580-585.
10. Fuster V, Ross R, Topol EJ. Atherosclerosis and coronary artery disease. Philadelphia, PA: Lippincott-Raven 1996: p.441-60.
11. Sandier M, Bourne GH. Atherosclerosis and its origin. New York, NY: Academic Press, 1963: p.43-52.
12. Timothy A Welborn, Satvinder S Dhaliwal and Stanley A Bennett. Waist hip ratio is the dominant risk factor predicting cardiovascular death in Australia. MJA 2003;179 (11/12): p.580-585.
13. Grottol, M Huertal, J D Kark,O Shpilberg and J Meyerovitch. Relation of parental history of coronary heart disease to obesity in young adults. International journal of obesity 2003;27: p.362-368.
14. Gupta R, Rastogi P, Sarna M,Gupta VP, Sharma SK and Kothari K. Body mass index, waist size, waist hip ratio and cardiovascular risk factors in urban subjects. *J.* Assoc. Physicians India 2007 ;55: 621-7.
15. M Hippe, J Vestbo, A M Bjerg, K Borch- Johnsen, M Appleyard, H O Hein et al. Cardiovascular risk factor profile in subjects with familial predisposition to myocardial infarction in Denmark. J. Epidemiol Community Health 1997 ; 51(3) : p.266-271.
16. Munir Ahmed and Mohammad Tayyib. Lipid abnormalities as predictor in offspring of premature coronary heart disease patients. Professional Med

J 2009;16(1): p.87-93.

17. Saghafi H, Mahmoodi M J, Heshmat R, Fakhrzadeh H, Shafaee A and Larijani B. Cardiovascular risk factors in first degree relatives of patients with premature coronary heart disease. Acta. Cardiol 2006; 61(6) : 607-613.
18. http://www.exrx.net/Testing/LDL%26HDL.html accessed on 18/08/2011.
19. Pedersen TR. Pro and con: Low density lipoprotein cholesterol lowering is and will be the key to future of lipid management. Am J Cardiol 2001; 87: 8B-12B.

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Effect of Swimming on Cognition in Elderly

Varsha SV[1], Shashikala KT[2]

[1]Post graduate Student, [2]Assistant Professor, Department of Physiology, Bangalore Medical College & Research Institute, Bengaluru, Karnataka, India

ABSTRACT

Previous studies report reduced risk of cognitive impairment in elderly who maintain higher levels of physical activity. Many studies also have proven that swimming has beneficial effect on skeletal and cardiovascular health. But studies to assess effects of swimming on cognitive health of elderly are lacking. This study was undertaken to assess and compare the level of cognition among elderly swimmers and non swimmers. 40 elderly subjects who regularly swim and 40 elderly non swimmers were recruited based on inclusion and exclusion criteria. Test for the cognitive domain executive function was performed with Category fluency and Verbal N back test to test Fluency and Working memory respectively. Results were statistically analyzed using students t test. In our study Elderly swimmers performed better than non swimmers in both the tests for executive function.

Keywords*: swimming, aerobic exercise, elderly, cognition, executive function, neurogenesis, BDNF, IGF-1, VEGF.*

BACKGROUND

Chronological aging, or senescence, is associated with an increased risk of chronic conditions and diseases such as cognitive impairment, cardiovascular disease, and metabolic syndrome. Due to prolonged life expectancy, age-related diseases have increased in alarming proportions in recent decades. An increasing body of studies have suggested that lifestyle factors have a significant impact on how well people age. Three lifestyle factors can play a significant role in slowing the rate of cognitive decline and preventing dementia: a socially integrated network, cognitive leisure activity, and regular physical activity.[1]

According to the prefrontal-executive theory[2], executive functions (EFs) and their underpinning prefrontal and frontal brain structures are particularly sensitive to the effects of normal and pathological aging[3,4]. Therefore, the preservation of these brain areas and their associated cognitive functions is of particular importance. Chronic physical activity (PA), aimed at improving cardio respiratory health, has been proposed to be a good, practical, and powerful candidate to overcome cerebral and behavioral declines [5-7]. Accordingly, the principal aim of the present study was to examine the potential benefits of an understudied form of PA—regular swimming (one of the most popular and accessible forms of PA for older adults)—on EF performance in a population aged 60 to 80 years old. As swimming is an ideal physical activity for the elderly population because of its low impact on joints and minimal risk of injury. Swimming is also a complete workout, incorporating the entire body and utilizing all muscles groups.[8]

But recently no studies have been done to study the effect of swimming on the age related cognitive decline. So we took up this study to assess and compare the level of cognition among elderly swimmers and non swimmers.

METHODOLOGY

40 elderly subjects aged more than 60 years, who regularly swim at least 30 min for 4 days a week from past 1 yr and 40 elderly non swimmers were recruited. Subjects with untreated cataract, refractory errors, and history of cerebrovascular / cardiovascular accidents, psychiatric illness, Kidney and Liver disorders, Respiratory disorders, Alcohol consumption, and smoking were excluded from the study. And those who perform other regular physical activity were also dropped from the study.

Institutional ethical clearance was obtained prior to the study. Subjects were asked to relax for 30min. And then Participants' written informed consent was obtained after explaining about the study protocol. Later they were

screened for their hearing. The participants were then tested for two sub domains of executive functions i.e. fluency and working memory with Category fluency and Verbal N back test respectively in a silent surrounding.[9]

Category fluency test

In this test the subject was asked to generate the names of as many animals as possible in one minute. The subject is asked to exclude the names of fish, snakes and birds. The number of names generated formed the score.

Verbal N back test

Thirty randomly ordered consonants common to multiple Indian languages were presented auditorily at the rate of one per second. Nine of the thirty consonants were repeated. The consonants which were repeated were randomly chosen. The subjects were asked to respond by tapping the table whenever a consonant was repeated consecutively. Number of hits and errors in each test formed the score. Number of errors was taken as negative score. And then total score was calculated.

The Descriptive statistics were used, i.e. mean and standard deviation (SD) for describing the parameters. The data was analyzed using student t-test to compare between the groups. The difference was considered statistically significant when P0.05. SPSS V.11.0 was used for analysis of data.

RESULTS

Results of present study show significant difference between elderly swimmers and non swimmers in both the tests for working memory and fluency. Wherein nonswimmers had lower cognitive ability compared to the swimmers.

Elderly swimmers were able to name more number of animals in one minute (11.27±1.25) than nonswimmers (9.97±1.31), which was statistically significant which is represented in Table 1

In Verbal N back test which was used to assess working memory elderly swimmers performed better with less number of errors and a total high score (8.05±0.79) compared to nonswimmers (7.27±0.81), represented in Table 1.

Table 1: Comparison of cognitive tests between elderly swimmers and non swimmers.

Cognitive tests	Swimmers	Non Swimmers	P Value
Category Fluency	11.27±1.25	9.97±1.31	0.005 ***
Verbal N Back	8.05±0.79	7.27±0.81	0.004 ***

Note: *P value < 0.05 significant, *** P value < 0.005 highly significant.

DISCUSSION

The growth of the proportion of the population aged 65 and older in the industrialized world, as well as in developing countries, has profound implications for public health and the economic costs of medical care. Cerebral and cognitive decline, as a function of aging, represents a predominant cause of autonomy loss in aging populations. According to the prefrontal-executive theory[2], executive functions (EFs) and their underpinning prefrontal and frontal brain structures are particularly sensitive to the effects of normal and pathological aging [3,4]

Most of the recent literature on aging, fitness, and cognition has shown that chronic exercise would result in selective improvements in executive functions rather than general benefits.[10,11,12]

A meta-analysis by Colcombe and Kramer[10] showed that the effect size of the positive effects of chronic exercise is significantly smaller on information processing speed than on executive functions.

Several studies support the notion that physical activity is a significant moderator of age-related cognitive decline. In cross-sectional studies, age-related differences in cognitive performance observed when older adults are compared to younger participants are reduced if the comparisons involved higher-fit individuals rather than sedentary older adults[13-17]. As a whole, these cross-sectional studies suggest that cardio respiratory fitness is associated with more efficient cognitive functions.

In the present study the comparison was done among Elderly population, between swimmers and nonswimmers. The results show that Elderly swimmers

performed significantly better than non swimmers in terms of Executive function tasks both fluency and working memory.

In Kramer et al.'s[18] study, older adults who completed a six-month aerobic training program (walking) showed a significant improvement in cognitive performance unlike those who completed a stretching program. Cognitive improvement was greater in tasks that tapped attentional control or executive control functions and was correlated with improvement in VO2 max. In another study, Albinet et al. [19] reported that 12 weeks of aerobic training lead to enhanced performance in executive control and increased heart rate variability in older men and women aged 65– 78. These results suggest that aerobic exercise may be an important cardiac and brain protective factor as people age. The greater improvement induced by aerobic training in executive control compared to other cognitive domains has also been confirmed by several meta-analyses.

To the best of our knowledge, only one study was designated to explicitly test the specific relationship between water aerobics and cognitive improvements in older adults [20]. In this study, Hawkins and collaborators examined the influence of a 10-week program of basic swimming skills on variations of two experimental tasks involving processing speed. They found that subjects who trained in water aerobics showed significantly better results than the control group

Better executive function among swimmers than nonswimmers may be attributed to the neuro-protective effect of swimming, an aerobic exercise. It promotes neurogenesis by increasing the production of neurotrophic factors (compounds which promote the growth or survival of neurons), such as brain-derived neurotrophic factor (BDNF), insulin-like growth factor 1 (IGF-1), and vascular endothelial growth factor (VEGF).[21]

CONCLUSION

Swimming has a beneficial effect on cognition in the elderly. Including swimming as a part of day to day activity may help in reducing age related cognitive decline.

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REFERENCES

1. Louis Bherer, Kierk I. Erickson, Teresa Liu-Ambrose. A Review of the Effects of Physical Activity and Exercise on Cognitive and Brain Functions in Older Adults. Journal of aging research 2013. Available from: http://dx.doi.org/10.1155/2013/657508
2. R. L. West, "An application of prefrontal cortex function theory to cognitive aging," Psychological Bulletin, vol. 120, no. 2, pp. 272–292, 1996.
3. C. T. Albinet, G. Boucard, C. A. Bouquet, and M. Audiffren, "Processing speed and executive functions in cognitive aging: how to disentangle their mutual relationship?" Brain and Cognition, vol. 79, no. 1, pp. 1–11, 2012.
4. L. H. Phillips and J. D. Henry, "Adult aging and executive functioning," in Executive Functions and the Frontal Lobes: A Lifespan Perspective, V. Anderson, R. Jacobs, and P. J. Anderson, Eds., pp. 57–79, Taylor & Francis, New York, NY, USA, 2008.
5. M. Audiffren, N. Andr´e, and C. T. Albinet, "Effects of chronic exercise on cognitive functions in older adults: assessment and prospects," Revue de Neuropsychologie, vol. 3, no. 4, pp. 207– 225, 2011.
6. C. H. Hillman, K. I. Erickson, and A. F. Kramer, "Be smart, exercise your heart: exercise effects on brain and cognition," Nature Reviews Neuroscience, vol. 9, no. 1, pp. 58–65, 2008.
7. A. F. Kramer and K. I. Erickson, "Capitalizing on cortical plasticity: influence of physical activity on cognition and brain function," Trends in Cognitive Sciences, vol. 11, no. 8, pp. 342– 348, 2007.
8. Charlie Nadler. 6 reasons why swimming is great exercise for seniors [Internet]. 2013. Available from: http://www.nspf.org/en/blog/13-01-11/6_Reasons_Why_Swimming_is_Great_Exercise_for_Seniors.aspx
9. Esther strauss, Elisabeth M.S. Shermann, Otfried Spreen. A compendium of neuropsychological tests.3rd ed. New York: Oxford university press; 2006.
10. S. Colcombe and A. F. Kramer, "Fitness effects

on the cognitive function of older adults: a meta-analytic study," Psychological Science, vol. 14, no. 2, pp. 125–130, 2003.

11. A. F. Kramer, S. Hahn, N. J. Cohen et al., "Ageing, fitness and neurocognitive function," Nature, vol. 400, no. 6743, pp. 418–419, 1999.
12. A. L. Smiley-Oyen, K. A. Lowry, S. J. Francois, M. L.Kohut, and P. Ekkekakis, "Exercise, fitness, and neurocognitive function in older adults: the "selective improvement" and "cardiovascular fitness" hypotheses," Annals of Behavioral Medicine, vol. 36, no. 3, pp. 280–291, 2008.
13. T. Abourezk and T. Toole, "Effect of task complexity on the relationship between physical fitness and reaction time in older women," Journal of Aging and Physical Activity, vol. 3, pp. 251–260, 1995.
14. L. Clarkson-Smith and A. A. Hartley, "Relationships between physical exercise and cognitive abilities in older adults," Psychology and Aging, vol. 4, no. 2, pp. 183–189, 1989.
15. C. H. Hillman, E. P. Weiss, J. M. Hagberg, and B. D. Hatfield, "The relationship of age and cardiovascular fitness to cognitive and motor processes," Psychophysiology, vol. 39, no. 3, pp. 303–312, 2002.
16. M. Renaud, L. Bherer, and F. Maquestiaux, "A high level of physical fitness is associated with more efficient response preparation in older adults," Journals of Gerontology B, vol. 65, no. 3, pp. 317–322, 2010.
17. W.W. Spirduso, "Reaction and movement time as a function of age and physical activity level," Journals of Gerontology, vol. 30, no. 4, pp. 435–440, 1975.
18. A. F. Kramer, S. Hahn, N. J. Cohen et al., "Ageing, fitness and neurocognitive function," Nature, vol. 400, no. 6743, pp. 418–419, 1999.
19. C. T. Albinet, G. Boucard, C. A. Bouquet, and M. Audiffren, "Increased heart rate variability and executive performance after aerobic training in the elderly,"EuropeanJournal of Applied Physiology, vol. 109, no. 4, pp. 617–624, 2010.
20. H. L. Hawkins, A. F. Kramer, and D. Capaldi. Aging, exercise, and attention. Psychology and aging. 1992;7(4): 643–653.
21. Tarumi T, Zhang R (January 2014). Cerebral hemodynamics of the aging brain: risk of Alzheimer disease and benefit of aerobic exercise. Front Physiol. 2014; 5:6.

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Comparative Study on Benefits of Conventional Practical Training Versus Objective Structured Practical Examination in Phase II MBBS Students

Manishankar Subramanian[1], Rashmi Ramanathan[2], Vinoth Kumar S[3], Mohan Jeyabal[2] , Jyothi Sivalingiah[4], Rajeswari[5]

[1]Tutor, Physiology, [2]Assistant Professor, Physiology, [3]Tutor, Physiology, [4]Associate Professor, Physiology, [5]Assistant Professor, Community Medicine, Karpagam Faculty of Medical Sciences & Research, Othakalmandapam, Coimbatore

ABSTRACT

Background: The present study was conducted to evaluate and compare the benefits of Conventional Practical Training (CPT) and Objective Structured Practical Examination (OSPE) for Phase II MBBS students.

Material and Method: Study was carried out among II year medical students of Karpagam Faculty of Medical Sciences and Research, Coimbatore. A total of 100 students of both genders were given questionnaire and feedback was taken regarding the benefits of CPT and OSPE in their routine clinical examination in hospital postings and a comparative study was done.

Results: The student's attitude towards the OSPE was found to be positive. OSPE appeared to be the valid index for developing knowledge, communication and psychomotor skills for the MBBS students.

Conclusion: OSPE was found to be a valuable method to improve the competency of a medical student in various domains. Thus OSPE can be used as routine practical examination in basic medical sciences rather than CPT for better learning and application of knowledge in clinical settings.

Keywords: *Conventional Practical Teaching, Objective Structured Practical Examination, Knowledge, psychomotor.*

INTRODUCTION

Objective Structured Practical Examination (OSPE) is derived from Objective Structured Clinical Evaluation (OSCE) in 1975 which was later extended to practical examination and was modified by Hardenand Gleeson[1,2]. This method is now believed to meet the deficiencies of the conventional system of practical examination in medical students. In an international conference held in Ottawain 1985, OSCE and

OSPE techniques were introduced as a teaching and evaluation tool and its advantages were compared with disadvantages[3].

The conventional practical examination system usually involves writing of detailed procedure of one or two given practicals, one as the major and the other minor. It is followed by un-observed performance on self or subject. The assessment is made on the basis of global performance rather than the candidate's individual competency. Some of the problems involved in conventional practical examination include patient and examiner variability which significantly affects the score. In OSPE, individual's competency is given importance by testing the process as well as the product[4].

Considering problems mainly of technical nature, which were faced at some places lead them to develop a combination of conventional and OSPE systems called as SOSPE or Semi Objective Structured Practical

Corresponding author:
Mr. S. Manishankar,
Tutor, Department of Physiology,
Karpagam Faculty of Medical Sciences & Research,
Othakalmandapam, Coimbatore – 641032

Examination that involve conduction of one experiment and the student was questioned on it[5].

So this OSPE was reported as good method of practical teaching compared to the conventional practical teaching since it is more objective. OSPE is considered to be the assessment system based on competency levels for practical and procedural skills aiming at producing good products[6].

The OSPE system can offer a better tool for assessment of skill in the basic sciences. A different skill or task is performed by a student at each station[7]. OSPE has been claimed to be a reliable device that has a good capacity to differentiate between different categories of students. It also tests the mental ability and the student's attitude to learning during the time of practical demonstration and performance[8].

The benefits of CPT and OSPE can be compared by taking feedback from the students and therefore the merits and demerits of each method of training can be analyzed. This will help in implementing the better way of practical teaching to fulfill the objectives and to improve the cognitive, affective and psychomotor domains among the medical students[9].

MATERIALS AND METHOD

This was a cross sectional study, conducted in Department of Physiology, Karpagam Faculty of Medical Sciences and Research after obtaining instituitional ethical committee clearance. A total of 100 students from Phase II MBBS participated in this study. Study design and objectives were explained and verbal consent was obtained from the students.

A questionnaire targeting the objectives of practical teaching and their implementation in clinical setting was used to evaluate the benefits of CPT and OSPE in these students. The questionnaire consists of 10 divisions, each division is directed to obtain the feedback from the students regarding their knowledge, analytical skills, ability to perform tasks, confidence level, communication skills etc. These divisions are made common for CPT and OSPE, each student is instructed to answer the questionnaire separately for CPT and OSPE. The scoring for each division was done as follows: (never – 0, rarely – 1, often – 2, always – 3).

From the total scores calculated (out of 30) from the questionnaire separately for CPT and OSPE from each student, they were divided into 3 categories: 21 – 30 as Highly useful, 11 – 20 as Fairly useful, below 10 as Little useful.

Each division in the questionnaire was separately analyzed with the scores given by each student. The total scores obtained for each division under CPT is compared with total scores obtained for each division under OSPE.

The benefits of CPT and OSPE obtained as questionnaire scores is statistically analyzed using paired sample 't' test and results were interpreted.

RESULTS

Table 1 shows the Categorization of System of Practical teaching (CPT and OSPE) based on the scores from the questionnaire given to the students. 36% students marked OSPE type of practical teaching is highly useful when compared to 14% for CPT. Also only 4% students marked OSPE to be little useful whereas in CPT it is 21%. And for the II category fairly useful for both CPT and OSPE method of teaching 60% and 65% of students have marked.

Table 1: Categorization of System of Practical teaching based on student's feedback

Categories	Conventional Practical Teaching (CPT) % of students	Objective Structured Practical Examinations (OSPE) % of Students
Highly useful (21 – 30)	14 %	36 %
Fairly useful (11 – 20)	65 %	60 %
Little useful (below 10)	21 %	4 %

This clearly shows that the OSPE type of practical teaching is beneficial to medical students when compared to conventional type of practical teaching.

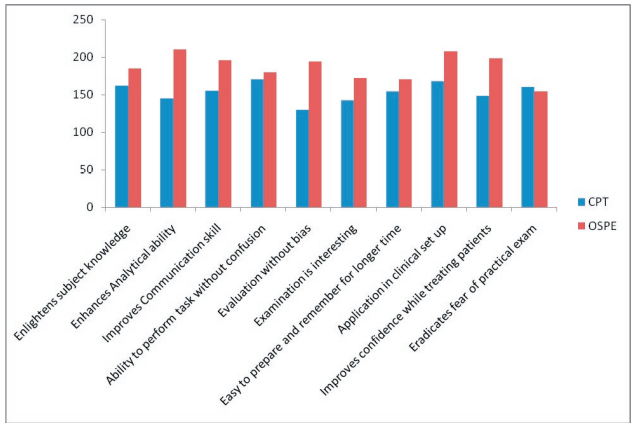

Figure – 1 Comparison of total scores of each division in CPT and OSPE

The total scores obtained for each division in the questionnaire for CPT and OSPE respectively is compared using a bar diagram. All the division except for the division 'Eradicates fear of exam', the scores are high for OSPE when compared to CPT. This clearly indicates the effectiveness of OSPE type of practical training is beneficial over CPT satisfying all the domains of learning.

The total scores which includes sum of all the divisions for CPT and OSPE is statistically analyzed using paired sample 't' test.

Table 2: Paired sample 't' test for CPT and OSPE

Teaching Methodology	Mean	SD	't' Value	'p' value
CPT	153.40	12.41	4.544	0.001*
OSPE	186.70	17.86		

Results obtained from scores of benefits of CPT versus OSPE type of practical teaching methodology were analyzed statistically using paired sample't' test. The 'p' value is 0.001* significant at 5% level. This clearly shows that OSPE type of teaching methodology is highly beneficial over CPT in practical teaching for MBBS students.

DISCUSSION

The significantly higher score of OSPE as compared to Conventional practical training in most of the divisions in the present study indicates importance of OSPE in satisfying the objectives of practical teaching.

OSPE plays a vital role in improving all the aspects of Bloom's taxonomy. It divides educational objectives into three domains – Cognitive, Affective and Psychomotor. The goal of Bloom's taxonomy is to motivate the educators to focus on all three domains, creating a holistic form of education[10].

Cognitive domain is knowledge, comprehension and critical thinking on a particular topic. Affective domain describes the way people react emotionally and ability to feel others agony or joy. Psychomotor domain is the ability to physically manipulate a tool or an instrument. Analyzing the scores of the students, OSPE certainly improves the knowledge, analytical ability, communication skills and motor skills of the medical graduate.

In a previous study, a combination of CPT and OSPE was preferred over pure OSPE. Majority of students considered it as an effective, interesting and useful technique to meet the objectives of the practical teaching. The OSPE system involves wider coverage of the course and it tests individual competency in different topics and skills by asking targeted questions at the Non Observed stations.

On the contrary, the Conventional system evaluates randomly the subjective recall of the given practical. Students both regular and irregular were able to score high in CPT by memorizing the procedure without proper understanding of concepts and facts. OSPE has been shown to have a better scope for being structured so that all the objectives of laboratory teaching can be tested. Instead of the established benefits of OSPE, it is difficult to implement everywhere, due to its limitations. The major reasons are time constraints and space restraints in small setups. However, it has been generally seen that in different medical colleges, the tools of assessment are being continuously switched from one to another. The conventional practical exam had become completely obsolete as it does nor evaluate the student's overall competency level as effectively as OSPE, due to lack of objectivity, purposefulness and focus on important concepts.

CONCLUSION

OSPE appears to be important for performance discrimination on the basis of individual competency,

attitude towards learning and communication skills. It may not only improve the quality of student's performance in laboratory but also improves the ability of a student to apply their knowledge and skills while examining and treating patients.

Both OSPE and Conventional practical training test different abilities. Both have their own advantages and disadvantages. Based on the present results of the study, practical teaching can be modified by incorporating more of OSPE training along with Conventional practical training to improve the knowledge, skills and competency of the medical student and to become a better medical practioner.

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Ethical Clearance: The present study was approved by institutional ethical committee, KFMSR Coimbatore-Tamilnadu

Source of Funding- Self

Conflicts of Interest - Nil

REFERENCES

1. Harden RM, Gleeson FA. Assessment of clinical competencies using an objective structured clinical examination (OSCE): ASME Medical Education Booklet No. 8. Dundee: ASME, 1979;64: 123-5.
2. Harden RM, Stevenson M, Wilson DW, Wilson GM. Assessment of clinical examination. Br. Med. J. 1975; 5955(1): 447-51.
3. Hart IR, Honden RM, WaltonHJ. Newer developments in assessing clinical competence. International conference proceedings. Ottawa: Congress centre, 1985.
4. Ananthakrishnan N. Objective structured clinical/ practical examination (OSPE/OSCE). JPGM 1993; 39(2):82-4.
5. Gitanjali B. The other side of OSPE. Indian J Pharmacol 2004; 36:388-9.
6. Huseyin Cahit Taskiran.A new competency level system for practical and procedural skills in an undergraduate curriculum. Foundation for Advancement of International Medical Education and Research (FAIMER) Institute. 2003.available at: http://www.faimer.org /education/fellows/ abstracts/03taskiran.pdf [Retrieved on 30th June 2009]
7. Adome RO. The introduction of Objective Structured Clinical/Practical Examination (OSCE/ OSPE) in the Undergraduate Bachelorof Pharmacy Student Assessment in Makerere University.
8. Ravi P. Shankar, Arun K. Dubey, Pranaya Mishra, Vibhavri Y. Deshpande, T.S. Chandrasekhar, P.G. Shivanda. Education for Health: Change in Learning and Practice 2006;19(1):71–84.
9. Jhansi Charles, Kalpana S, Joseph Stephen Max L, Shantharam D. A Cross Sectional Study On Domain Based Evaluation Of Medical Students At The Tamil Nadu Dr.M.G.R.Medical University-A Success: IOSR Journal of Research & Method in Education (IOSR-JRME): 2014; 4: 33-36.
10. Airsian, Peter W, Cruikshank, Kathleen A, Mayer, Richard E. A taxonomy for learning, teaching, and assessing: A revision of Bloom's taxonomy of educational objectives. Allyn and Bacon. ISBN 978-0-8013-1903-7.

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Reduced Stress Tolerance in Males? An Animal Model

N Ethiya[1], M Shanthi[2], Maheswaran[3]

[1]Associate Professor, Physiology, Institute of Physiology, Madurai Medical College, Madurai, [2]Associate Professor, Physiology, CSI Dental College, Madurai, [3]Assistant Veterinary Surgeon, Madurai Medical College, Madurai

ABSTRACT

The aim of the study is to understand the affection due to stress in both male and female albino rats. 24 albino rats were used for the study. The animals were divided into two groups, control and study, study group was exposed to heat stress for 10 days and the levels of corticosterone was estimated before and after study. Osmotic fragility was estimated in both the groups. Both the genders were compared and the results tabulated statistically.

Keywords: *Stress, Gender Variation, Corticosterone, Osmotic fragility, albino rats.*

INTRODUCTION

Stress is a reaction that disturbs us both physically and mentally[1] The most detrimental factor that affects the physiology of every living being in various aspects. The research compliments studies which have found that in times of stress, male rats are less likely to survive [2] when people feel stressed their bodies undergo changes through HPA axis and sympathetic system activation.[3] Though it affects every individual ,there exists a gender variation for the same quantum of stress [4] Men and women react differently for the same stress. Such an understanding would have a significant impact, on analyzing the problems faced by each [5]Gender is an important determinant of health, and their exists clear pattern of sex-specific prevalence rates of various problems. This study actually focuses on gender specificity during stress. This was done on experimental animals, albino rats.[6]

MATERIALS AND METHOD

The protocol for the study was approved by Animal Ethical committee, Madurai Kamaraj University, Madurai.

ANIMALS AND EXPERIMENTAL DESIGN

Type of stress: Heat stress

Induction by: 100 watts bulb, to a temperature of 38-40c, for 2 hours everyday for 10 days .

Period of study: 10 days .

Animals Required: 24 albinorats (12 Males & 12 Females) weighing 200gms-225 gms.

Physiological parameters: blood corticosterone level Osmotic fragility.

At the end of the study, these parameters were estimated and statistically analysed .

We studied 24 albino rats of either sex, the animals of same age and weight was taken. 12 males rats were divided into two groups. (control & study group). Likewise 12 female rats were divided into two groups (control & study group). The animals were acclimated to a temperature of 22c with normal feeds and water ad libitum. The study group was exposed to a temperature of 38-41c for 2 hours. Everyday for 10 days. At the end of 10 days, serum corticosterone level and osmotic fragility were estimated. The blood was drawn from the animal using cardiac puncture.

The corticosterone levels were estimated using ELISA method in lab. The osmotic fragility was estimated using saline method. The results were statistically analyzed and tabulated.

Corresponding author :
DR N Ethiya, MD (Physiology),
Associate Professor,Institute of Physiology, Madurai Medical College, Madurai

Table 1: Levels of Hormone in Control Group

S.No	Level of hormone	Males	Females
	Corticosterone	2.50 microgram/dl	2.82 microgram /dl

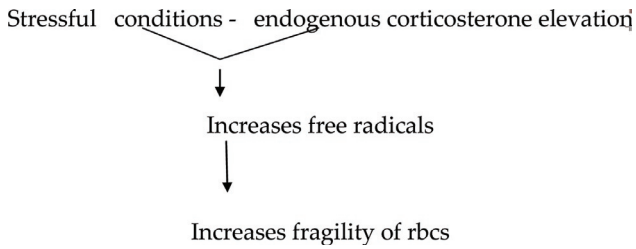
Table 2 Levels of Hormone in Study Group

S.No	Levels of the hormone	Males	Females
	Corticosterone	25.07microgram/dl	22.8microgram/dl

NOTE : The hormone levels after exposure to stress is more in males compared to females.

Table 3 Osmotic fragility

S.NO		Lysis starts	Lysis ends
Control group	male	0.60%	0.30 %
	female	0.60%	0.35%
Study group	male	0.85%	0.40%
	female	0.75%	0.40 %



DISCUSSION

Measurement of erythrocyte osmotic fragility (EOF) could be used as a biomarker of stress in humans. Erythrocyte osmotic fragility is a measure of erythrocyte strength and its ability to withstand varying osmotic gradients and it has being reported to be increased in situations of low oxygen tension, red blood cell membrane abnormality and during oxidative stress [7]

Many researchers have established the response of both genders to a stressor. The activation of sympathetic nervous system, causes release of various hormones.

The hormones like oxytocin, vasopressin, and CRF (corticotrophin releasing factor) are released during stress Among these hormones, oxytocin, counteracts the effects of the stress response.

However oxytocin is present in both males and females, but in greater quantities in females.

Oxytocin works to reduce the blood pressure as well as cortisol, the hormone responsible for facing stress. Oxytocin can induce anti-stress-like effects such as reduction of blood pressure and cortisol levels. It increases pain thresholds, exerts an anxiolytic-like effect and stimulates various types of positive social interaction. In addition, it promotes growth an healing[8]

Actually in our study, female albino rats showed less response to stress, compared to their male counterparts, indicating a possible interference of oxytocin in normal stress response [9]

- Oxytocin – Decreases cortisol, Decreases BP
- Reduces stress by altering the stress cascade
- Central and peripheral oxytocin levels have been found to increase in response to a wide variety of stressful stimuli, such as conditioned fear stimuli and restraint stress [10]. In humans an increase in plasma oxytocin was found after stressful periods.

So, there is definite correlation between stress and oxytocin levels.

CONCLUSION

New researches suggests that stressful events have major impact on mens health, both (mental & physical) than women. As a result of their decreased ability to cope up with stress, they either get affected by diseases like DM, HT or they go in for addiction, aggressiveness and antisocial behavior.

To conclude for the, for the same quantum of stress ,men are more affected than women, and needs an early identification and rectification, which would otherwise result in a major threat to mankind.

Conflict of Interest : Nil

Source of Funding: Self

REFERENCES

1. John.A.Bowersox ,Brain research /vol 478 issue 1 ,pages 1 – 204.
2. McClintock, B. (1984). The significance of responses of the genome to challenge. Science, 226: 792–801.
3. Dr.Rajiv laroiya ,article on The Physiology of stress
4. September 2005 web Medical News
5. Yah hu et al, 2007 , genes role in stess in plant species
6. Springer article 2005
7. Aldrich et al ,matsumara ,, Niger Journal of physiology dec 2012 pages 157 -164
8. International journal of Neurosciences August 2009 29(32) pgs 10111 - 10119
9. Mendel et al Environmental *stress* tolerance genes
10. Role of oxytocin in stress ,Neumann et al., 2000 and Onaka, 2004

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Effects of Endurance and Resistance Training on Pulmonary Function Tests: A Randomised Controlled Study

Mradul Purwar[1], Manish Bajpai[2], Sunita Tiwari[3], Pradeep Kumar[2]

[1]Resident, [2]Professor, [3]Professor and Head, Department of Physiology, King George's Medical University, Lucknow

ABSTRACT

Introduction: Exercise has been a means of testing the physical capabilities and physiological responses of an individual. Exercise when performed regularly has beneficial effects on the various systems of the body. Exercise shows overall improvement in pulmonary function.

Objectives: To evaluate the effects of endurance training and resistance training on Pulmonary function tests.

Methodology: A total of 50 male non-smoker healthy subjects aged 18-25 years were randomized to Group A (n=25; Resistance) and Group B (n=25; Endurance). At baseline FVC, FEV_1, FEV_1/FVC, $FEF_{25-75\%}$, PEF were recorded. The exercise schedule continued till 3 months. After three months, PFTs were revaluated. Changes in pulmonary function were assessed. Data were analyzed using SPSS version 20.0. Student paired't'-tests were used. $P<0.05$ was considered significant.

Results: At baseline both the groups had comparable pulmonary functions. After 3 months, both the groups showed increase in PFT values. FEV_1/FVC was significantly higher in Group B as compared to Group A ($p=0.010$). Group B had higher % increase as compared to Group A for all PFT parameters.

Conclusion: Exercise had a positive impact on PFT with endurance training being slightly better.

***Keywords**: Endurance training Resistance Training Pulmonary function tests Parallel effect*

INTRODUCTION

Exercise has a deterministic effect on heart and lungs. The lungs bring oxygen into the body, provide energy, and remove carbon dioxide. The heart pumps the oxygen to the muscles that are doing the exercise. While exercising muscles work harder and body uses more oxygen and produces more carbon dioxide. To cope with this extra demand, breathing had to increase from about 15 times a minute (12 litres of air), while resting, extra demand is up to about 40–60 times a minute (100 litres of air) during exercise. Circulation also speeds up to take the oxygen to the muscles so that they can keep moving[1]. There are broadly two types of exercises – resistance and endurance. Resistance training targets the muscles, causing them to contract against an external resistance (such as weights) in order to increase strength, tone, mass, and mobility weight-lifting is an example of a resistance exercise while endurance training works on cardiovascular strength and is the most effective way of burning calories fast - Running and swimming are examples of endurance exercise. Cycling is an example of both types of exercise.

Exercise when performed regularly has beneficial effects on the various systems of the body. There are several studies that have shown significant improvement in pulmonary functions as a result of the effect of exercise[2,3,4]. However, there are studies which show non - significant change in pulmonary functions as an effect of exercise[5,6,7]. There are some other studies that present an altogether different scenario. These studies have shown that exercise/sports activities in some particular environments have a deteriorating effect on lung functions resulting into occurrence of asthma and exercised induced bronchoconstriction [8,9,10,11]. These evidences, thus are paradoxical, and as such the issue of effect of exercise on pulmonary functions remains unresolved.

In a recent study, Endurance training (ET) and resistance training (RT) have been considered since the studies show further beneficial effects of strength training on improvement of pulmonary function[12]. Encouraged by these results, the present study was planned with an aim to evaluate and compare the effects of endurance and resistance training on pulmonary functions.

MATERIAL AND METHOD

The study was conducted in the Department of Physiology at King George's Medical University, Lucknow (U.P) between years 2015 to 2016. 50 males apparently healthy non-smoker, normotensive (resting blood pressure <140/90 mmHg) undergraduate students aged 18 to 25 years, having BMI between 18.0 to 25.0 kg/m^2 range were included in the assessment. Those having a history of regular exercise training or sports activity, having previous history of cardiovascular and respiratory problems, those under medication which influence the metabolic or cardiorespiratory response to exercise, having bony deformity of chest or spine, any respiratory epidemic or infection, history of pulmonary embolism, unstable angina or myocardial infarction were excluded from the assessment.

All the subjects were required to fill a **Physical Activity Readiness (PAR-Q)** Form before exercise for screening.

The students were then randomized to one of the two study groups as follows:

- Group A: 25 apparently healthy male subjects for resistance exercise
- Group B: 25 apparently healthy male subjects for endurance exercise

At the time of enrolment, following pulmonary functions were evaluated:

- FVC (Force vital capacity)
- FEV1 (Force Expiratory Volume in 1 sec.)
- FEV1/FVC (Ratio of force expiratory volume in 1 sec to force vital capacity)
- FEF (25-75%) (Force expiratory flow)
- PEF (Peak expiratory flow)

Participants were taken to the exercise physiology lab two times before the beginning of training period. In the first session, their one repeat maximum (1RM) was determined for each of the major muscle group i.e biceps, triceps.

Training Protocol (Based on American College of Sports & Medicine, 2013)

- Each participant performed exercise/training 3 days/week
- 2-4 sets of 8-12 repetitions were done for major muscle groups.

Trial run on treadmill:-

All the subjects were given one session of trial run on the treadmill to relieve the anxiety related to the treadmill running during actual testing and data collection. For examination, all the subjects were advised adequate hydration, avoid heavy physical exertion, complete rest and have a sound sleep on previous night. Subjects were advised to reach the department after taking light breakfast. There was at least a gap of 2 to 3 hours between the last meal and exercise to avoid the nausea and regurgitation. They were then asked to rest for next 30 minutes lying with closed eyes. All subjects for the study underwent through clinical examination (General and Systemic). The ambient temperature of the laboratory was maintained between 20 - 25ºC.

The training was continued for 3 months. After three months, pulmonary functions were evaluated again.

Data Analysis: Data was analyzed using Statistical Package for Social Sciences (SPSS) version 20.0. Independent and paired 't' tests were used to analyze the data. 'p' value less than 0.05 was considered to be statistically significant.

RESULTS

Age of patients ranged from 18 to 24 years. Mean age was 20.60±1.96 and 20.68±1.91 years respectively in Groups A and B. In Group A, mean BMI, heart rate, systolic blood pressure and diastolic blood pressure values were 21.87±1.92 kg/m^2, 75.64±3.15 bpm, 122.24±3.93 mmHg and 75.04±2.95 mmHg respectively whereas in Group B the corresponding values were 21.34±1.87 kg/m^2, 75.28±3.58 bpm, 120.08±6.62 mmHg and 75.12±2.01 mmHg respectively. Statistically, there was no significant difference between two groups with

respect to age, anthropometry and haemodynamic parameters (p>0.05) (Table 1).

Table 1: Comparison of Baseline Demographic, Anthropometric and haemodynamic profile between two study groups

SN	Characteristics	Group A	Group B	Statistical significance ('p' value)
1.	Mean Age±SD (Range) in years	20.60±1.96 (18-24)	20.68±1.91 (18-24)	0.771
2.	Mean BMI±SD (kg/m^2)	21.87±1.92	21.34±1.87	0.323
3.	Mean HR±SD (bpm)	75.64±3.15	75.28±3.58	0.379
4.	Mean SBP±SD (mmHg)	122.24±3.93	120.08±6.62	0.090
5.	Mean DBP±SD (mmHg)	75.04±2.95	75.12±2.01	0.911

At baseline mean FVC, FEV_1, FEV_1/FVC, $FEF_{25-75\%}$ and PEF values were 4.13±0.57L, 3.46±0.50L, 0.83±0.02, 3.79±0.52 L/s and 8.23±0.32 L/s respectively in Group A and 3.98±0.48 L, 3.35±0.41 L, 0.84±0.02, 3.49±0.57L/s and 8.13±0.38 L/s respectively in Group B. Statistically, there was no significant difference between two groups with respect to any of the pulmonary functions being studied (p>0.05) (Table 2).

Post-3 month intervention mean FVC, FEV_1, FEV_1/FVC, $FEF_{25-75\%}$ and PEF values were 4.28±0.51L, 3.69±0.45L, 0.85±0.02, 3.86±0.40 L/s and 8.65±0.30 respectively in Group A and 4.14±0.46L, 3.61±0.35L, 0.87±0.02, 3.77±0.37 L/s and 8.54±0.36 L/s respectively in Group B. Statistically, a significant difference between two groups was observed only for FEV_1/FVC values (p=0.010) (Table 2).

Table 2: Between Group Comparison of Pulmonary function tests at baseline and 3 months post-intervention

SN	Characteristics	Group A	Group B	Statistical significance ('p' value)
Baseline				
1.	FVC (L)	4.13±0.57	3.98±0.48	0.347
2.	FEV1 (L)	3.46±0.50	3.35±0.41	0.434
3.	FEV1/FVC	0.83±0.02	0.84±0.02	0.105
4.	FEF 25-75% (L/s)	3.79±0.52	3.49±0.57	0.054
5.	PEF(L/s)	8.23±0.32	8.13±0.38	0.302
Post-intervention				
1.	FVC (L)	4.28±0.51	4.14±0.46	0.322
2.	FEV1 (L)	3.69±0.45	3.61±0.35	0.503
3.	FEV1/FVC	0.85±0.02	0.87±0.02	0.010
4.	FEF 25-75% (L/s)	3.86±0.40	3.77±0.37	0.405
5.	PEF(L/s)	8.65±0.30	8.54±0.36	0.263

Following intervention mean increases in FVC, FEV_1, FEV_1/FVC, $FEF_{25-75\%}$ and PEF values were 0.15±0.11 L (3.71%), 0.23±0.09 L (6.67%), 0.02±0.02 (2.60%), 0.07±0.32 (1.77%) and 0.42±0.11 (5.06%) respectively in Group A. As compared to baseline, for all the parameters except $FEF_{25-75\%}$, the change was significant statistically (p<0.001) (Table 3). In Group B, mean increases in FVC, FEV_1, FEV_1/FVC, $FEF_{25-75\%}$ and PEF values were 0.16±0.04L (3.94%), 0.26±0.08L (7.62%), 0.03±0.02 (3.43%), 0.28±0.37 L/s (8.01%) and 0.41±0.13 (L/s) (5.09%) respectively. As compared to baseline, the change was significant statistically for all the five PFT parameters being studied (Table 3).

Table 3: Intragroup Change in Pulmonary Function Variables (Pre-Exercise to Post-Exercise)

Pulmonary Function Variables	Group A	Group B						
	Mean Change±SD	% change	't'	'p'	Mean Change	% change	't'	'p'
FVC (L)	0.15±0.11	3.71	6.952	<0.001	0.16±0.04	3.94	18.051	<0.001
FEV1 (L)	0.23±0.09	6.67	12.191	<0.001	0.26±0.08	7.62	16.079	<0.001
FEV1/FVC	0.02±0.02	2.60	6.177	<0.001	0.03±0.02	3.43	7.252	<0.001
FEF 25-75%(L/s)	0.07±0.32	1.77	1.048	0.305	0.28±0.37	8.01	3.803	0.001
PEF (L/s)	0.42±0.11	5.06	18.434	<0.001	0.41±0.13	5.09	16.324	<0.001

DISCUSSION

In present study change in pulmonary functions as observed in Group A (Resistance training) showed a mean % increase in FVC, FEV_1, FEV_1/FVC, $FEF_{25-75\%}$ and PEF as 3.71%, 6.67%, 2.60%, 1.77% and 5.06% respectively whereas the same in Group B (Endurance training) was 3.94%, 7.62%, 3.43%, 8.01% and 5.09% respectively. Thus in resistance training group, maximum change was observed for FEV_1 and minimum for $FEF_{25-75\%}$ whereas in Group B (endurance training), maximum change was observed for $FEF_{25-75\%}$ and minimum for FEV_1/FVC. In both the groups, change from baseline was significant statistically for all the pulmonary function parameters. In effect, the findings showed that pattern of change in different pulmonary functions were different for the two groups under study.

A similar observation was also made by Mehrotra *et al.*[13] who although did not carry out an intervention study yet found pulmonary functions to vary significantly among players playing different sports (football, hockey, volleyball, swimming and basketball). The relevance of exercise training could be equated with the controls (non-players) in their study who had significantly lower values as compared to those playing different sports, thus showing that regular exercise/sports activity has a positive impact on pulmonary functions. In present study, such impact was observed in both the groups, and for all the five pulmonary function parameters being studied. However, some workers like O'Donnell *et al.*[14] did not find a significant impact of 12week endurance training programme on pulmonary functions. However, the difference in type of study population could be specified the reason for this difference between two studies. In present study, all the subjects were young healthy volunteers (18-25 years), however, the cited study had included patients with chronic airflow limitation. Thus the pattern of response could be dependent on the type of patient. In another study, Ortega *et al.*[15] showed a significant change in pulmonary functions of COPD patients undergoing 12week endurance training but did not find a significant change among those undergoing resistance training or a combination of two. In present study too, though the pattern of response for some of the pulmonary function parameters varied across two groups yet in general an improvement in all the pulmonary function parameters (irrespective of magnitude) was observed in both the groups. In general, the findings of the study showed that exercise of either type had a positive impact on pulmonary function. Such observation has also been made in previous studies too. Amonette and Dupler[16] showed a significant improvement in pulmonary functions of both competitive triathletes as well as marathon runners.

There are relatively fewer studies targeted healthy individuals. However, similar to results of our study they have also showed a significant increase in pulmonary functions parameter(s) irrespective of the type of exercise[17,18,19,20,21]. However, these responses were specific for some factors like gender but did not show much difference with respect to type of exercise. In present study too, we did not find a significant difference between two exercise training programmes for most of the parameters except FEV1/FVC.

The findings in present study thus showed that both resistant and endurance training exercises have a positive impact on pulmonary functions. These findings are interesting and show the relevance and importance of exercise in today's world where respiratory disorders, particularly, COPD is expanding extensively. Given the usefulness of either of two training programmes, one can select the type of exercise dependent on the targeted

performance goals. For muscle building resistant exercises are a better option whereas for athletic performances, endurance exercises could be the better option. These results have a high relevance both in terms of application in fitness, performance improvement and pulmonary rehabilitation programmes, however, inclusion of more variables with targeted objectives other than pulmonary functions is recommended.

CONCLUSION

FEV1/FVC ratio in group B(Endurance training) were found to be higher and statistically significant than group A(Resistance training).Increase in pulmonary function variables like FVC, FEV1, FEV1/FVC, FEF25-75% and PEF were found to be higher in group B than group A and change is found to be statistically significant.

Both endurance as well as resistance training programmes provided significant improvement in pulmonary functions.But endurance training being better in achieving targeted goals for exercise.

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Ethical Clearance - Taken

REFERENCES

(Endnotes)

1 ELF Fact Sheet: Your lungs and exercise. European Lung Foundation. available at http: //www.europeanlung.org/assets/files/en/ publications/ lungs-and-exercise-en.pdf

2 Chandran CK, Nair HK, Shashidhar S Respiratory functions in kalaripayattu practitioners. India J Physiol Pharmacol, 2000; 48(2): 235-240.

3 Nourry C, Deruelle F, Guinhouya C, Baquet G, Fabre C, Bart F, Berthoin S, Mucci P. High intensity intermittent running training improves pulmonary function and alters exercise breathing pattern in children. Eur J Appl Physiol, 2005; 94: 415-423.

4 Shivesh P, Sushant M, Ujjwal R 2007. Athletes, yogis and individuals with sedentary lifestyles; do their lung functions differ? Ind J Physiol Pharmacol, 51(1): 76-80.

5 Hamilton P, Andrew GM. Influence of growth and athletic training on heart and lung functions. Eur J Appl Physiol, 1976; 36: 27-38.

6 Kuppu Rao KV, Vijayan VK Maximum expiratory flow volume loop in Southern Indian College Sportsmen. Ind J Physiol Pharm, 1988; 32(2): 93-99.

7 Doherty M, Dimitriou L. Comparison of Lung volume in Greek Swimmers, Land Based Athletes and sedentary controls using allometric scaling, Br J Sports Med. 1997, 31, 337-341.

8 Wilber RL, Rundell KW, Szmedra L, et al. Incidence of exercise-induced bronchospasm in Olympic winter sport athletes. Med Sci Sports Exerc 2000;32:732–7.

9 Weiler JM, Ryan EJ 3rd. sthma in United States olympic athletes who participated in the 1998 olympic winter games. J Allergy Clin Immunol2000;106:267–71.

10 Sue-Chu M, Larsson L, Bjermer L. Prevalence of asthma in young cross-country skiers in central Scandinavia: differences between Norway and Sweden. Respir Med1996;90:99–105.

11 Larsson K, Ohlsen P, Larsson L, et al. High prevalence of asthma in cross country skiers.BMJ 1993;307:1326–9.

12 Chtara M, Chamari K, Chaouachi M, Chaouachi A, Koubaa D, Feki Y, et al. Effects of intra-session concurrent endurance and strength training sequence on aerobic performance and capacity. Br J Sports Med .2005;39:555–560.

13 Mehrotra PK, Varma NS, Tiwari S, Kumar P. Pulmonary functions in Indian sportsmen playing different sports. Indian J Physiol Pharmacal 1998; 42(3): 412-416.

14 O'Donnell DE, McGuire M, Samis L, Webb KA. General exercise training improves ventilatory and peripheral muscle strength and endurance in chronic airflow limitation. Am J Respir Crit Care Med 1998;157:1489–1497.

15 Ortega F, Toral J, Cejudo P, Villagomez R, Sa´nchez H, Castillo J, and Montemayor T. Comparison of Effects of Strength and Endurance Training in Patients with Chronic Obstructive Pulmonary Disease. Am J Respir Crit Care Med Vol 166. pp 669–674, 2002.

16 Amonette WE and Dupler TL. The effects of respiratory muscle training on VO2 max, the ventilatory threshold and pulmonary function. 2002;5(2):29-35.

17 Singh VP, Jani H, John V, Singh P, Joseley T. Effects of upper body resistance training on pulmonary functions in sedentary male smokers. Lung India 2011; 28(3): 169-173.

18 Khosravi M, Tayebi SM, Safari H. Single and Concurrent Effects of Endurance and Resistance Training on Pulmonary Function. Iran J Basic Med Sci: 2013; 16: 628-34.

19 Hulke SM, Phatak MS. Effect of endurance training on lung function: a longitudinal study. Int J Biol Med Res. 2011; 2(1): 443-446.

20 Enright SJ, Unnithan VB, Heward C, Withnall L, Davies DH. Effect of High-Intensity Inspiratory Muscle Training on Lung Volumes, Diaphragm Thickness, and Exercise Capacity in Subjects Who Are Healthy. Physical Therapy 2006; 86(3): 345-354.

21 Galvan CCR, Cataneo AJM. Effect of respiratory muscle training on pulmonary function in preoperative preparation of tobacco smokers. Acta Cir. Bras. 2007; 22(2): 98-104.

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Effect of Acute Exercise on Pulmonary Function Tests among Young Individuals at Indore, India- A Cross-sectional Study

Shrikrishna Nagorao Bamne

Associate Professor, Department of Physiology, Index Medical College Hospital and Research Centre, Indore, India

ABSTRACT

Background and Aim: The lungs, with their better surface area, are straight open to the outside environment and are greatly prejudiced by epidemiological, environmental and occupational factors. For the functional status of the lungs, pulmonary function testing has major role. Present study was aimed to study the influence of acute exercise on pulmonary function tests in normal young individuals.

Materials and Method: Present study was conducted at Department of Physiology, Index Medical college Hospital and Research Centre, Indore. A total of 102 students comprising of 51 males and 51 females in the age group of 17-22 years were divided into four groups based on their body mass index as Underweight, normal, overweight and obese individuals. Respiratory parameters were measured at rest and after an incremental form of acute exercise in the bicycle ergometer.

Results: No significant changes were observed in all the four groups before and after exercise in males. However the post exercise values of FVC and VC were reduced than the baseline values in overweight and obese females ($p < 0.01$).

Conclusion: Acute exercise did not significantly affect the respiratory parameters. However the body fat distribution of the individual may significantly influence the ventilatory response to acute exercise in otherwise healthy individuals.

Keywords: *Body Mass Index, Exercise, Lungs, Vital Capacity.*

INTRODUCTION

The lungs, with their better surface area, are straight open to the outside environment and are greatly prejudiced by epidemiological, environmental and occupational factors. For the functional status of the lungs, pulmonary function testing has major role. In combination with the clinical assessment and other investigations, they can be used for establishing diagnosis, representing severity of the disease and also in assessing the prognosis.

Exercise symbolizes a situation of physical exertion of the body and it is connected with extensive alterations in the circulatory and respiratory systems. The cardiovascular and respiratory mechanisms function in an incorporated fashion to meet the oxygen demands of the tissues during exercise.[1] Measurement of pulmonary functions after work out could offer valuable information about the functional reserve capacity of lungs both in healthy persons and in patients with respiratory diseases. Exercise is used as a confront test to make a diagnosis of exercise induced bronchoconstriction in asthmatic patients with a history of breathlessness through or subsequent to exertion.[2]

The ventilatory ability of a fit individual often exceeds the demands even during strenuous exercise.[3] Despite this enormous reserve, the ventilatory reply to exercise may become unnatural in obese individuals with normal lungs.[4] Astonishingly very few studies had explored the outcome of acute exercise on pulmonary function tests in normal individuals and they had revealed controversial results.

Corresponding author:
Dr Shrikrishna Nagorao Bamne,
Department of Physiology, Index Medical college Hospital and Research Centre, Indore, India
E-mail: shrikrishna_bamne@rediffmail.com, researchguide86@gmail.com, Tel: 9427350988,

Though the relationship of gender and anthropometric indices on lung functions have been well recognized, [5,6] their influence on the exercise persuade changes on pulmonary function tests in young healthy individuals have received less notice. Thus the present study aimed to assess the influence of exercise on pulmonary function tests in young healthy individuals.

MATERIALS AND METHOD

Present study was conducted at Department of Physiology, Index Medical college Hospital and Research Centre, Indore. A total of 102 students comprising of 51 males and 51 females in the age group of 17-22 years were enlist for present cross sectional study. Simple random sampling was used for study participants' recruitment studying at the institution. Students with History of current respiratory infections, allergies, H/o smoking, H/o bronchial asthma etc. were excluded from the study. After obtaining permission from the Institutional ethical committee, the procedure and purpose of the study were clearly stated to all the study participants. Informed consent was obtained from them. A thorough review of their medical history was done, followed by general and systemic examination.

The participants were trained to wear light clothing during their study visits. During anthropometric measurements, the participants were instructed to stand erect with abdomen relaxed, arms at their sides and feet together. Weight (in kilograms) and Height (in centimeters) were measured. Body Mass Index (BMI) was calculated as the ratio of weight and square of Height in meters, using Quetelet Index.

The study participants were divided into four subgroups based on their body mass index

(BMI) in both the genders as:

Group 1 – BMI < 18.5 (Underweight)

Group 2– BMI – 18.5 – 24.9 (Normal)

Group 3– BMI – 25.0 – 29.9 (Overweight)

Group 4 – BMI ≥ 30 (Obese)

Computerised spirometer "Superspiro" was used to measure the pulmonary function tests. The following variables were deliberate – Vital capacity (VC), Forced vital capacity (FVC), and Peak expiratory flow (PEF) at rest. The subjects were asked to make at least three acceptable exercises and the best of the three trials was chosen for reporting.

Exercise testing was done in a computerized bicycle ergometer, with electronic gear shift of 28 gears as well as an intensity ranging from 25 – 800 watts. Each subject was permitted to take rest for 10 minutes, before starting the exercise. Each subject was allowed toundergo incremental exercise, for first 5 minutes in the bicycle ergometer, by increasing the resistance to pedaling (from 25 watts to 50 watts). Then the subject continued cycling at that fixed power, for a period of ten minutes. At the end of exercise, the subject was asked to relax and the pulmonary function parameters were another time measured using the computerized spirometer, within the first 2 minutes after the end of exercise. The results obtained were tabulated and analyzed.

Statistical analysis:

The data was coded and entered into Microsoft Excel spreadsheet. Analysis was done using SPSS version 15 (SPSS Inc. Chicago, IL, USA) Windows software program. The variables were assessed for normality using the Kolmogorov-Smirnov test. Descriptive statistics were calculated. Means of both groups were compared by independent student t-test. **L**evel of significance was set at p=0.05. One way analysis of variance was used for the comparison of the respiratory parameters within various groups of BMI in both the genders at rest.

RESULTS

A total of 102 students were recruited for this cross sectional study, comprising of 51 males and 51 females. Table 1 shows the baseline characte respiratory parameters of the study participants at rest. every respiratory parameters other than FEV1% were significantly higher in males compared to the females ($p < 0.001$). Respiratory parameters before and after acute exercise within the groups in male revealed that VC, FEV1, FVC and PEF were significantly lower in groups 1(underweight), 3 (overweight) and 4 (obese) compared to group 2 (normal)($p< 0.001$). No significant changes were observed in the respiratory parameters after exercise in all the four groups.

Respiratory parameters before and after acute exercise within the groups in female revealed that revealed that VC, FEV1, FVC and PEF were

significantly lower in groups 1(underweight), 3 (overweight) and 4 (obese) compared to group 2 (normal) ($p< 0.001$). However intragroup comparison of the pre and post exercise values revealed that FVC was significantly reduced in 3(overweight) group after exercise and VC was reduced in 4 (obese) group after exercise ($p < 0.01$).

Table 1: Baseline respiratory parameters of the study participants

Gender	Numbers	VC (Mean±SD)	BMI (Mean±SD)	FEV_1 (Mean±SD)	PEF (Mean±SD)
Male	51	3.34±0.74*	24.12±2.66	3.56±0.70*	6.34±1.43*
Female	51	3.05±0.32	23.84±2.69	3.01±0.57	6.01±1.23

BMI – Body mass index, VC – Vital capacity, FEV1 – Forced expiratory volume in first second

* indicates statistically significance at $p\leq0.05$

DISCUSSION

The present cross sectional study designed to study the influence of exercise on pulmonary function tests in young healthy individuals. The baseline values of the respiratory parameters between the genders showed a significant statistical difference, with males showing the higher values. These results are in accordance with other studies and could be explained with the greater muscular strength in males.[5-7] A comparison of the respiratory parameters before work out between the various groups of males and females, revealed a statistically significant influence of body mass index on the pulmonary function. Individuals with a normal body mass index had a significantly higher values contrast to the underweight, overweight and the obese individuals. However there was no change in FEV1 %. These results are in agreement with the results of Saxena et al.[8] and Wannametheeet al.[9] Increased body fat percentage, mechanical limit to the movement of abdomen and thorax and increased airway resistance in overweight and obese individuals, could explain current results. Poor respiratory muscle strength could add to lower values of the respiratory parameters in the underweight individuals as suggested by Muralidhara DV.[10]

Considering the effect of acute exercise, overall no significant change was observed in the respiratory parameters after exercise in males and the underweight and normal females. These results are in accordance with the results of Chen Y et al.[11] However this was in contrast to the findings of Ikram MH, who stated that release of catecholamines during exercise, cause a noteworthy rise in FEV1 after exercise in both the sexes.[12]Lakshmi PVV studied the cardiopulmonary changes with exercise in adolescents and observed an increase in FEV1, but without any changes in FVC. It has also been reported that mild and moderate exercise does not create a significant alteration in the pulmonary function tests in young individuals.[13] In contrast, Sagher F in his study explored the bronchoconstrictor effect of exercise as a fall in PEF, in healthy Libyan children. The bronchospasm in healthy children was accredited to the low temperature and dry stimulus to the airways during exercise.[14] The disparity in the results could be due to the differences in the mode and strength of exercise.

In females, a significant reduction was observed in FVC and VC after acute exercise in individuals with a superior body mass index. However Faria AG et al reported that body fat distribution persuade the resting values more than the changes after exercise.[15]A decrease in lung volumes in persons with higher body mass index appears to increase respiratory resistance, causative to exercise induced reduction in FVC in these subjects as observed by Navarro B et al[16] and Kaplan et al.[17] This reduction being significant only in the females could be explained by the fact that they have slighter respiratory muscle strength and therefore prone for a larger decline of lung volumes and flow rates, which matched with the findings of Canoy D et al.[18]

CONCLUSION

The findings of the present study indicates that pulmonary function tests are not distorted with acute exercise in normal individuals, though exercise induced changes may be considerably influenced by higher body mass index and respiratory muscle strength. This demonstrates that enormous ventilatory reserve in an

individual with regular lungs could be compromised due to many factors like obesity. Although the beneficial effects of constant physical training has demonstrated effects, more research required to be done to discover the beneficial effects of acute exercise and its efficiency as a selection tool in assessing the functional capacity of the lungs.

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REFERENCES

1. Ganong WF. Respiratory adjustments in health and disease. In: Ganong WF (Ed.), Review of medical physiology, 22nd ed., United states of America: McGrawHill, 2005: 681.
2. Custovic A, Arifhodzic M, Robinson A, Woodcock A. Exercise testing revisited. The response to exercise in normal and atopic children. Chest. 1994; 105(4):1127-32.
3. Aaron EA, Seow KC, Johnson BD, Dempsey JA. Oxygen cost of exercise hyperpnea: implications for performance. J Appl physiol. 1992; 72(5): 1818-25.
4. Ofir D, Laveneziana P, Webb KA, Donnell DE. Ventilatory and perceptual responses to cycle exercise in obese women. J Appl Physiol.2007; 102: 2217-2226.
5. Harik-Khan RI, Wise RA, Fleg JL. The effect of gender on the relationship between body fat distribution and lung function. J Clin Epidemiol. 2001; 54:399–406.
6. Lazarus R, Gore CJ, Booth M, Owen N. Effects of body composition and fat distribution on ventilatory function in adults. Am J Clin Nutr. 1998;68:35–41.
7. Bhavsar SD,Abhange RS, Afroz S. A comparative study on effect of acute exercise onpulmonary function tests of first year MBBS students. International Journal of Recent Trends in Science and Technology .2015;13(3): 484-489.
8. Saxena Y, Saxena V, Divedi J, Sharma RK. Evaluation of dynamic function tests in normal obese individuals. Indian J Physiol Pharmacol. 2008; 52(4): 375-382.
9. Wannamethee SG, Shaper AG, Whincup PH. Body fat distribution, body composition, and respiratory function in elderly men. Am J Clin Nutr. 2005; 82: 996–1003.
10. Muralidhara DV, Ramesh bhatt M. Some aspects of pulmonary functions in the underweight and overweight human subjects. TJPS. 2007; 20: 3-7.
11. Chen WY. Reactivity of normal airways to short term exercise. Europ J Appl Physiol.1978;38:277-280.
12. Ikram MH. Evaluation of pre and post exercise pulmonary function tests in medical students. Professional Med J. 1998; 5(1):77.
13. Lakshmi PVV, Reddy KS. A study on cardiopulmonary changes with exercise in adolescent boys and girls. J of Evolution of Med and Dent Sci. 2015;4(13);2164 -71.
14. Sagher F, Hweta A. Bronchoconstrictor effect of exercise in healthy Libyan chidren in Tripoli. Eastern Mediterranean Health journal .1999; 5 (2): 350-53.
15. Faria AG, Ribeiro MA, Marson FA, Schivinski CI, Severino SD, Ribeiro JD, et al. Effect of exercise test on pulmonary function of obese adolescents. J Pediatr (Rio J). 2014;90: 242-9.
16. Navarro B, Rivero M, Eslava A, Reyna G, Monge J. Exercise induced bronchospasm in asthmatic and non-asthmatic obese children. Allergol Immunopathol (Madr). 2000;28(1):1-4.
17. Kaplan TA, Montana E. Exercise-induced bronchospasm in nonasthmatic obese children. Clinical pediatrics. 1993, 32(4):220-5.
18. Canoy D, Luben R, Welch A, et al. Abdominal obesity and respiratory function in men and women in the EPIC-Norfolk Study, United Kingdom. Am J Epidemiol. 2004;159:1140–9.

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Relationship between Lung Function Abnormalities and Duration of Type 2 Diabetes

Swati Sinha[1], Anju Kumari[1], Pooja Sakshi[1], Anita Kumari[1], Ashok Sharan[2]

[1]Tutor, Department of Physiology, [2]Professor & HOD Physiology, Indira Gandhi Institute of Medical Sciences, Patna

ABSTRACT

Background: Diabetes mellitus (DM) is a leading health care problem with long term complications. Studies have shown compromised lung function in type-2 DM but there is still lack of clarity on its relation with disease duration. This study was carried out to determine effect of duration of type-2 DM on pulmonary function.

Objectives: We aimed to investigate if any relation exists between deterioration of lung function and duration of disease.

Material and method: A cross sectional study was carried out on 80 diagnosed type-2 DM patients from the rural population of Sullia who attended KVG medical college OPD, they were non smokers and did not suffer from any cardiopulmonary disease. They were divided in two groups based on disease duration, Group-A had 38 subjects with diabetes for 2-4years and Group-B consisted of 42 subjects with 8-10years of disease. PFT was performed using a digital spirometer (UNI-EM Spiromin). Statistical analysis was done using unpaired t test.

Results: FVC (in L) in Group-A and B was 4±0.67 and 3.06±0.39 respectively with $p<0.0001$. FEV_1 (in L) in Group-A and B was 3.6±0.63 and 2.86±0.34 respectively with $p<0.0001$. FEV1/FVC ratio (in %) in Group-A and B was 90.26±5.08 and 93.74±4.2 respectively with $p=0.03$. So, FVC and FEV_1 showed extremely significant decrease, FEV1/FVC ratio showed significant increase and PEFR on the other hand showed no significant change with increase in duration of diabetes.

Conclusion: PFT findings in this study indicate that, as duration of type-2 DM increases, restrictive lung disease becomes more prominent.

Keyword: *lung function, type 2 diabetes mellitus, spirometry.*

INTRODUCTION

Diabetes mellitus (DM) is a leading health care problem with long term complications. Type 2 diabetes results from the body's ineffective use of insulin.[1] Type 2 diabetes comprises the majority of people with diabetes around the world [1], and is largely the result of excess body weight and physical inactivity. It is associated with an ongoing malfunction of numerous organs, and its complications are mainly a consequence of macrovascular and microvascular damage.

Corresponding author:
Dr. Swati Sinha
Tutor (Physiology), IGIMS, Patna- 14, Bihar
Dr.swatisinha123@gmail.com, Mob.: 9661548621

Several respiratory alterations have been reported in association with diabetes mellitus, mainly insulin-dependent diabetes including elastic recoil[2,3] reduced lung volumes,[2] diminished respiratory muscle performance,[4] decrease in pulmonary diffusion capacity for carbon monoxide.[5-8] The association of reduced lung function and diabetes has been described for many years.[9] Some studies have shown that pulmonary functions are reduced in type 2 DM and duration of diabetes has more influence on pulmonary functions than glycemic control.[10]

If diabetes is detected early and adequate steps are taken, it may be possible to significantly delay the occurrence of complications and there after their progression. A lot of research work is being carried out on the after effects of Diabetes Mellitus on pulmonary

parameters worldwide. Several studies have shown reduced pulmonary function in DM but there is paucity of literature on its relation with disease duration. This study was carried out to determine effect of duration of type-2 DM on pulmonary function. Therefore this study was undertaken to find out the correlation between duration of type 2 DM and Pulmonary function test parameters.

AIMS & OBJECTIVE

To investigate if any relation exists between deterioration of lung function and duration of disease.

MATERIAL & METHOD

A cross sectional study was carried out on 80 patients diagnosed with type-2 DM of age 40-60 years, from the rural population of Sullia who attended the KVG medical college out patient department. Written and informed consent was taken from the study subjects. Ethical clearance was taken from the institute's ethics committee.

Inclusion criteria

Type 2 DM patients of age 40 - 60 years, not involving any exclusion criteria.

Exclusion criteria

1. Patients not willing to participate in the study.
2. Age above 60 years.
3. Patients of known chronic obstructive or restrictive lung disorders.
4. Subjects with history of smoking/ chronic drug intake.
5. Subjects with gross abnormalities of the vertebral column or thoracic cage, neuromuscular disease, malignancy, cardiopulmonary disease or a history of major abdominal or chest surgery.

The study subjects were divided in two groups based on duration of type-2 diabetes mellitus. Group-A had 38 subjects with diabetes for 2-4 years and Group-B consisted of 42 subjects with 8-10 years of disease. A detailed history was obtained and recorded from the control and the study group in the prescribed proforma. Height (in cms) of the subjects was measured in standing and erect posture. Weight (in kgs) was recorded using standard weighing machine in standing posture.

The pulmonary function tests, forced vital capacity test (FVC) and Percentage forced expiratory volume in first second (FEV1) and peak expiratory flow (PEF) were carried out by using the computerized Spirometer-(**UNI-EM** Spiromin) using the standard laboratory methods. A disposable mouth piece was inserted into the sensor housing of the Spiromin ensuring that the mouthpiece was inserted at least 0.5 cm into the housing and was firmly held. The mouthpiece was inserted well into the mouth of the subject (beyond the teeth) and the mouth must be closed around the mouthpiece to ensure that air cannot escape from the sides of the mouth. A nose clip was fitted to the nose of the subject to ensure that no air can escape through the nostrils. The subject was asked to hold the spiromin either in two hands (one at each end) or as an alternative in one hand.

The relevant data of the subject (age, sex, height in cm and weight in kg) were fed into the Spirometer. The test module was activated and the subject was given proper instructions about the procedure to be performed. All the pulmonary function tests were done on the subjects in standing position. During the test the subject was adequately encouraged to perform his/her optimum level.

FVC test

The subject was asked to breathe at rest for a few moments, and then inspire slowly as much air as possible and then make a complete expiration as fast as possible, to complete the cycle by inspiring again as quickly as possible.

Parameters recorded during FVC test

1. FVC (forced vital capacity)
2. FEV1 (forced expiratory volume at the end of first second)
3. PEF (peak expiratory flow)
4. FEV1/FVC ratio

Statistical analysis was done using unpaired t test.

OBSERVATION & RESULTS

The data which has been presented in Table-1 shows that there were 38 type 2 diabetes patients who had the

disease for 2-4 years made up 47.5% of the study population belonged to Group A. Group B comprising of 52.5% of the study population were the ones who had type 2 DM for 8-10 years.

Table-1: Division of diabetic population based on duration of disease

Duration	Number	%
Group A	38	47.5
Group B	42	52.5

Table 2 and Table 3 show that no significant difference ($p > 0.05$) is there between the physical characteristics of group A and group B subjects on statistical analyses of age, sex, height, weight and BMI.

Table-2: Age and gender distribution of study subjects

Groups	N	Age (Yrs)	Sex	
			Male	Female
Group A	38	52.60 ± 3.1	20	18
Group B	42	52.52 ± 3.2	22	20
Significance	p	> 0.05, NS	>0.05, NS	

All values are expressed as Mean ± SD Analysis of all parameters done by Independent T- test, HS-Highly significant, S- Significant, NS-Not significant

Table-3: Physical characteristics of study subjects

Groups	Height (meter)	Weight (Kg)	BMI (kg/m^2)
	Mean ± SD	Mean ± SD	Mean± SD
Group A	1.73 ± 0.05	66.76 ± 11.11	22.32 ± 3.33
Group B	1.71 ± 0.07	66.12 ± 11.71	22.38 ± 3.21
Significance p	> 0.05, NS	> 0.05, NS	> 0.05, NS

Analysis of parameters done by Independent T- test HS-Highly significant, S- Significant, NS-Not significant

Table 4: Comparison of pulmonary function test between the groups

	Group A	Group B	Significance p
FVC (in l)	4.00 ± 0.67	3.06 ± 0.39	<0.0001, HS
FEV_1 (in l)	3.60 ± 0.63	2.86 ± 0.34	< 0.0001, HS
FEV_1/FVC (%)	90.26 ± 5.1	93.74 ± 4.2	< 0.05, S
PEFR (l/sec)	5.00 ± 2.2	5.2 ± 1.7	> 0.05, NS

All values are expressed as Mean ± SD, Analysis of all parameters done by Independent T- test , HS-Highly significant, S- significant, NS-Not significant

It is evident from Table-4 that in group B subjects there was a highly significant decrease in the FVC and FEV_1 as compared to group A individuals. FEV1/FVC showed significant increase and PEFR showed no significant change in group B as compared to group A.

DISCUSSION

In this study, there was no significant difference in anthropometric parameters between group A and group B. These being the major determinants of spirometric values, the main determinants of ventilatory differences are likely to be the duration of diabetes.

In this study we found that statistically there was a highly significant decrease in the level of FVC and FEV1 in diabetics with 8-10 yrs of diabetes compared to those with 2-4 yrs of the disease. FEV1/FVC showed significant increase and PEFR showed no significant change with increased duration of disease (Table 1).

Similar findings were reported in their study by Meo SA et al.[11] & Anand R et al. who concluded that lung functions were negatively correlated with glycemic status and duration of diabetes (r = –0.390, & –0.342).[12]

In a study by Robert E. Walter[13] with duration of the disease, the ratio was increased by 1.5% in diabetics which was stastically significant. Similar to our findings.

Similarly, Meo et al.[14] in their study showed a significant reduction in FVC for patients with diabetes of duration of 5–12 years compared with their matched controls and patients with diabetes with duration of disease more than 12 years showed a significant reduction in FVC, FEV1, and FEF25–75% relative to their matched controls.

Rosenecker et al.[15] reported that in patients with diabetes, FVC and FEV1 declined significantly over the 5-year study period. Patients without diabetes did not experience a significant decline in these measurements during the study period.

PEFR was seen to be reduced but not significantly in our study. Similarly, in a study by Kanya KDH et al.,[16] no change in PEFR values in diabetics was observed as the duration of diabetes increased indicative for restrictive pattern.

CONCLUSION

Lung volumes including FVC, FEV1, PEFR, and FEV1/FVC using digital spirometer were recorded to test the pulmonary functions. Significantly higher lung volumes were seen in the group with shorter (2-4yrs) duration of diabetes as compared to longer (8-10yrs) duration of diabetes group. Hence, significant increase in restrictive pattern of pulmonary function was seen with increased duration of diabetes.

Ethical Clearance- Taken

Source of Funding- Self

Conflict of Interest - Nil

REFERENCES

1. Definition, diagnosis and classification of diabetes mellitus and its complications. Part 1: Diagnosis and classification of diabetes mellitus. World Health Organization, Geneva, 1999. Report Number: WHO/NCD/NCS/99.2.
2. Sandler M, Bunn AE, Stewart RI. Cross-section study of pulmonary function in patients with insulin dependent diabetes mellitus. Am Rev Respir Dis. 1987;135:223-229.
3. Schulyler.M, Niewoehner D., Inkley S, Kohn R: Abnormal lung elasticity in juvenile diabetes mellitus. Am Rev Resp Dis. 1976;113:37-41.
4. Wenke T, Formanek D, Auinger M, et al: Inspiratory muscle performance and pulmonary function changes in IDDM. Am Rev Respir Dis. 1991;143:97-100.
5. Cooper BG, Taylor R, Albert GMM, Lung function in patients with diabetes mellitus. Respir Med. 1990;84:235-239.
6. Maccioni FJ, Colebatch HJH: Lung volumes and distensibility in insulin dependent diabetes mellitus. Am Rev Respir Dis. 1991;143:1253-1256.
7. Weir DC, Jennings PE, Hendy MS, Transfer factor for carbon monoxide in patients with diabetic with and without microangiopathy. Thorax. 1988;43:725-726.
8. Strojek K, Ziora d, Srocynski JW: Pulmonary complications of Type 1 diabetic patients. Diabetolgia. 1992;35:1173-1176.
9. Goldman MD: Lung dysfunction in diabetes. Diabetes Care. 2003; 26:1915–1918.
10. Davis Timothy ME, Mathew Knuimann, Peter Kendall, Reduced pulmonary function and its association in type-2 Diabetes. Diabetes Research and Clinical Practice. 2000;50:152-159.

11. Meo SA, Al-Drees AM, Arif M, Al-Rubean K. Lung function in type 2 Saudi diabetic patients. Saudi Med J. 2006 Mar;27(3):338-43.

12. Anand R. Dharwadkar, Asha A. Dharwadkar, Gouher B, Shrilaxmi B. Reduction In Lung Functions In Type-2 Diabetes In Indian Population : Correlation With Glycemic Status. Indian J Physiol Pharmacol 2011; 55(2):170–175.

13. Walter R, Beiser A, Rachel J et.al., Association between glycemic state and lung function. The Framingham Heart Study. American Journal of Respiratory and Critical Care Medicine, 2003 ; (167) : 911-916.

14. Meo SA, Al-Drees AM, Ahmed J, Shah SF, Al-Regaiey K, Al-Rubean K et al. Effect of Duration of Disease on Ventilatory Function in an Ethnic Saudi Group of Diabetic Patients. J Diabetes Sci Technol. 2007 Sep;1(5):711-717.

15. Rosenecker J, Hofler R, Steinkamp G, Eichler I, Smaczny C, Ballmann M, et al. Diabetes mellitus in patients with cystic fibrosis: the impact of diabetes mellitus on pulmonary function and clinical outcome. Eur J Med Res 2001; 27, 6 (8): 345-50.

16. Kanya KDH, Nataraj SM, Devaraj HS. Correlation of duration of diabetes and pulmonary function tests in type 2 diabetes mellitus patients. Int J Biol Med Res. 2011; 2(4): 1168 -1170.

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Thyroid Hormone Levels in Patients with Polycystic Ovarian Syndrome

Santosh Palekar[1], Umesh Balgi[2], Sandhya Metta[1], Anvar Batakurki[3]

[1]Assistant Professor, [2]Associate Professor, Department of Physiology, Kamineni Institute of Medical Sciences, Nalgonda, [3]Gynaecologist, Government Hospital, Bagalkot

ABSTRACT

Context: Polycystic ovarian syndrome, commonly known as PCOS, is an endocrine disorder seen in women of reproductive age. Polycystic ovarian syndrome is estimated to effect 4-12% of women throughout the world and is most commonly characterized by hyperandrogenism and insulin resistance each of which affect 60% to 80% of PCOS patients and 50-80% of PCOS women respectively. **Aims**:To evaluate the levels of thyroid hormones in women with PCOS. **Method** :80 female patients with PCOS based on Rotterdam criteria,80 volunteer females included as controls , serum levels of TSH, T3 and T4 were tested in two groups. **Results** Significant increase in TSH along with a significant decrease in T3 and T4 in PCOS females matched against controls ($p< 0.05$).

Conclusion PCOS is linked to hypothyroidism and more studies should be carried to reveal the precise relationship.

Keywords: *Thyroid hormones, polycystic ovarian syndrome, T3, T4, TSH*

INTRODUCTION

Polycystic ovarian syndrome (PCOS) [the major endocrinopathy of females in the reproductive age] and the thyroid disorders are the two most common endocrine disorders in the general population and though these both disorders differ in etiopathogenesis , these two entities have common features[2]. Polycystic ovarian syndrome (PCOS) also called as Stein- Leventhal syndrome causes the signs and symptoms due to elevated male hormone in women[10]. These include irregular or no menstrual periods, excess body and facial hair, acne, pelvic pain, patches of thick, darker and valvetty skin[10]. During the reproductive years, PCOS is associated with important reproductive morbidity including infertility, irregular uterine bleeding and increased pregnancy loss[10]. Associated with increased cardiovascular and metabolic risk factors like type 2 diabetes, obesity, obstructive sleep apnoea, mood disorders, heart disease and endometrial cancer[3]. The first recognition of an association between glucose intolerance and hyperandrogenism (HA) was the famous report of the bearded diabetic woman by Archard and Thiers in 1921[4].The level of thyrotropin releasing hormone (TRH) in primary hypothyroidism is raised which leads to rise in prolactin and thyroid stimulating hormone (TSH)[2]. The change in the ratio of follicle stimulating hormone (FSH) and Leutinizing hormone(LH) and increased DHEA from the adrenal gland, all these contributes towards polycystic morphology by inhibing ovulation[2]. Increased TSH also has its effects on FSH receptors. Increased TSH also contributes in the deposition of collagen in the ovaries[2]. According to the study conducted by Muderris *et al*, twenty six females on treatment for primary hypothyroidism with mean TSH 57.1mcg/dl underwent evaluation of ovarian volumes before and after replacement with thyroxine[2]. Out of twenty six, ten of the hypothyroid females had polycystic appearing ovaries on ultrasound sonography test[2]. All the women with primary hypothyroidism had significantly higher ovarian volumes than controls[2]. Normalization of ovarian volumes in all patients with or without polycystic appearing ovaries , after replacement with thyroxine[2]. Consistent regression of the ovarian cysts after thyroid hormone replacement therapy supports a causal relationship between hypothyroidism and ovarian stimulation[5]. Speculation regarding the autoimmune thyroiditis, which predisposes subjects to develop characteristics suggestive of PCOS or whether PCOS is the forerunner of autoimmune thyroiditis is not yet cleared[2]. The aim of the present study is to evaluate

thyroid hormones level and their role in women with polycystic ovarian syndrome.

MATERIALS AND METHOD

The study was conducted on the subjects attending the out patient clinic in M.R.Medical college & Teaching Hospital , Gulbarga, Karnataka between July 2012 to Feburary 2013. The study included 80 female patients suffering from PCOS. Diagnosis of PCOS is made according to the Rotterdam European Society for Human Reproduction and Embryology/ American Society for Reproductive Medicine. The protocol was approved by the local ethics committee. All the patients gave a written consent.The Control group (n= 80) consisted of healthy subjects without any systemic disorder. Free T3, Free T4 and TSH concentration were measured by mini-VIDIS.

Inclusion criteria

- Female between 18 to 39 years of age
- Presented with clinical history of PCOS and Hypothyroidism.

Exclusion criteria

- Female below 18years and over the age of 39years were excluded from the study
- Diabetes Mellitus
- Hperprolactinemia
- Congenital adrenal hyperplasia
- Androgen secreting tumours
- Cushing syndrome
- Infection diseases
- Hypertension
- Medications including OC pills, antilipidemic drugs, insulin sensitizing drugs, within 3 months before enrolement.

STATISTICAL ANALYSIS

All data analysed using the Statistical Package for Social Sciences (SPSS) software computer program version 20.0.

Data expressed as mean ± Standard Deviation(SD) following analysis using independent t-test. A value of $p<0.05$ was considered significant.

RESULTS

Table 1: Serum level of TSH in women with PCOS were significantly elevated compared to healthy control group. Serum level of free T4 and free T3 were significantly decreased compared to healthy control group.

Parameters	Patients n=80	Control n =80	P-value
TSH	8.2 ± 8.0	1.6± 1.2	0.00*
Free T4	0.3 ± 0.2	1.0 ± 0.2	0.00*
Free T3	5.4 ± 1.8	9.2 ± 2.0	0.00*

Table shows mean ± SD and probability (p) *

*P – value < 0.05 is considered significant

DISCUSSION

The prevalence of subclinical thyroid dysfunction in reproductive years is about 4-6%[2].Various publications have reported increased incidence of thyroid disorders in females with PCOS[2].A higher prevalance (26.9% versus 8.3% of controls) of autoimmune thyroiditis (AIT) in PCOS has been reported in one study to date[7]. Sinha et al, compared 80 PCOS females with 80 controls and found significant higher prevalance of goiter in PCOS as compared to controls[2]. Janssen et al, documented a high mean level of TSH in PCOS patients[1]. Ghosh et al, analysed the part of hypothyroids in the causation of PCOS and proposed that hypothyroidism resulted in reducing sex hormone binding globulin level and increament of testosterone level[1]. The most obvious connection between PCOS and hypothyroidism is increased BMI and insulin resistance common to both conditions[2]. Experimental studies have shown that in normal conditions, thyroid hormones may influence the expression or activation of uncoupling protein, b-adrenergic receptor, and peroxisome proliferator-activated receptor-gamma, all of which are involved in regulating insulin sensitivity (Frederiksen et al., 2002; Dallongeville et al., 2003; Wang et al., 2004)[8]. The association of IR and hyperinsulinemia of PCOS with elevation of various cytokines such as IL-4, IL-6, TNF-a, and their alteration after treatment with insulin sensitizers is well established[9]. Obesity is

associated with increase in proinflammatory markers and increase in insulin resistance[2]. This leads to decreased deiodinase-2 activity at pituitary level resulting in relative T3 deficiency and increase in TSH levels[2]. High insulin levels cause the pituitary gland to make too much luteinzing hormone (LH) and too much LH causes overproduction of testosterone, these hindering ovulation[10]. Kachuei et al, found that women with PCOS had a 65% increase in thyroid peroxidase antibodies and a 26.6% increase in the incidence of goiter, when compared to age matched subjects[10]. It has been proposed that women with Subclinical hypothyroidism and ovulatory dysfunction, infertility, or desire to become pregnant should be treated[6].Our study revealed a significant increase in mean ± SD level of serum TSH level in PCOS patients in contrast to controls[1]. In this study there was a significant decrease in mean ± SD level of serum T4 and T3 in PCOS women compared with those in control group.

CONCLUSION

The study suggests that hypothyroidism is related to PCOS and this will lead to autoimmune disease. Thyroid health has a profound impact on the pathology of PCOS affecting all aspects of disorder[10]. Correcting subclinical hypothyroidism is the key in improving overall hormonal and metabolic health[10]. Doctors should look at the specific relationships that exist in each and every patient to create a plan that helps to restore optimal metabolic and hormonal health[10].

Source of Financial Support – Self

Conflict of Interest – None

REFERENCES

1. Osman AA et al., Evaluation of Thyroid Hormones Level in Sudanese Women with Polycystic Ovarian Syndrome, Sch. J. App. Med. Sci., March 2016; 4(3A):664-668
2. Singla R, Gupta Y, Khemani M, Aggarwal S. Thyroid disorders and polycystic ovary syndrome: An emerging relationship. Indian J Endocrinol Metab. 2015;19:25–9. [PMC free article] [PubMed]
3. Sinha U, Sinharay K, Saha S, Longkumer TA, Baul SN, Pal SK. Thyroid disorders in polycystic ovarian syndrome subjects: A tertiary hospital based cross-sectional study from Eastern India. Indian J Endocrinol Metab. 2013;17:304–9. [PMC free article] [PubMed]
4. Ramanand SJ, Ghongane BB, Ramanand JB, Patwardhan MH, Ghanghas RR, Jain SS. Clinical characteristics of polycystic ovary syndrome in Indian women. Indian J Endocrinol Metab. 2013;17: 138–45.[PMC free article] [PubMed]
5. Muderris II, Boztosun A, Oner G, Bayram F. Effect of thyroid hormone replacement therapy on ovarian volume and androgen hormones in patients with untreated primary hypothyroidism. Ann Saudi Med.2011;31:145–51. [PMC free article] [PubMed]
6. Benetti-Pinto CL, Berini Piccolo VR, Garmes HM, Teatin Juliato CR. Subclinical hypothyroidism in young women with polycystic ovary syndrome: An analysis of clinical, hormonal, and metabolic parameters.Fertil Steril. 2013;99:588–92. [PubMed]
7. Garelli S, Masiero S, Plebani M, Chen S, Furmaniak J, Armanini D, et al. High prevalence of chronic thyroiditis in patients with polycystic ovary syndrome. Eur J Obstet Gynecol Reprod Biol. 2013;169:248–51.[PubMed]
8. Mueller A, Schöfl C, Dittrich R, Cupisti S, Oppelt PG, Schild RL, et al. Thyroid-stimulating hormone is associated with insulin resistance independently of body mass index and age in women with polycystic ovary syndrome. Hum Reprod. 2009;24: 2924–30. [PubMed]
9. Ganie MA, Marwaha RK, Aggarwal R, Singh S. High prevalence of polycystic ovary syndrome characteristics in girls with euthyroid chronic lymphocytic thyroiditis: A case-control study. Eur J Endocrinol.2010;162:1117–22. [PubMed]
10. https://en.wikipedia.org/wiki/Polycystic_ovary_syndrome
11. http://www.hashimotosawareness.org/pcos-and-thyroid-health-2
12. http://www.runningwithpcos.com/pcos-information-and-facts.html

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Predominance of Multi Modality Preferences in both Males and Female I Year Medical Students, Using VARK Questionnaire

Sowmya Rajaram

Assistant Professor, Dept of Physiology, BMCRI

ABSTRACT

Background: The sensory modality which we use to assimilate and learn information may be visual (V), auditory (A), read-write (%) or Kinesthetic (K). Individuals who prefer one modality are said to be unimodal and those preferring two or more than two sensory modality are multimodal. Medical students are no exception to this. Males and females excel differently from each other as males have better spatial ability and females have better language ability. The aim of our study was to find out whether there were any differences in sensory modality preferences between male and female I year medical students.

Method: The VARK 7.8 questionnaire in paper pencil format was distributed to the students of I year MBBS. Students were informed that they should complete the form and fill up gender information which was entirely voluntary. The completed forms with gender information was collected randomly from 60 males and 60 females. The completed forms were processed and the learning style preferences based on VARK was determined.

Results: Multimodality was the most dominant preference with 66% of males and an equal percentage of females preferring two or more of the modalities. Chi-square test did not find any significant difference between learning modality preferences in Males and females.

Conclusion: There are no significant differences between males and females with respect to VARK learning style preferences.

Keywords: *VARK , Medical students, gender differences, multimodal, unimodal, Visual, auditory, kinesthetic*

BACKGROUND

Each of us assimilate information by using one or more of our sensory modalities. While some of us prefer visual (V) modality and hence learn best by seeing pictures and maps, some others may be auditory (A) and they would prefer hearing information and learn best by assimilating information through auditory modality. While some others prefer read write mode(R) and may assimilate best from reading books, a few others may prefer kinesthetic modality (K) and assimilate best by manipulating models or doing an experiment [1, 2]. Individuals could have single strong preference that is, they could have a unimodal preference or they could have multimodal preference where they learn best by assimilating information through more than one sensory modality. Medical students also have their own preferences in assimilating information. Just as we cannot feed a stork food in a flat plate, knowledge of student preferences is required for reasons of pedagogy.

Research has revealed that male and female brains are quite different. For example, boys have better spatial ability whereas girls have better language skills[3]. Furthermore, attention deficit hyperactivity disorder in more common in males whereas inattention is more common among girls[4]. I hypothesize that there are differences in sensory modality preferences between male and female medical students.

Corresponding author:
Dr Sowmya Rajaram
Assistant Professor, Dept of Physiology, BMCRI
Mobile no. 8050629315
Email id- rajaram.sowmya@gmail.com

SUBJECTS, MATERIALS AND METHODOLOGY

Subjects: I year medical students /freshers were included in the research project.

Design: comparative study design

Instrument: The VARK questionnaire 7.8 devised and improvised by Fleming was used in pencil paper format. The questionnaire has 16 questions. Each question presents a real life situation which could be solved in one of the 4 ways as the answers given to each question. Students can use one or more of the 4 sensory modality preferences to solve the real life situation. The students were instructed to complete the questionnaire in the next 10-15 minutes.

METHODOLOGY

The hard copy of the questionnaire was distributed to all the 210 students studying in I year MBBS. Students were informed that they should write their age and gender on the first page of the questionnaire and to return the completed VARK 7.8 questionnaire. Students were also instructed that offering gender information was entirely voluntary. 60 male and 60 female I year medical students whose VARK questionnaire was complete with respect to gender information were included in the study.

Statistical analysis: Data were entered in Microsoft excel and was represented by pie charts. Comparison of learning preference in two groups male and female genders was compared using chi square test. Significance was at $P<0.05$

The following chart shows selected few questions provided in the VARK questionnaire 7.8

Choose the answer which best explains your preference and circle the letter(s) next to it. **Please circle more than one** if a single answer does not match your perception.

Leave blank any question that does not apply.

1. You are helping someone who wants to go to the airport, the center of town or railway station. You would:

a. go with her.

b. tell her the directions.

c. write down the directions.

d. draw, or show her a map, or give her a map.

2. You are planning a vacation for a group. You want some feedback from them about the plan. You would:

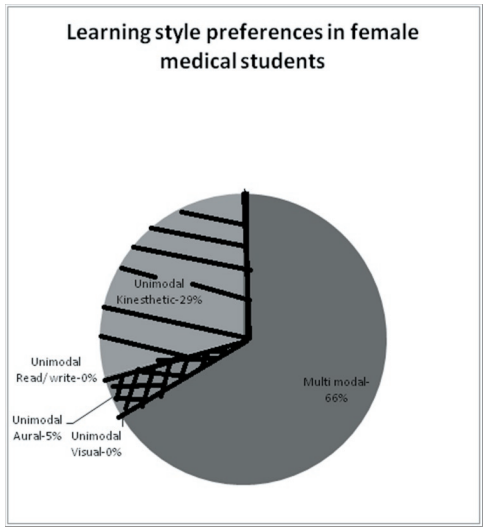
a. describe some of the highlights they will experience.

b. use a map to show them the places.

c. give them a copy of the printed itinerary.

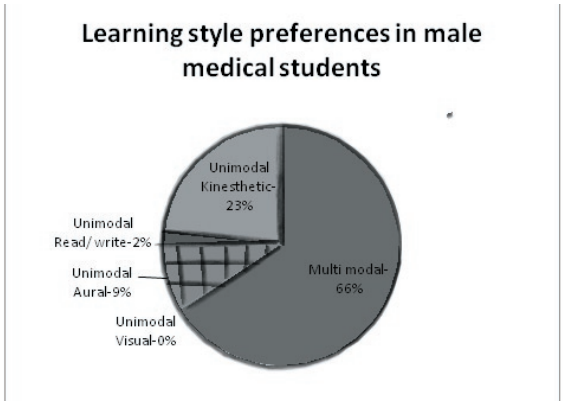
d. phone, text or email them.

RESULTS



Graph 1-

Graph 1 shows percentages of females with multimodal preferences, unimodal visual, unimodal auditory, unimodal read write and unimodal kinesthetic references

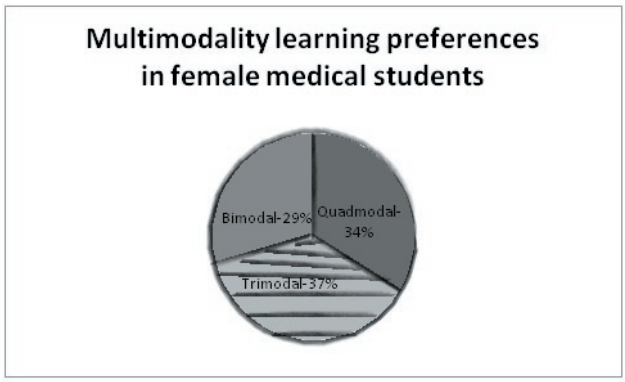


Graph 2

Graph 2-Shows percentages of males with multimodal preferences, unimodal visual, unimodal auditory, unimodal read-write and unimodal kinesthetic preferences

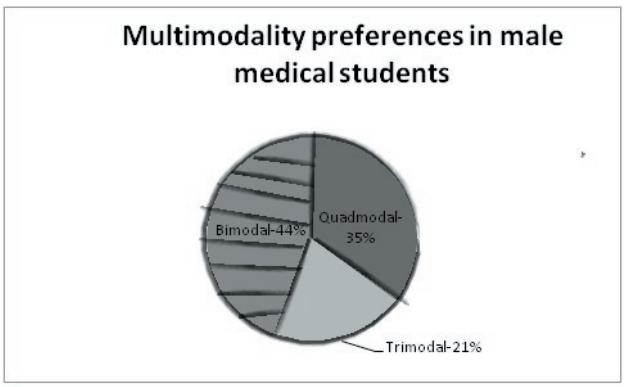
Contingency Table 1:

	MALES	FEMALES	P
Unimodal visual	0	0	Chi-square -2.28 P=0.699(Not significant)
Unimodal Aural	6	3	
Unimodal read write	1	0	
Unimodal kinesthetic	15	18	
Multimodal	43	41	



Graph 3

Graph 3 shows how females with multimodality preferences could be further subdivided into those with bimodal, trimodal and quad modal preferences.

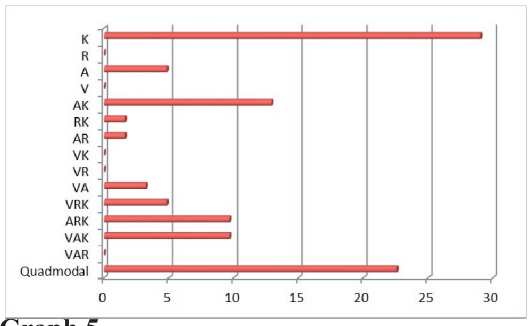


Graph 4

Graph4 shows Subdivisions of males with multimodality preferences into bimodal, Trimodal and quadmodal preferences.

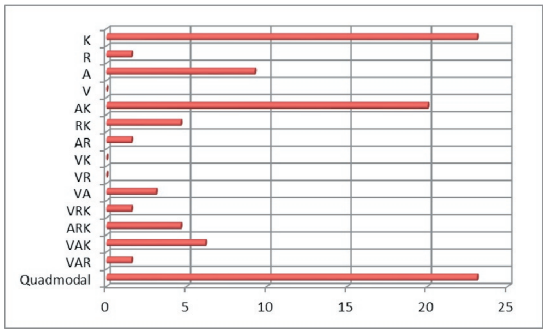
Contingency table 2

	Males	**Females**	**P**
Bimodal	15	14	Chi-square-3.07 P=0.22(Not significant)
Trimodal	9	15	
Quadmodal	19	12	



Graph 5

Graph 5 shows all the subdivisions of learning modality preferences with the horizontal bars representing percentages of females in each subdivision of learning modality preferences.



Graph 6

Graph 6 shows all the subdivisions of learning modality preferences with the horizontal bars representing percentages of males in each subdivision of learning modality preferences

Graph 1 shows sensory modality preferences in I year female medical students.66% of female students had multimodal preference. The rest had unimodal preferences. Among female students, 29% of them were unimodal kinesthetic while 5% had unimodal auditory preferences. Unimodal with visual and unimodal with read write were nil.

Graph 2 shows learning preferences in male medical students. 66% of the males had multimodal preferences.

Among male students, 23% had unimodal kinesthetic preferences. Unimodal auditory preference was found in 9% of males, 2% had unimodal read write preferences and none had unimodal visual preferences.

Table 1 shows the contingency table as observed in female students where number of students in each category of unimodal, and multimodal (depicted as a single group). Chi square was found to be insignificant

Graph 3 shows that, of the female students who had multimodal preferences, 29% had bimodal, 37%had Trimodal preferences and 34% had quad modal preferences.

Graph 4 shows that, of the male students who had multimodal preferences, 44% of the multimodal males had bimodal, 21% had Trimodal and 35% had quad modal preferences.

Table 2 shows the contingency table representing the subdivisions of the multimodal group. Chi-square test showed no significant difference between males and females.

Graph 5 and 6 show each modality and their combinations expressed as horizontal bars in female and male I year medical students respectively. While the X axis represents Percentages, the Y axis denotes various modalities.

Graph 5 shows that the largest group among females was the unimodal Kinesthetic at 29%. The second largest was quadmodal (VARK) at 23%. AK, ARK, VAK, VRK followed quadmodal in descending order of popularity. K is a component in all combinations of popular multimode preferences while R, VK, VR and VAR preferences were absent.

Graph 6 shows that among males, Unimodal kinesthetic and quadmodal were popular groups, with 23% of males opting for unimodal kinesthetic and 23% opting for quadmodal preferences.. The next popular preference was AK at 19.5 % and V, VK and VR were unpopular at 0%.

DISCUSSION

Multimodal learning preference was found to be popular among both female and male I year medical students. Sixty six percent of male and same percentage among females was found to be multimodal. Multi modal means a preference of two or more sensory modality for assimilating information. Slater et al found 56.1% males and 56.6% females were multimodal[5]. Dissanayake found no difference between men and female physiotherapy students. Only 26% had multimodal preferences in the Srilankan study on physiotherapy students[6]. Mitesh Sinha found that 46% females were found to be multimodal while 82% of male medical students were found to be multimodal[7]. Werheim et al found 87.5% of males and 45.8% of females to have multimodal learning preference[8]. We can observe from this that while Slater et al and Dissanayake et did not find any gender differences , Werheim et al and Mitesh Sinha et al found differences between the males and females with respect to sensory modality preferences.

Table 1 shows the contingency table where number of students in each category of unimodals, and multimodals (depicted as a single group). Chi square test showed that the two groups were not significantly different from each other[9].

Werheim et al conducted research on gender differences in learning style preferences in undergraduate physiology students. He found that while majority of males preferred multimodal, females preferred Unimodal learning preferences. In our study, 29% of the female students were unimodal kinesthetic while 5% had aural preference. Unimodal with visual and unimodal with read write were nil. 23% of the males were unimodal kinesthetic. Aural preference was found in 9% of males, Unimodal read write was at 2% and unimodal visual at 0%. According to research literature, Asiabar found 48.4% of the sample to be unimodal[10]. Among the unimodal, read write was 21.7%, aural was at 18.5% and 6.5% preferred kinesthetic and1.6% preferred visual in contrast to our study where most of the unimodal among females had kinesthetic preference at 29% among females. Mitesh Sinha et al found that among the unimodal which consisted of 54% of the female sample and 18% of the male sample, those with aural preference were the largest group among unimodal females and among the 18% of males who were unimodal, two largest groups were 8%with aural preference and 8% were kinesthetic[7].

In our study, in the multimodal category, multimodality consisted of bimodal 29%, Trimodal 37% and quad modal were at 34% in female medical students. 44% of the multimodal males were bimodal, 21% were Trimodal and 35% were quad modal. In the research study done by Slater et al, among the multimodal females, bimodal was 33.3%, Trimodal was at 26.7% and quad modal was at 40% among females. Among the

males, bi, tri and quad modal were at 13%, 30.4% and 56.5% respectively. This meant that a large percentage of men were quadmodal[5]. Whereas in our research study, the highest number of multimodal males were bimodal and among females it was shared to same extent by bimodal, Trimodal and quad modals.

Most classes are conducted in lecture format at our institute. The advantage of a traditional lecture format is that large volumes of information are passed to the student in a relatively short time compared to other methods. Replacement of this format with active learning strategies would help students learn better. This research project found no differences between the male and female students. However most of the students of either gender had multimodal preferences especially including the kinesthetic component. Designing lab experiments which apply basic principles of physiology or to understand certain concepts, would help students learn the topic better as they would use the kinesthetic modality to learn and assimilate new information.

Strength of the study: The VARK instrument 7.8 has been validated and is accurate as given in their website [11, 12].

Limitations of this study: This research study was a single centre study with students coming from different parts of India with multicultural background and varied socioeconomic status. One confounding factor could have been the varied socioeconomic status, which we could not control for.

CONCLUSION

There were no differences between male and female students with respect to learning style differences. Multimodal preferences were seen in both males and females. Of the unimodal preferences, most females had kinesthetic preference and same was found in males.

Conflict of Interest -Nil

Source of Funding- Self

Ethical Clearance – Obtained

REFERENCES

1. Fleming N. VARK | a guide to learning preferences [Internet]. Vark-learn.com. 2016 [cited 13 September 2016]. Available from: http://vark-learn.com/
2. Fleming ND, Mills C. Not another inventory, rather a catalyst for reflection. To Improve Acad, 1992, vol 11: 137–144
3. Exploring the Biological Contributions to Human Health: Does Sex Matter?. Journal of Women's Health & Gender-Based Medicine. 2001;10(5): 433-439.
4. NIMH » Attention Deficit Hyperactivity Disorder [Internet]. Nimh.nih.gov. 2013 [cited 14 September 2016]. Available from: http://www.nimh.nih.gov/health/topics/attention-deficit-hyperactivity-disorder-adhd/index.shtml#part_145446
5. Slater J, Lujan H, DiCarlo S. Does gender influence learning style preferences of first-year medical students? AJP: Advances in Physiology Education. 2007;31(4):336-342.
6. Dissanayake T. D. The Learning Styles and the Preferred Teaching Learning Strategies of First Year Physiotherapy Students. International Journal of Scientific and Research Publications, Volume 4, Issue 7, July 2014
7. Mitesh M. Sinha, Shobha S.Naik, J.M. Jadeja Gender Differences In Preferences Of Various Modalities Of Learning Styles Among Undergraduate Medical Students . International Journal of Basic and Applied Physiology Vol. 2 Issue 1 page 88-93
8. Wehrwein E, Lujan H, DiCarlo S. Gender differences in learning style preferences among undergraduate physiology students. AJP: Advances in Physiology Education. 2007;31(2):153-157.
9. VassarStats: Statistical Computation Web Site [Internet]. Vassarstats.net. 2016 [cited 15 September 2016]. Available from: http://vassarstats.net/
10. Sarabi-Asiabar A, Jafari M, Sadeghifar J, Tofighi S, Zaboli R, Peyman H et al. The Relationship Between Learning Style Preferences and Gender, Educational Major and Status in First Year Medical Students: A Survey Study From Iran. Iranian Red Crescent Medical Journal. 2014;17(1)
11. Leite, W. L., Svinicki, M. & Shi, Y. (2010). Attempted Validation of the Scores of the VARK: Learning Styles Inventory With Multitrait-Multimethod Confirmatory Factor Analysis Models. Educational and Psychological Measurement. 70, 323-339.
12. Hill Rhem J. Research & Statistics | VARK [Internet]. Vark-learn.com. 2016 [cited 15 September 2016]. Available from: http://vark-learn.com/introduction-to-vark/research-statistics/

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Study of Pattern Reversal Visual Evoked Potentials in Newly Diagnosed IDDM Patients in North India

Sanjeev Kumar Shrivastava[1] Brajesh Sharma[2], P.S. Tonpay[3] Asha Shrivastava[4] Rashmi dave[5]

[1]Assistant Professor, Department of Physiology, Gandhi Medical College, Bhopal, [2] Assistant Professor, Department of Physiology, Mahaveer institute of Medical Sciences, Bhopal, [3] Professor, Department of Physiology, Shri Aurobindo Institute of Medical Sciences, Indore, [4] Professor, Department of Physiology, Mahaveer Institute of Medical Sciences, Bhopal, [5]Assistant Professor, Department of Physiology, Gandhi Medical College, Bhopal

ABSTRACT

Objectives: The present study was carried out to assess visual evoked potentials abnormalities in visual function exist in newly-diagnosed IDDM patients.

Method: Pattern reversal visual evoked potentials were recorded on evoked potentials recorder in 18 newly-diagnosed IDDM patients (age: 21.3 ± 3.2 years; duration of disease: 6 ± 2.6 months), and in 18 age matched control subjects.

Results: In comparison with control subjects, newly diagnosed IDDM patients showed: VEP P100 latencies significantly delayed ($P<0.05$) but amplitudes were not changed significantly.

Conclusions: VEP measurement seems non-invasive and highly sensitive method for detecting early involvement and changes in optic pathways in diabetics.

Keywords: *Pattern Reversal Visual Evoked Potentials (PSVEP) , P100 latencies , P100 amplitude, IDDM.*

INTRODUCTION

Diabetes mellitus (DM) is a metabolic disorder which is characterised by hyperglycaemia resulting from defects in insulin secretion, insulin action or both. The long-term specific effects of DM include the development of retinopathy, nephropathy and neuropathy. Cardiac disease, peripheral arterial and cerebrovascular disease are also known to be linked with DM. Type 1 diabetes mellitus (IDDM) accounts for approximately 10% of all individuals with DM, and insulin therapy is the only available treatment. Type 2 diabetes mellitus (NIDDM) accounts for 90% of all individuals with DM. Diet, exercise, oral hypoglycaemic agents and occasionally exogenous insulin are used to manage NIDDM.

Corresponding author-
Dr. Sanjeev Kumar Shrivastava
Assistant Professor Department of Physiology,
Gandhi Medical College, Bhopal
Email- sanjeevshrivastava8@gmail.com

Diabetes mellitus is one of the most frequent endocrine disease, is characterized by metabolic abnormalities and long-term complications that affect various organs and systems.

Diabetes mellitus (DM) is a global health problem. It is estimated that by 2030, diabetes will affect about 366 million people [1].

Hyperglycemia which, if untreated, is associated with significant risk of microvascular disease, and in particular diabetic retinopathy[2]. Nervous system involvement in diabetes has been amply documented. Important detectable changes in the higher functions appear to occur frequently in diabetics than commonly believed.[3]

Pattern-reversal visual evoked potential (PVEP) testing is an objective means of evaluating impulse conduction along the central nervous pathways. Increased peak time of the visual P100 waveform is an expression of structural damage at the level of myelinated optic nerve fibers.

The aim of this study was to firstly observe pattern-reversal visual evoked potentials (PVEPs) abnormalities in newly diagnosed IDDM patients. Secondly, to assess whether the central nervous system (CNS) and in particular visual function is affected by IDDM.

MATERIAL & METHOD

The present study involved 18 newly diagnosed IDDM patients of age (21.3 ± 3.2) years and duration of disease (6 ± 2.6 months) as cases and 18 age matched healthy volunteers as controls. The study was approved by the Institutional Ethical Committee. All the study subjects were investigated to rule out any other medical, neurological and ophthalmic problems that could affect VEP findings. The study subjects were instructed not to take any medication likely to influence VEP findings.

Exclusion Criteria:

1. Patients with history of any cardiac diseases, renal diseases, disease involving liver and respiratory system, hypertensive patients, patients with significant anemia (as per WHO criteria), electrolyte imbalance or resting abnormal ECG were excluded from the study.

2. Patients with any ophthalmological abnormalities like retinopathy, glaucoma or cataract, or visual acuity <6/18 with corrective lenses were excluded.

3. Duration of IDDM more than 1 year.

Before the test, complete procedure of the test was explained to the subjects and their informed written consent was taken. All the study subjects underwent a standardized protocol comprising of complete history, clinical examination including ophthalmic examination and other necessary investigations following which they were subjected to visual evoked potential (VEP) testing using RMS EMG EP MK-II machine equipped with pattern-shift stimulator monitor screen, signal amplifier with filters and a computer software system for averaging. VEP waves were recorded and analyzed.

Instructions to the subjects before the test:

- Thoroughly wash **hair** and asked not to apply any hair chemicals, lotions or oils.
- Subjects were instructed to ensure adequate **sleep** in the night before the test date.
- To bring the corrective lenses, if worn.
- Not to take any medications without consulting.

VEP was performed in a dark, quiet room specially equipped for electro-diagnostic procedure. Subjects were made to relax and sit comfortably in front of a video monitor displaying black and white checkerboard pattern at approximately 100 cm distance from the pattern-shift monitor screen. The subjects were asked to focus their gaze onto the red spot at the center of the screen. Each eye was tested separately (monocular testing). The checker pattern changed at a rate of approximately twice per second. Every time the pattern alternates, the visual system generates an electrical response that is detected and recorded by surface electrodes, placed on the scalp overlying the occipital and parietal regions as follows:

Surface electrodes were fixed with adhesive electrolyte paste as follows: active electrode at Oz (which is highest point on the occiput), with reference electrodes on the midline of frontal region (Fz) or 12 cm above the inion, ground electrode was placed at the vertex(Cz) (Fig-1). The bioelectric signal were filtered (band-pass, 1-100 Hz), and 150 events were averaged for every trial.

The visual stimuli were generated on a video monitor in form of checkerboard patterns (contrast 70%, mean luminance 50 cd/m2) that reversed in contrast at the rate of two reversals per second**.** The check edges subtend a visual angle of 15 minutes at the viewing distance of 100 cm, with video monitor screen subtending an angle of 12.5°. The refractive errors of all subjects were corrected for this viewing distance.

RESULTS

All the data were presented as mean values with standard deviation (SD) for descriptive results. Comparisons were made between groups by unpaired 't' test. Statistical significance was set on $p < 0.05$.

PRVEP was recorded in the IDDM patients as well as the control group and P100 latencies and P100 amplitude differences were analysed. [Table-1].

We found statistically significant prolongation of P_{100} latencies in newly diagnosed patients than controls (Table-1) i.e.101±5.62 Vs 97.16±4.11, $p<0.05$ and there was not significant change in P_{100} amplitudes values.

(5.42±1.43 Vs 5.88±2.05, P=0.44).

Table-1: **Mean P100 latencies and amplitudes in newly diagnosed IDDM and controls.**

Subjects	No. of subjects	Mean P100 Latency (Mean ± S.D.)	Mean P100 Amplitude (Mean ± S.D.)
IDDM	18	101±5.62	5.42±1.43
Controls	18	97.16±4.11	5.88±2.05
p- Value	---	0.02	0.44

DISCUSSION

The P100 is a prominent and more stable wave. It shows little variations between the subjects, minimal within-subject interocular difference, and minimal variation with repeated measurements over time[4]. Therefore, this paper focused more on the correlation P100 latency values among the groups which were examined.

In current study, The mean P_{100} latencies in newly diagnosed IDDM patients were significantly prolonged compared to controls (Table-1) i.e. 101±5.62 Vs 97.16±4.11, p value - 0.02 ($p<0.05$).

Previous findings shown that prolonged latencies, particularly P100, could occur and be registered very early in patients with DM1 [5,6].

The above findings are in accordance with Sima et al.[5], Karlica et al.[6], Yaltkaya K et al.[7]

The mean value of amplitude of P100 among cases was 5.42±1.43 and that of controls was 5.88±2.05.There was no significant difference in the amplitudes of P100 among cases and controls (p=0.44). [Tables 1]

Chronic exposure to high blood glucose levels is strongly correlated with peripheral nerve lesion severity[8,9]. Hyperglycemia leads to some metabolic changes that are extremely harmful for nerve fibers: increased polyol pathway activity, upregulation of advanced glycation end products (AGEs), and increased oxidative stress. Excess glucose in nerve cells is diverted via polyol pathway, where the formation of sorbitol and fructose will reduce the level of myo-inositol and decrease 4 Na+ /K+ ATPase activity, with secondary impairement of axonal transport and peripheral nerve structure [10-12].

Thus, the delay of P100 latencies in IDDM patients in the current study could be a manifestation of structural damage at the level of the myelinated optic nerve fibers or retinal ganglion cell damage before the development of diabetic retinopathy.

CONCLUSION

We therefore conclude that VEP is a useful tool in detecting early dysfunction due to retinal ganglion cell damage in IDDM patients before signs of diabetic retinopathy are actually detected in the patients. The present study has shown that P100 latency was significantly prolonged in IDDM patients. So VEP as a non-invasive, reliable and highly sensitive test to detect early neuronal changes in the pre-retinopathy stage in IDDM patients. Thus, VEP can be recommended as an early investigation in IDDM patients before the occurrence of retinopathy to monitor the early effects of diabetes on visual function.

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REFERANCE

1. Wild S, Roglic G, Green A, Sicree R, King H. Global prevalence of diabetes: estimates for the year 2000 and projections for 2030. Diabetes Care. 2004 May;27(5):1047–53.

2. Colledge NR, Walker BR, Ralston SH. Davidson's principles and practice of medicine, 21st edition, Elsavier; 2010.798.

3. Om P. Tandon, Atul verma and B.K.Ram. Cognitive Dysfunction In NIDDM: P_3 Event Related Evoked Potential Study. .Indian J Physiol Pharmacol 1999;43(3):383-388.

4. Odom JV, Bach M, Brigell M, Holder GE, McCulloch DL Tormene AP, et al. ISCEV standard for clinical visual evoked potentials (2009 update). Doc Ophthalmol 2010;(120):11-9.

5. Sima AA, Zhang WX, Cherian PV & Chakrabarti S. Impaired visual evoked potential and primary axonopathy of the optic nerve in the diabetic BB/W-rat. *Diabetologia* 1992; 35, 602–607.

6. Karlica D, Galetović D, Ivanisević M, Skrabić V, Znaor L, Jurisić D. Visual evoked potential can be used to detect a prediabetic form of diabetic retinopathy in patients with diabetes mellitus type I. CollAntropol. 2010; 34(2):525-9.

7. Yaltkaya K, Balkan S et al. Visual evoked potentials in diabetes mellitus. Acta Neurol Scand. 1988;77(3): 239-41.

8. Brownlee M. The pathobiology of diabetic complications: a unifying mechanism. Diabetes. 2005 Jun;54(6):1615–25.

9. Muntean C, Mitrea A, Popa SG, Tudorică V, Moța M. Biochemistry of hyperglycemia induced vascular dysfunction. Romanian J Diabetes Nutr Metab Dis. 2013;20(4):419–25.

10. Carrington A, Litchfield J. The aldose reductase pathway and nonenzymatic glycation in the pathogenesis of diabetic neuropathy: a critical review for the end of the 20th century. DIABET REV. 1999;7(4):275–99.

11. Greene DA, Sima AA, Stevens MJ, Feldman EL, Lattimer SA. Complications: neuropathy, pathogenetic considerations. Diabetes Care. 1992 Dec;15(12):1902–25.

12. Folli F, Corradi D, Fanti P, Davalli A, Paez A, Giaccari A, et al. The role of oxidative stress in the pathogenesis of type 2 diabetes mellitus micro- and macrovascular complications: avenues for a mechanistic-based therapeutic approach. Curr Diabetes Rev. 2011 Sep;7(5):313–24.

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A Study on Profile of Dietary Status, BMI and Physical Activity in Patients with Type 2 Diabetes Mellitus

Sumit Garg[1], Jagadamba A[2], Vinutha Shankar[3], Karthiyanee Kutty[4]

[1]Assistant Professor, Department of Physiology, Saraswathi Institute of Medical Sciences, Hapur, [2]Associate Professor, [3]Professor & Head, [4]Professor, Department of Physiology, Sri Devaraj Urs Medical College, Kolar

ABSTRACT

Introduction: Diabetes is a life-long illness with no proven cures and demands only management. Apart from conventional treatment, life style modification including diet and exercise has been accepted as cornerstone of treatment as it helps to maintain euglycemic levels and hence reduce the associated complications. This study has been designed to assess BMI, dietary status and physical activity in diabetic patients.

Materials & method: 300 patients with diagnosed type 2 diabetes mellitus (T2DM) without any complications were selected. BMI (kg/m^2) was calculated. Dietary intake was determined by dietary recall. Physical Activity profile was studied using standardized questionnaire.

Results: 65% of the subjects had high BMI. 68% had sedentary lifestyle. 35% of the subjects were consuming excess caloriesExcess calories intake was present in 61% of subjects in high BMI group. Sedentary lifestyle was observed in 73.3% of the subjects having high BMI and 89.6% of the subjects taking excess calories.

Conclusion: Sedentary lifestyle and high BMI were more commonly observed in the diabetic patients studied. Awareness regarding lifestyle modification with respect to diet, physical activity and weight control should be created among diabetic patients.

Keywords*: Diabetes Mellitus, BMI, Dietary status, Physical activity,*

INTRODUCTION

Diabetes, a major non-communicable disorder, is a life-long illness with no proven cures and demands only management. India leads the world in diabetes prevalence with 61.3 million diabetics estimated to rise to 101.2 million by 2030 [1]

This increased prevalence of T2DM is attributed to increased prevalence of obesity and lifestyle changes. High proportion of body fat is associated with insulin resistance. People in South Asia tend to develop diabetes with a lesser degree of obesity at younger ages and suffer longer with complications of diabetes due to ethnic susceptibility. Moreover, rapid economic developments have improved the availability of nutrients, specifically an energy dense diet predisposing people to both obesity and T2DM. [2]

The increased prevalence of impaired glucose tolerance and diabetes in urban India has been documented. Rural sector is catching up with the urban trends due to rapid industrialization and urbanization. [3,4]

In addition to conventional treatment, life style modification including diet and physical exercise has been accepted as cornerstone of treatment for diabetic patients as it helps to maintain euglycemic levels and reduce associated complications.

Rural population is generally unaware about the importance of diet and physical activity in control of DM. There is a need to evaluate the dietary pattern of these diabetic patients in order to provide appropriate information to plan a proper diet which includes locally

Corresponding author:
Sumit Garg
Assistant Professor, Department of Physiology,
Saraswathi Institute of Medical Sciences, Hapur

available food items in right proportions. This study has been designed to assess BMI, dietary status and physical activity profile in diabetic patients, so as to implement the necessary dietary and exercise interventions to control DM.

OBJECTIVES

1. To calculate BMI to determine obesity in patients with T2DM.

2. To assess their dietary status using dietary recall.

3. To determine their physical activity profile using standard questionnaire.

MATERIALS AND METHOD

300 subjects with diagnosed T2DM and >30 years age of both genders were recruited after taking written informed consent. Ethical clearance was obtained from the Institutional Ethical Committee. Subjects with complications of T2DM or with H/O diagnosed tuberculosis, congestive cardiac failure and carcinoma were excluded. Systematic random sampling was done for collection of samples by recruiting every alternate patient attending OPD.

BMI was calculated by the Quitelet's formula: weight/height^2 (kg/m^2) and subjects were classified under low, normal and high BMI groups according to South Asian Standards.[5]

Dietary intake was determined by dietary recall. Total calorie and protein intake were estimated after noting the recommended daily allowance for that age.[6] Nutritive Value of different food items were calculated using Dietary Guidelines Manual, National Institute of Nutrition, Hyderabad.[7]

Physical Activity profile was studied using standardized questionnaire and average duration of the activity per day was calculated.[8] Physical Activity Level is a composite index of physical activity and is given by the formula: 24-hour energy expenditure/basal metabolic rate. 24-hours' energy expenditure is calculated as sum of energy expenditures of all reported activities for a single day. BMR/min was calculated first and MET (Metabolic equivalent) of that activity was applied as a multiple of BMR. 24 hour Energy expenditure= MET*Average duration of activity per day (min/day)*Basal metabolic rate. Residual energy expenditure relates to those periods of a day which are unaccountable by recall and a uniform MET of 1.4 was employed for all residual time.[8] BMR was calculated from regression equations recommended by WHO.[9] Physical activity Level values: Sedentary (< 1.4),moderate physical activity (1.4 – 1.75) and heavy physical activity (>1.75).

RESULTS

Mean age of the study group was 57.3 $\pm$ 10.81 years. General characteristics of the study population are shown in table 1.

Low BMI was reported in 6% of the subjects, 29% had normal BMI and 65% high BMI. With regard to the dietary status, 35% subjects consumed excess calories whereas regarding protein, 83% were deficient in daily protein intake.(Table 1).

Excess calories intake was present in 61% of subjects in high BMI group while it was 18.3% in normal BMI group and none in low BMI group. 73% of the subjects were consuming vegetarian diet. Food items with highest daily consumption were white rice, ragi and wheat. Most of the subjects (32%) consume a mixture of cereals. While 24% consumed rice and ragi, 11.3% only ragi, 11% ragi and wheat, 7.6% only white rice and none had only wheat. Only 9% were consuming pulses. 42.3% were consuming milk products. Egg was consumed by 7.6% of subjects. Vegetables, a good source of dietary fibers were consumed by 30.6% of the subjects.

Mean BMI of subjects taking excess calories intake was significantly higher than calories deficient(Table 2). Mean BMI of subjects consuming higher protein intake was also higher than protein deficient. (Table 3).

As far as physical activity level was concerned, 68% subjects were having sedentary lifestyle, 16.3% were moderately active and 15.7% were doing heavy physical activity. Sedentary lifestyle was observed in 73.3% of the subjects having high BMI. 89.6% of the subjects taking excess calories were having sedentary lifestyle.

Mean BMI was significantly more in subjects with sedentary lifestyle in contrast to subjects having moderate and heavy activity.(Table 4)

DISCUSSION

This study presented descriptive data from diabetic subjects. Obesity was prevalent in 65% of the diabetics. These results are comparable to other studies. Higher prevalence of obesity in diabetics was observed in 58.1% of subjects in Chennai, 83% in Gujarat, 78% in South Africa and 86% of in UK. [10,11,12,13]

The higher prevalence of obesity may be due to various factors of which diet and sedentary lifestyle being most important. In relation to obesity, 61% subjects in high BMI group were having high calorie diet making dietary calories an important cause of obesity in diabetes. Only 35% of diabetics consumed excess calories but 65% had high BMI. This discrepancy may be due to under reporting. The problem of under reporting in nutritional research has been reported earlier and it is said to be particularly common among obese. [14]

Regarding diet, it is not only the quantity of food intake but also the quality of food item which is important. High intake of foods with a high glycemic index (GI) and glycemic load (GL) increases risk of T2DM. Foods with higher GI and GL cause rapid post-prandial increase in blood glucose resulting in hyperglycemic state. [15]

South Indian population is rice-eating and eats preparations made from rice throughout the day. But in Karnataka and in our study, diet does not solely contain rice; it also constitutes ragi and wheat. 75% subjects had rice in their diet. Rice has been a staple food in Asian populations for many years, the transition to more refined white rice has rendered Asian populations more susceptible to the adverse effects of high intakes of white rice. Higher white rice intake is associated with a significantly elevated risk of T2DM, especially among Asians due to high GI and low fiber in white rice.[15,16] The deleterious effects of refined grains (predominantly white rice) and its strong association with T2DM and also with metabolic syndrome were evident from CURES Study. [17]

As far as Ragi is concerned, 81% of subjects consumed ragi daily. Though it has high dietary fibre content and dietary fibre is known to exert an inhibitory effect on the starch digestibility but it elicits glycaemic response equivalent to glucose load.[18,19,20] So, the usefulness of ragi as diabetic diet is questionable. According to American Journal of Clinical Nutrition, ragi has high glycemic index and load which is even higher than rice.[21] But according to Association of Food Scientists & Technologists (India) ragi contains phenolics that inhibit Malt amylase, α glucosidase, pancreatic amylase reducing postprandial hyperglycemia by partially inhibiting the enzymatic hydrolysis of complex carbohydrates.[22] But to date there are no long term intervention trials to bring to light the health benefits of ragi consumption.[23]

Only 57% of subjects consumed wheat in their diet and none of them were purely consuming wheat. Wheat has a low glycemic index compared to rice and ragi and also contains high dietary fiber. In addition to fiber wheat also contains resistant starch which has glycemic index lowering capacity and hence helps to manage T2DM.[24]

In NUDS study, prevalence rates of diabetes was higher in three southern cities (Hyderabad, Chennai and Bengaluru) where rice is staple diet, compared to three northern cities (Delhi, Kolkata and Mumbai) where it is wheat.[25]

Regarding protein more than 80% of the subjects were protein deficient. Majority i.e. 73% of the subjects were vegetarian, among them only 9% were consuming pulses. Although around 40% were consuming milk products but it was in the form of either butter milk. Only 30% of the subjects consumed vegetables which are good source of fibres and micronutrients.

An increase in protein content, particularly if associated with a decrease in carbohydrate would result in a decrease in the integrated glucose concentration. Such diet is useful for controlling blood glucose in T2DM. [26]

Another important factor responsible for obesity was sedentary lifestyle in most subjects. Similar results were revealed from other studies. Sedentary lifestyle was observed in 84% of subjects in Gujarat, 47.5% in Chandigarh, 17% in Chennai and 33.3% in Malaysia.[11,14,27,28]

In our study, in high BMI group, sedentary activity was observed in around 73% of the subjects making it an important contributing factor for obesity. In excess calories group, around 90% were sedentary. Overall, around 30% of the subjects had high BMI, excess calories and sedentary lifestyle.

As a consequence of urbanization, there has been an increase in the standard of living leading to a nutritional transition with consumption of diet which is energy dense and high in fat and sugar component. Moreover, with changes in occupation from predominantly agriculture based manual labour jobs to sedentary office type; there is an immense decrease in physical activity. This is the basis for the rapid weight gain and obesity seen in India.

Type & quantity of diet and exercise form a solid foundation for the prevention and treatment of T2DM. Regular physical activity increases insulin sensitivity, lowers blood sugar, reduces body fat, builds muscle and improves cardiovascular fitness.

Table 1: Characteristics of study population

PARAMETERS			
Gender	Males (68%)	Females (32%)	
BMI (kg/m²)	Low (6%)	Normal (29%)	High (65%)
Physical activity	Sedentary (68%)	Moderate (16.3%)	Heavy (15.7%)
Diet			
Calories	Excess (35%)	Deficiency (65%)	
Protein	Excess (17%)	Deficiency (83%)	

Table 2: Independent t test comparing BMI with calories intake

	Calories	**N**	**Mean±SD**	**p-value**
BMI	Excess	135	27.61 ±4.17	<0.01
	Deficient	165	23.21 ±4.24	

Table 3: Independent t test comparing BMI with protein intake

	Protein	**N**	**Mean±SD**	**p value**
BMI	Excess	51	27.72 ± 4.65	<0.01
	Deficiency	247	24.58 ± 4.34	

TABLE 4: ANOVA results comparing BMI with physical activity

	Sedentary activity	**Moderate activity**	**Heavy activity**	**ANOVA (F value)**	**Post Hoc (Bonferroni)** (p value)
BMI (mean ±SD)	25.81 ±4.75	24 ±3.47	23.08 ±3.9	8.925 p <0.001	Sed vs mod: p=0.033 Sed vs heavy: p<0.01 Mod vs heavy: p=ns

CONCLUSION

Obesity was prevalent among diabetics establishing it a major risk factor for T2DM. Majority of them had sedentary lifestyle. Excess calorie intake was observed in those with high BMI and sedentary lifestyle. Most of them were consuming a protein deficient diet.

Majority of the subjects were consuming a mixture of cereals, white rice and ragi being most important among them. White rice has high glycemic index and low fiber whereas ragi's benefit in diabetes is to be proved. Emphasis should be placed on improving intake of protein rich foods and whole grain cereals like wheat with a low glycemic index rather than refined grains. Awareness regarding lifestyle modification with respect to diet, physical activity and weight control should be

created among diabetic patients.

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REFERENCES

1. International Diabetes Federation. IDF Diabetes Atlas [homepage on the Internet]. Brussels: International Diabetes Federation;[updated 2011; cited 2012 Sept 12]. The Global Burden. Available from: http://www.idf.org/diabetesatlas/5e/the-global-burden.
2. Yoon KH, Lee JH, Kim JW, Cho JH, Choi YH, Ko SH et al. Epidemic obesity and type 2 diabetes in Asia. Lancet 2006;368:1681–88.
3. Diabetes India [Homepage on the Internet]. The Indian Task on Diabetes Care in India. Mumbai; [cited 2010 Sept 29]. Available from: http://www.diabetesindia.com/diabetes/itfdci.htm.
4. Ebrahim S, Kinra S, Bowen L, Anderson E, Shlomo YB, Lyngdoh T et al. The Effect of Rural-to-Urban Migration on Obesity and Diabetes in India: A Cross-Sectional Study. PLoS Med [Serial on Internet].2010 Apr;7. Available from: http://www.plosmedicine.org/article/info%3Adoi%2F10.1371%2Fjournal.pmed.100026.
5. World Health Organisation. Asia Pacific perspective: Redefining obesity and its treatment. Australia: Health Communications;2000.
6. FAO/WHO. Energy and protein requirements, Report of a Joint FAO/WHO Ad Hoc Expert Committee. Geneva:FAO/ WHO; 1973.p.118. Report No.:FAO Nutr. Meet, Rep. Ser. No. 52; WHO Tech. Rep. Ser. No. 522.
7. National Institute of Nutrition. Dietary Guidelines for Indians -A Manual. 2nd ed. Hyderabad: National Institute of Nutrition;2010.
8. Vaz M. Evaluating Habitual Physical Activity Patterns. State Level Workshop on Human-Experiments in Physiology – Setting up innovative experiments with minimal equipment and expenditure; 2000 Jan 28-29; Bangalore.p.70-81.
9. FAO/WHO/UNU Expert Consultation. Energy and protein requirements. Geneva: FAO/WHO/UNU;1985.p.120.Technical Report Series 724.
10. Mohan V, Shanthirani CS, Deepa R. Glucose intolerance (DM and IGT) in a selected South Indian population with special reference to family history, obesity and lifestyle factors – the Chennai urban population study (CUPS 14). J Asso Physicians India 2003;51:756-57.
11. Patel M, Patel IM, Patel YM, Rathi SK. A Hospital-based Observational Study of Type 2 Diabetic Subjects from Gujarat, India. J Health Popul Nutr 2011;29:265-72.
12. Adebayo FO. Dietary habits and prevalence of obesity among type 2 Diabetes patients seen at Scott Hospital, Morija, Lesotho [dissertation]. Morija: University of Limpopo;2007.
13. Daousi C, Casson I F, Gill G V, MacFarlane I A, Wilding J P H, J H Pinkney JH. Prevalence of obesity in type 2 diabetes in secondary care: association with cardiovascular risk factors. Postgrad Med J 2006;82:280-84.
14. Klesges RC, Eck LH, Ray JW. Who underreports dietary intake in a dietary recall? Evidence from the Second National Health and Nutrition Examination Survey. J Consult Clin Psychol 1995;633:438-44.
15. Villegas R, Liu S, Gao YT, Yang G, Li H, Zheng W et al. Prospective study of dietary carbohydrates, glycemic index, glycemic load, and incidence of type 2 diabetes mellitus in middle-aged Chinese women. Arch Intern Med 2007;167:2310-6.
16. Hu EA, Pan A, Malik V, Sun Q. White rice consumption and risk of type 2 diabetes: meta-analysis and systematic review. Br J Med. 2012 Jan 19;344. Available from: http://www.bmj.com/content/344/bmj.e1454.
17. Radhika G, Dam RMV, Sudha V, Ganesan A, Mohan V. Refined grain consumption and the metabolic syndrome in urban Asian Indians (Chennai Urban Rural Epidemiology Study 57). Metabolism 2009;58:675-81.
18. Raghuram TC, Pasricha S, Upadhyaya AC, Krishnaswamy K. Glycaemic Index Of Indian Foods. Hyderabad: National Institute of Nutrition;1987.6 p.
19. Torangatti G, Naik Rk. Glycemic And Lipemic Response of Composite Foods In Normal and NIDDM Subjects. Int J Diab Dev Countries 1999;19:167-71.
20. Mani UV, Prabhu BM, Damle SS, Mani I. Glycaemic index of some commonly consumed

foods in western India. Asia Pacific J Clin Nutr 1993;2:111-114.

21. Powell KF, Holt SHA, Miller JCB. International table of glycemic index and glycemic load values: 2002. Am J Clin Nutr 2002;76:5–56.
22. Devi PB, Vijayabharathi R, Sathyabama S, Malleshi NG, Priyadarisini VB. Health benefits of finger millet polyphenols and dietary fiber: a review. J Food Sci Technol. 22 November 2011. Available from: http://link.springer.com/article/10.1007/s13197-011-0584-9.
23. Shobana S. Health Benefits of Ragi.In: Pradeepa RG,editor. Diabetes Monitor. 32 ed. Chennai: Direct, A Charitable Trust for Diabetes;2011.p.9-11.
24. Sramkova Z, Gregova E, Sturdik E. Chemical composition and nutritional quality of wheat grain. Acta Chimica Slovaca 2009;2:115–138.
25. Mohan V, Radhika G, Vijayalakshmi P, Sudha V. Can the diabetes/cardiovascular disease epidemic in India be explained, at least in part, by excess refined grain (rice) intake? Indian J Med Res 2010;131:369-72.
26. Gannon MC, Nuttall FQ , Saeed A, Jordan K, Hoover H. An increase in dietary protein improves the blood glucose response in persons with type 2 diabetes. Am J Clin Nutr 2003;78:734–41.
27. Puri S, Kalia M, Swami M, Singh A, Abhimanyu, Mangat C, Kaur A, Kaur S et al . Profile of diabetes mellitus in elderly of Chandigarh, India. Internet J Endocrinol. 2007;4. Available from: http://www.ispub.com/journal/the_internet_journal_of_endocrinology/volume_4_number_1_16/article/profile_of_diabetes_mellitus_in_elderly_of_chandigarh_india.html.
28. Shazwani MNN, Suzana S, Mastura YH, Lim CJ1, Teh SC, Fauzee MZM. Assessment of Physical Activity Level among Individuals with Type 2 Diabetes Mellitus at Cheras Health Clinic, Kuala Lumpur. Mal J Nutr 2010;16:101-12.
29. Looker HC, Knowler WC, Hanson RL. Changes in BMI and Weight Before and After the Development of Type 2 Diabetes. Diabetes Care 2001; 24:1917-22.

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The Relationship of Vital Capacity between Male & Female Elderly Indian Population

Ramita Raheja[1], David Mohan[2], Mohan Lal Arora[3]

[1]Associate Professor, [2]Assistant Professor, Physiology Department, Glocal Medical College Sup. Hospital & Research Centre, Mirzapurepole,(Saharanpur), [3]Associate Professor, Physiology Department, Govt. Medical College, Orai

ABSTRACT

The purpose of this study was to find out the relationship of vital capacity between in male & female elderly Indian population. "The cardiorespiratory function tests" was conducted on a randomly selected 110 apparently healthy subjects of 60 years and above age group belonging to both the sexes at Agra. Out of these 110 subjects, 84 were male and 26 females. In elderly Male (60+) the average vital capacity (V.C) was 2334.3 ± 370.3 ml and in elderly women (60+) 2206.2 ± 297.5 ml. The vital capacity shows a declining pattern with age in all age groups in men as well as in women and the relationship is statistically significant in both the sexes ($p < 0.01$ in men as well as in women).

Keyword: - *Spirometer, Vital Capacity, male and female, elderly Population*

INTRODUCTION

We are entering the 21st Century with the W.H.O. The concept "Health for All by 2000 A.D", but the older population is still ignored. Ageing is a universal process. In the words of SENECA[1] old age is an incurable disease

Sir James Sterling Ross[1]commented:"You do not heel old age, you protect it, you promote it, you extend it".

In a developing country like ours, older age groups are of special interest, particularly from a social and economical point of view. There is no escape from the fact that we are becoming a nation of elders.

UNESCO[2]estimates that the number of the aged above 60 is likely to go up from 350 million in 1975 to 590 million in 2005. About half of them are in the developing countries. In India out of the total population of 685,184,692 (Census, 1981) the aged i.e., above 60 yrs from about 6.3%. In fact,statistics in respect of the aged in India have been increasing constantly. In 1901 as the Census reveals, there were about 12 million people above the age of 60 years. In the next 50 years, i.e., in 1951, the population of the aged was 20 million. In the next 30 years from 1951 to 1981, the population of the aged rose to 43 million. Now the population of the aged is about 48 millions. It is expected that their population will67 million by the turn of this Century.

The founders of experimental physiology are Eras stratus (280 B.C)[3]and Galen (280 3.C)[4] who between them demonstrated the role of the diaphragm as a muscle of respiration, the origin and function of the phrenic nerve and function of the intercostals and accessory muscles. The function of the diaphragm was further explored by Da Vinci (1452-1519)[5] who observed that during inspiration the lung expands in all directions following the movement of the thoracic cage. The collapse which follows puncture of the pleura was described by Vesalius (1514 - 1564).[6]

The need for fresh air was recognized by Galen (280 B.C) [4] who believed it reacted with the blood, in the left heart and arteries to produce the 'vital spirit1. The absence of a visible communication between the pulmonary artery and pulmonary vein led him to suggest that blood passed through invisible pores between the two sides of the heart. He, therefore, failed to appreciate the true functions of the lungs.

Danders (1849)[7] demonstrated the role of elastic recoil of the lungs causing expiration, was the first to measure the retractive force. The work was extended by Cloetta (1913)[8]. Peabody (1915)[9] gave an idea of the relationship of vital capacity to breathlessness. The

term Forced Vital Capacity was used first time by Strohl (1919)[10]. Roher (1915)[11] tried to explain the relationship between the force exerted by the respiratory muscles and the rate of air flow on the basis of Newton's law. This work was further extended by Neergaard and Wirz (1927)using the pneumatochrograph of Fleisch. Neergaardin the same year (1927) also demonstrated the roleof surface forces in the lung by comparing the relationship of lung volume to retractive force when the air in the lung was replaced by water.

Jansen, Knipping and Stromberger (1932)[12] calculated the equivalent minute volume frookyaograph records of a forced vital capacity and introduced the term maximal breathing capacity as one of the lung function test. The measurement of maximal breathing capacity was made first time in 1933 by Hermannsen. Christie (1934) demonstrated the role of change in lung distensibility in causing breathlessness.

Bhargava et al. (1973)[13] in their study in Bhopal reported the low vital capacity in female subjects as compared to male subjects of same age group (56 - 65 yrs). They reported theV.C. 2260 ± 82 ml in men and 1875 ±165 ml in women.

Damoder et al. (1983)[14] also reported the decreased ventilatory function in smokers as compared to non-smokers and reported that all the indices decreased with age

Meenakshi (1984)[15] in her study "Spirometric data in South Indian subjects 60-80 years" also reported a declining trend of vital capacity with age. She reported the lower value of vital capacity in female as compared to male subjects of the same age group.

J. Pathak and P.P. Mehrotra et al. (1989)[16] in their study "Pulmonary Functions of Elderly Indian Subjects" concluded a decreasing pattern of V.C. with age but the decline is not uniform.

Anderson et al. (1978)[17] in their WHO publication quoted that Framingham longitudinal studies indicated that high physical performance capacity i.e., a strong hand grip, high vital capacity and a low resting heart rate, are associated with a lower than average incidence and severity of cardiovascular pathology.

MATERIAL AND METHOD

The present study "The Cardiorespiratory Function Tests" was conducted on a randomly selected 110 apparently healthy subjects of 60 years and above age group belonging to both the sexes at Agra. The survey v/as conducted under the joint auspices of Department of Physiology and Department of Cardiology, S.N. Medical College, at Agra.

The following Cardiorespiratory function tests were carried out on these subjects

Vital Capacity in ml

Methods for Recording :-

Vital Capacity : It is defined as maximum volume of air that a person can forcefully expire with maximum expiratory efforts after taking deepest possible inspiration. It is expressed in terms of litres

Procedure :

The instrument used was Spirometer. Before starting the test, procedure was well demonstrated to the subject. The pointer was adjusted to zero level. The subject was asked to take the mouth piece in the grip of his mouth. Now the subject was instructed to take a deepest possible inspiration in order to fill the lungs with air to the maximum extent. The nose was closed with nose clip and then exhaled out the air with maximum expiratory efforts through mouth piece. Three readings were taken at the interval of five minutes. Highest of three was taken as final reading for the study.

Precautions:-

The following precautions were taken to obtain the best results:-

The subject was explained the detailed procedure.

The subject was taken in full confidence before starting the test,

The Spirometer was thoroughly checked for any zero error,

Measures were taken to avoid any leaks through nose or from around the mouth piece.

Resistance and inertia of the instrument should be minimum. The air passage should be wide (more than 3.2 cm).

Before taking reading the subjects were given

preliminary training/practice attempts to attain the best of their ability.

OBSERVATIONS

In the present study "Assessment of Cardio-respiratory function tests in Indian Population of 60 years and above Age Group", 110 subjects belonging to both sexes were studied. Out of these 110 subjects, 84 were male and 26 females. The details of these findings in various age groups and different sexes are shown in Tables

Following cardio-respiratory function tests were performed on these subjects:-

Vital capacity (V.C) in ml.

For the sake of convenience the subjects were grouped in male and female subgroups. Each subgroup was further divided in four subgroups as follows:-

Group I	: 60 yrs to 64 yrs
Group II	: ↓65 yrs to 69 yrs
Group III	: ↓70 yrs to 74 yrs
Group IV	: ↓75 yrs and above.

For each group the mean age was calculated as shown in Table 2.

A predesigned Performa (From WHO Publication European Series No.6) appended herewith was filled up in order to obtain a detailed personal history, medical history and other information regarding each subject.

The mean values and standard deviation of all the parameters with respect to age group, comparative evaluation of these parameters in corresponding age group of male and female subjects were calculated and the findings are tabulated, Finally, the statistical correlation in form of r, t and p values of each parameter was calculated as shown in each table.

DISCUSSION

Ageing is a progressive failure of body's homeostatic adaptive response resulting in increased vulnerability to environmental stress and disease. The physiological sign of ageing are gradual deterioration in function and capacity to respond to environmental stress. Ageing is a general physiological on-going process and despite intensive research the mechanisms of ageing are still to be explored. Even though the mechanism of ageing will probably be attributed to a number of different regulatory mechanisms; such as cellular or molecular function, the study of system-integration should remain an important topic in the scientific investigation of ageing (Shock, 1977)[18]. The performance of most human physiological functioning is dependent on the co-ordinated efforts of several organ systems.

Shock (1979)[18] demonstrated greater ageing decrements in the performance of integration system than in the separate variables themselves. One of the most rapidly declining and perhaps most devastating decrement in ageing is the declining functional ability of cardiorespiratory system.

The present study of evaluation of cardio-respiratory functional ability in elderly age group was conducted with the objective to determine the effect of ageing on these functional abilities and also to compare and observed, were carried out and studied in relation to various age groups in both the sexes.

Pathak and Mehrotra et al. (1989)[16] in their study "Pulmonary Functions of Elderly Indian Subjects" concluded a declining pattern of vital capacity with age but the decline was not uniform.

Table - 1: Comparative evaluation of vital capacity of total number of male and female subjects studied (n= 110)

Sex	No.	Vital Capacity in ml	
		Mean	S.D
Male	84	2334.30	± 370. 30
Female	26	2206.20	± 297.50

t = 7.1103 P <0.01

Table - 2: Comparative evaluation of vital capacity of different age groups in male and female subjects studied (n = 110)

Age Groups (Years)	No.	Male		No.	Female	
		Mean	S.D.		Mean	S.D.
60 – 64	26	2559.0	± 368.5	11	2339.0	± 293.3
↓65-69	20	2396.5	± 321.9	8	2150.0	± 222.40
↓70-74	17	2340.0	± 254.1	4	2045.0	± 235.5
↓75+	21	1990.4	± 210.2	3	1843.3	± 175.9

RESULT

In elderly (60+) men the average vital capacity (V.C) was 2334.3 ± 370.3 ml and in elderly women (60+) 2206.2 ± 297.5 ml. The vital capacity shows a declining pattern with age in all age groups in men as well as in women and the relationship is statistically significant in both the sexes ($p < 0.01$ in men as well as in women) showing table no.1.

Ethical Clearance:-Yes

Source of Funding :-Self

Conflict of Intrest:- None

REFERENCES

1 J.E.Park & K. Park,(l986) "Preventive Medicine and Geriatrics" Textbook of Preventive & Social Medicine by 11th ed,p.382

2 Bhattacharya, S.K. The Problems of the Aged. Specific Article for Civil Services Examination, Psychology. Employment News Weekly : Published by Ministry of I & B, New Delhi, 1989; P 1-2, Sept. 23-29.

3 Erasistratus (280 B.C). Lung Functions, Assessmentand Applications in Medicine, by J.E. Cotes, III ed., 1975; pp. 3.

4 Galen (280 B.C). Lung Function. Assessment and Application in Medicine, by J.E. Cotes, III ed, 1975;

5 Da Vinci (1452-1519). Lung functions. Assessment and Application in Medicine, by J.E. Cotes, III ed,1975; P.3.

6 Vgsalius (1514-1564). Lung functions, Assessment and Application in Medicine, by J.E. Cotes, III ed, 1975; PP.3.

7 Danders (1849). Lung functions. Assessment and Application in Medicine, by J.E. Cotes, III ed, 1975; p.6.

8 Cloetta (1913). Text Book by J.E. cotes, III ed,1975; P.6.

9 Robinow, M.W.F., Hamilton, R.A. et al. The accuracy of clinical determination of blood pressure in children with value under normal and abnormal conditions. Am.J.Dis.Child, 1939; 58:102-118.

10 Strohl (1919). Lung Function, Assessment & Application in Medicine, by J.E. Cotes, III ed, 1975; 6.

11 Roher (1915). ^ung function. Assessment and Application in Medicine, by J.E. Cotes, III ed, 1975; PP.6.

12 Jansen, Knipping and Stromberger (1932). Lung Functions, Assessment and Application in Medicine, by J.E. Cotes, III ed., 1975; PP.6.

13 Lovell, R., R.H.:Raceand Blood Pressure with special reference to ocenion. Hypertension, 1977; pp.617.

14 Damodar, Agarwal, D. and Sharma, P.M. : Changes inventilatory capacities due to exposure to talk dust. Ind. J. Chest Dis. & Allied Sc. 1983; 25:21-24.

15 Meenakshi, S. Spiro Data in South Indian subjects60-80 yrs. Ind.J.Physiol.Pharmacol. 1984; 28:58-62.

16 Mehrotra, P.P.,Pathak, J.D., Joshi, S.D., Shah, P.H.: Pulmonary functions of elderly Indian subjects. Trends of decline with age. Ind.J.Physiol. Phanaacol. 1989; 33:3, 157-162.

17 Habitual Physical Activity and Health. WHO Publ.European series No.6, 1978; 1-3.

18 Shock (1972, 1979). Physical conditioning intervention in ageing Quantitation epidemiology and clinical research; by Janet P. Wallace, 1983; 307.

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Effect of Head Up Tilt on Cardiovascular Autonomic Responses in Females

Kalpana Medala[1], Smilee Johncy[2]

[1] Associate Professor, Department of Physiology, Kamineni Acadamy of Medical Sciences and Research Center, Hyderabad, India, [2]Professor, Department of Physiology, J J M Medical college, Davangere, Karnataka

ABSTRACT

Orthostatic stress is commonly utilized to evaluate the cardiovascular autonomic function. This is done mainly by Head Up Tilt (HUT) testing. The parameters which represent the cardiovascular autonomic function involved the Heart Rate (HR), Systolic Blood Pressure (SBP), Diastolic Blood Pressure (DBP), Mean Arterial Pressure (MAP) and Pulse Pressure (PP).

Method: Hundred apparently healthy females in the age group of 18-45 years were selected to evaluate the effect of HUT on cardiovascular autonomic responses. Parameters like HR and BP were recorded at supine, 30^0, 60^0 and 80^0HUT.In each position the HR was determined by recording the ECG for 5 min in lead II.Niviquire software was used.BP was measured within 20 seconds of the change in tilt position.

Results: HR, DBP, MAP increased on HUT in females. SBP and PP decreased on HUT.

Interpretation and conclusion: During HUT there is increase in sympathetic activity (increase in HR, DBP) Postural stress test is useful for medical students, physiologists and clinicians to understand cardiovascular reflex response in healthy or diseased individuals.

Keywords: *Autonomic nervous system; Posture.*

INTRODUCTION

Baroreflexes are an important mechanism by which the central nervous system controls blood pressure in response to acute challenges imposed by change in posture. There is debate as to whether or not gender differences exist in sympathetic reflex responses. [1] Most reports indicate that susceptibility for orthostatic intolerance is more common in women than in men.[2]

Imbalance between sympathetic activation of heart and the vasculature has been described in heart failure patients and postural tachycardia patients. There are many factors which will influence the baroreflex function. Variation in blood pressure with age and gender has also been reported. The postural hypotension is the most disabling feature of autonomic dysfunction. The autonomic function tests are helpful when the history and physical examination findings are inconclusive.[3]Tilt table test is a standardized, physiological, clinically relevant stimulus that challenges the cardiovascular regulation. By the performance of head up tilt, it is possible to assess the dynamic capacity of regulatory system. Human responses to upright tilt is a window on central autonomic integration.[4]

Light was thrown over the gender related differences in the baroreceptor reflex control of HR in normotensive humans. Average age and BP were similar in both sexes, but females had a significantly higher HR. A major difference existed between the two sexes when the BP was elevated by intravenous administration of phenylephrine. Females had a significantly smaller baroreflex sensitivity, which inferred a gender-related difference in baroreceptor reflex control of HR. However, a positive correlation existed between basal HR and baroreflexsensitivity. It was important to investigate whether this difference was related to the significantly lower basal HR in females.[5]

The effects of various degrees of tilt in normal control subjects was taken into consideration. This study suggested that a protocol of 60^0 or 70^0 tilt testing for not more than 10 min would provide a reasonable

specificity for assessing syncope. Even with 60^0 or 70^0 HUT for less than 10 min, 30% to 40% of patients with otherwise unexplained syncope had a negative HUT test response[6].

Six healthy subjects aged 30-58 years and 6 patients with orthostatic hypotension were chosen. Arterial pressure and HR were recorded. In healthy subjects HUT induced gradual circulatory adjustments. After 2 min upright, stroke volume and cardiac output had decreased by 39 % and 26 % respectively. Little change in mean BP at heart level indicated that systemic vascular resistance had increased by 39% and 24%. The gradual responses upon HUT contrasted with the pronounced and rapid circulatory responses upon tilt back. In the patients a progressive fall in BP on HUT was observed.[7]

Dynamics of circulatory adjustment to HUT and tilt back were explained in healthy and sympathetically denervated subjects. It was observed that in healthy humans upon HUT neural compensatory mechanisms became very effective in maintaining arterial pressure at heart level. The gradual circulatory adjustments to HUT in healthy subjects contrasted with the pronounced and abrupt circulatory changes on tilt-back. In patients with a lack of neural circulatory reflex adjustments, graded BP decreased on HUT and gradually increased to tilt back position.[8]

METHODOLOGY

100 female subjects between the age group of 15-45 years are selected from general population randomly. The subjects were informed about the procedure which had to be followed by them. Consent was taken. The study was conducted before lunch between 12 noon to 2 pm. After the completion of procedure fruit juice was offered to all subjects.

Inclusion Criteria:

- Normal healthy females aged 15-45 years

Exclusion Criteria:

- Obese
- Alcoholics
- Smokers
- Hypertensives
- Age below 15 and above 45 yrs
- Subjects taking any medication
- Subjects suffering from any medical illness.
- Women taking oral pills
- Menstruating women
- Diabetic individuals

Method of Collection of Data:

100 female subjects between the age group of 15 to 45 were selected randomly from general population. A pretested structured proforma was used to collect the relevant information. Subjects were familiarized with HUT procedure.

Preparation for Tilt Table Test (TTT) :

Generally, there was no eating or drinking 4-6 hours prior to the test to limit symptoms of nausea / vomiting. Manually operated tilt table with foot plate support is used. Additional straps are applied at the level of knee, waist and shoulders. The metal arc is attached to the table where holes are made at various angles. The table is locked at particular angles by the iron rod. The angles used were 30^0, 60^0, 80^0 for HUT.

ECG leads were fixed at right arm, left arm, left foot and right foot. ECG recordings were observed over the monitor. When normal lead II ECG was obtained, these recordings were saved for a duration of 5 minutes.

In supine position BP was recorded by using Sphygmomanometer. BP was recorded within 20 sec after the change in posture. Pulse rate is recorded by 5 min ECG. Respiratory rate was recorded for 1 minute. The table is tilted to 30degree, 60degree and 80degree HUT position. Before the change in the tilt angle the subject was brought to the supine position for 5 mins rest. The subject was asked for any symptoms such as nausea, sweatiness, pallor, light headedness, palpitation and fainting. Frequency domain analysis was done by using Niviqure software.

Repeated measures ANOVA will be used for analysis at different tilts. Followed by Tukeys post hoc test and paired ‘t’ test. Inter group comparisons will be done by unpaired ‘t’ test.

DISCUSSION

Orthostatic stress is commonly utilized to evaluate cardiovascular autonomic function. This typically involves the passive movement from a supine to head up tilt ,while cardiovascular parameters are measured. One of the most commonly used techniques for assumption of orthostatic stress is head up tilt. The most common tilt table testing protocol is one that incorporates an angle of 30^0, 60^0 and 80^0 head up tilting.[4]

In our study, heart rate increased linearly with increasing angle of head up tilt in females. The increase in heart rate was statistically significant ($p < 0.001$). The head up tilt reduces the intra-thoracic blood volume and shifts it in to the legs where it forms a pool, thereby producing a fall in blood pressure and a reduction in the circulating blood volume. Compensation to this is brought about by a reflex blood pressure and, venoconstriction which helps to limit the maintenance of the arterial pool in the legs, keeps up the pre-load, and is helped by the increased activity of the abdomino-thoracic respiratory pump, the pumping action of the leg muscles and the venous valves.During upright posture there is pooling of the blood in the lower parts of the body and low pressure in the carotid sinus. This removes stretch from baroreceptors leading to increase in heart rate through withdrawal of vagal tone initially followed by increased sympathetic activity which leads to sustained tachycardia. The initial heart rate was under vagal control with an immediate vagal withdrawal and increase in sympathetic activity. The increase in heart rate response to an upright posture was smaller in magnitude in women than in men. Similar findings were reported by many workers, Shanker Rao9, Johntuckman[10], David A Lewis [11]and M.B. Dikshit[12].

Posture and systolic blood pressure :

In the present study the mean systolic blood pressure decreased from supine to head up 30^0,60^0, and 80^0 position. On head up tilt the systolic blood pressure decreased on changing from recumbent to upright position on the tilt table. There is 20-30% shift of venous blood from the central to the peripheral compartment, 50% of change occurs within seconds and results in decreased cardiac filling pressure. The stroke volume is also decreased by 40%. This decreased afferent activity from the sensory baroreceptor and the heart rate rises are due to increasing sympathetic activity. The sympathetic vascular resistance and overall cardiac output drops by 20% only. The decrease in systolic blood pressure on head up tilt had a greater decrease in females than males. Similar findings were reported by Robert S[13], Maxime Lamarre[7], M.B. Dikshit[12], John Tuckman[10].

In our study there was increase in the diastolic blood pressure with increasing angle of head up tilt. The mean value showed a statistical significance ($p < 0.001$) On head up tilt there is increase in the sympathetic activity, increase in vascular tone and increase in peripheral resistance which leads to an increased diastolic blood pressure. Similar findings were reported by U.K. Mishra[8], Sabita Yograj[15], Tomi Lai Tinin[16], John Tuckman[10] and Zaidi[17], M.B. Dikshit[12], Mukai[18].

In our study the pulse pressure decreased on 30^0, 60^0 and 80^0 head up tilting in females. There was a significant decrease in the value ($p < 0.001$).

Pulse pressure is the difference between the systolic and the diastolic blood pressure. This is the pressure that maintains the normal pulsatile nature of the flow of blood in the vascular compartment. The pulsatile nature of the flow is required for the perfusion of the tissue.[19,20,21].

This decrease can be explained by the fact that, increase in diastolic blood pressure and decrease in systolic blood pressure, decreases the pulse pressure. Similar findings were reported by Jane Youde[22] and J. Kevin Shoemaker[5].

Mean arterial pressure and posture :

In the present study the mean arterial pressure increased on the upright posture in females. On head up tilt increase in the diastolic blood pressure and decrease in systolic pressure resulted an increase in the mean arterial pressure. The hydrostatic gradients with head up tilt reduce the distending pressure in carotid sinus resulting in a sympathoexcitatory stimulus. This reduction in carotid sinus distending pressure would partially be corrected by the increase in mean arterial pressure. Similar findings were also observed by Frey MA[3] .*The* mean arterial pressure increased more in males than in females at 60^0 head up tilt. Similar findings were also observed by J. Kevin Shoemaker[5].

This study concluded that with head up tilt there are changes in the cardiovascular parameters in females.

In conclusion, cardiovascular reflex effects can be

assessed using various postural stress tests effectively for physiological and clinical investigations in the field, by the patients bed side, or in the laboratory using more elaborate equipment. Physiologists, clinicians and medical students can make use of these tests to assess or understand cardiovascular reflex response in man in health or disease.

Parameters	Supine		30 Deg		60 Deg		80 Deg	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
HR (bts/min)	70.8	3.3	72.9	3.4	74.7	3.4	77.2	3.0
SBP(mm of Hg)	112.3	5.4	110.2	5.2	108.6	5.7	106.2	5.6
DBP(mm of Hg)	78.2	6.6	80.1	6.2	83.5	5.9	85.2	5.5
PP(mm of Hg)	34.5	7.0	30.0	6.8	25.0	7.7	21.0	6.8
MAP(mm of Hg)	89.1	9.8	89.9	5.0	91.7	4.6	92.2	4.4

Ethical Clearance- Taken from our college ethical clearance.committee

Source of Cunding- Self

Conflict of Interest- Nil

REFERENCES

1). Fritsch – Yelle JM, Charles JB, Jones MM, Beightol LA, Eckberg DL. Space flight alters autonomic regulation of arterial pressure in humans(1994). J Appl Physiol;77:1776-1783

2). Convertino VA. Gender differences in autonomic function associated with blood pressure regulation.(1998). Am J Physiol Regulatory Integrative Comp Physiol;275:1909-1920.

3) Frey MAB, Porth CM. Sex differences in response to orthostatic and other stresses(1990). Circulatory response to the upright posture, edited by Smith JJ.Boea Raton FL: CRC;141-167.

4). Esquivias GB, Rubio AM.(2003). Tilt table test state of the art. Indian ElectrophysiolJ Oct-Dec;3(4):1-13.

5). Shoemaker JK, Hogeman CS, Khan M, Kimmerly DS, SinowayLI(2001). Gender affects sympathetic and hemodynamic response to postural stress. Am J Physiol Heart Circ Physiol;281:H2028-H2035.

6). Leonelli FM, Wang K, Evans JM, Patwardhan AR, Ziegler MG, Natale A, et al. (2000).False positive head up tilt : Hemodynamic and neurohumoral profile. J Am Coll Cardiol;35:188-193.

7). Lamerre-Clench M, Cusson J. (2001).The fainting patient : Value of the head up right tilt table test in orthostatic intoleranceCMAJ;164(3).

8). Wieling W, Lieshout VJJ, HarkelTAD(1998).Dynamics of circulatory adjustements to head-up tilt and tilt-back in healthy and sympathetically denervated subjects.Clin Sci;94(4):347-352.

9). Rao S. Cardiovascular responses to head-stand posture(1963). J Appl Physiol;18(5):987-990.

10). Tuckman J, Shillingford (1966).Effect of different degrees of tilt on cardiac output, heart rate, and blood pressure in normal man. Br Heart J;28:32-38.

11). Iwasaki KI, Zhang R, Zuckerman JH, Pawelczyk JA, Levine BD. Effect of head-down-tilt bed rest and hypovolemia on dynamic regulation of heart rate and blood pressure.(2000) Am J PhysiolRegulIntegr Comp Physiol Dec;279(6): R2189-99.

12). Dikshit MB. Postural stress tests for the clinico-physiological evaluation of cardiovascular reflexes.(1987)Ind J PhysiolPharmac January-March;31(1):1-11

13). Green RS, Iglauer A, Scott RC.(1956)Pressor and depressor responses to tilting in hypertensive patients. Circulation Sept;XIV:407-411.

15). Y ograj S, Sadhu AK, Kalsotra L, Bhat AN, Arora A.(2004) Effect of graded head-up tilt and head-reverse tilt on the sympathetic nervous system versus parasympathetic nervous system. J ApplPhysiol September 6(3):144-148.

16). Laitinen T, Niskanen L, Geelen G, Lansimies E, Hartikainen J(2004).Age dependency of cardiovascular autonomic responses to head-up tilt in healthy subjects. J Appl Physiol;96:2333-2340.

17). Zaidi A, Benitiz D, Vohra A, Gaydecki PA, Fitzpatrick AP(1998).Haemodynamiceffects of increasing angle of Head up tilt. ClinSci Apr;94(4):347-52.

18). Mukai S, Hayano J. Heart rate and blood pressure variabilities during graded head-up tilt(1995). J ApplPhysiol Jan;78(1):212-6.

19). Guyton AC, Hall JE. Circulation. In: Textbook of medial physiology. 11th Ed. Philadelphia Saunders WB company; 2006. p.161-244.

20). GanongWF. Haemostasis in health and disease.

In: Review of Medical Physiology, 22nd ed. Mac Graw Hill; 2005. p. 630-631.

21). Berne RM, Levy MN. Regulation of heart beat. In: Textbook of physiology. 5th ed. 1993. p. 322-326.

22). Youde J, Panerai R, Gillies C, Potter J(2003). Reproduction of circulatory changes to head-up tilt in healthy elderly subjects. Age Ageing;32: 375-381.

23). Ramsey, Wiechmann M(1966). Effects of head-up tilt on mean arterial pressure, heart rate.and regional cardiac output distribution in aging rats. J Appl Physiol.

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Comparative Study of Visual Reaction Time in Males and Females of 17-20 Years Age Group

Shrikrishna N Bamne

Associate Professor, Department of Physiology, Index Medical College Hospital & Research Centre, Post Bhavlia Khurd, Nemawar Road, Indore (M.P.)

ABSTRACT

Background: Human reaction time denotes time taken by an individual to react to an external stimulus. The response obtained while measuring human reaction time is voluntary response obtained after training and is specific in nature. The purpose of this study was to find out whether the reaction time was faster for green light stimuli or red light stimuli. And to compare the visual human reaction times in males and females.

Material & method: In this study we had studied the time taken between applications of visual stimulus and response obtained and comparison of the response in male and female volunteer. In this study visual reaction time (VRT) was studied in 125 male & 125 female Medical students in the age group of 17-20 years. Subjects were presented with two visual stimuli i.e. green light & red light stimuli. Paired and unpaired't' test was used at appropriate places as a statistical test. The p value <0.05 was considered significant.

Result: Human reaction times to green light stimuli were lesser than human reaction times to red light stimuli in males as well as in females.

Conclusion: Green color evoked a faster response due to its stronger stimulation on the visual receptor than for red color in both male and female subjects.

Keywords*: visual reaction time,green light,red light,male,female.*

INTRODUCTION

Reaction time is crucial for our everyday lives and requires intact sensory skills, cognitive processing and motor performance. Reaction time measurement is an indirect index of processing capability of central nervous system and simple means of determining sensory motor association and performance of an individual [(1)]. Reaction time has physiological significance and is a simple and non - invasive test for peripheral as well as central neural structures [(2)]. It determines the alertness of a person because how quickly a person responds to a stimulus depends on his reaction time and therefore it must be lesser in certain occupation e.g. Drivers, sportsmen, pilots, military people, doctors, nursing staff, security guards. Various factors influencing human reaction time are age, left or right-hand, direct (central) versus peripheral vision, practice, fatigue, fasting, breathing cycle, personality types, exercise, and intelligence of the subject. Out of these various factors, in this study we had studied the time taken between application of visual stimulus and response obtained and comparison of the response in male and female volunteer. The human reaction time measurement had been made from the volunteers subjected to visual stimulus.

Corresponding author :
Shrikrishna N Bamne
Associate Professor, Department of Physiology, Index Medical College Hospital & Research Centre,
Post Bhavlia Khurd, Nemawar Road, Indore (M.P.)
Mobile No.: 09752532088
E-mail:shrikrishna_bamne@rediffmail.com

MATERIALS AND METHOD

Proper consent of volunteer students was taken (a) Inclusion Criteria: Students between 17-20 yrswere included in this study on the basis of physical

examination-normal sensory and motorexamination, students having no muscle diseases (i.e. Myasthenia gravis, periodic paralysis,polymyositis) and students having no neural diseases (i.e. poliomyelitis, polyneuropathy) were included in the test and Students having normal acuity of vision as tested by Snellen's test type and Jaeger's test type. Students having normal color perception as tested by Ischihara's chart.

(b) Exclusion Criteria: Students below 17 yrs and above 20 yrs age group, Students not having normal acuity of vision as tested by Snellen's test type and Jaeger's test type. Students not having normal color perception as tested by Ischihara's chart.

Students not having and students not having normal sensory and motor examination, and having muscular diseases and students having neural diseases were excluded from the test.

Study procedure

Study was carried out on the Medical students of Index Medical College Hospital & Research centre, Indore. 125 Male and 125 Female Medical students fulfilling inclusion criteria were included. The apparatus used in this study was Audio-Visual reaction timer. Proper consent of volunteer students was obtained before the procedure. Each individual wasexplained about the test & sufficient trials were givenfor proper understanding. All the subjects weresubjected to the tests in the dark room. The visual reaction time was noted during morning hours (10 am-12 pm).

i. The apparatus is designed to measure R. T. for 4 stimuli: Two sound stimuli and two light stimuli.

Two response alternatives are provided by two response keys. The chronoscope is built in to count the reaction time.

ii. Subjects were instructed to press the response button by the Rt. Index finger already on it to stop the clock as soon as he/she will see the green light/red light visual stimuli from digital display, reaction time was noted.

iii. Three readings of each stimulus taken & their respective average calculated.

A comparison were made between –

1. Visual reaction time to green light & red Light visual stimulus in males and females Separate.

2. Visual reaction time to green light & red light Visual stimulus between males and females.

Statistical analysis:

To test whether there was any significant difference in between males and females with reference to the study variables between the study groups, paired and unpaired 't' test was used at appropriate places as a statistical test. The p- value <0.05 was considered significant.

RESULTS

Visual human reaction time was studied in 250 medical students of Index Medical College Hospital & Research Centre, Indor who formed the study group and out of which 125 were male students, and 125 were

Female students. The range of age was from 17-20 years. The results were tabulated and statistically analyzed. To test whether there was any significant difference in between males and females with reference to the study variables between the study groups, paired 't'and unpaired' test was used at appropriate places as a statistical test.

From Table No. I

i. T he VRT to green light stimuli male was 192.77±9.92 and the VRT to Red light stimuli in male was 203.79±9.54. TheVRT to red light stimuli in male was more than the VRT to green light stimuli in male and the difference between two were found statistically significant in case of males (P = 0.000).

ii. The VRT to green light stimuli in female was 202.00±10.18 and the VRT to red light stimuli in female was 211.71±8.82. The VRT to red light stimuli in female was more than the VRT to green light stimuli in female and the difference between two were found statistically significant in case of female (P = 0.000).

iii. The VRT to green light stimuli in males was192.77±9.92 and the VRT to green light stimuli in females was 202.00±10.18. TheVRT to green light stimuli in female was more than the VRT to green light stimuli in male and the difference between two were found statistically significant in case of (P = 0.000).

iv. The VRT to red light stimuli in males was 203.79±9.54and the VRT to red light stimuli in females was 211.71±8.82. The VRT to red light stimuli in females

was more than the VRT to red light stimuli in males and the difference between two were found to be statistically significant (P = 0.000).

Table No. 1: Measurement of VRT to green light & red light in males & females.

	Sex	N	VRT (in milliseconds)	P value
Green Light	Male	125	192.77±9.92	0.00*
	Female	125	202.00±10.18	0.00*
Red Light	Male	125	203.79±9.54	0.00*
	Female	125	211.71±8.82	0.00*

(Data presented are mean ±SD,*p<0.05=significant, VRT=Visual reaction time)

DISCUSSION

In the present study, it has been observed that females had a longer reaction time when compared to males. Retention of water and sodium due to variation in sex steroid levels during menstrual cycles might influence the process of axonal conduction time and availability of neurotransmitter at the synaptic level; changes in either of these two processes might cause conduction time to vary during menstrual cycle [3, 4]. The literature is replete with reports of patients suffering from severe premenstrual fluid accumulation sometimes even up to 10pounds in weight gain. The degree of premenstrual weight gain is reported to correlate with degree of various premenstrual neurological symptomatologies in many cases. This may be the cause of prolongation of visual reaction time in the present study, since reaction time indicates the minimum time taken by an individual to react to an external stimulus and is an indirect index of processing capability of central nervous system and sensory motor association. Green color evoked a faster response due to its stronger stimulation on the visual receptor than for red color in both male and female subjects [5]. The corpuscular theory of light, proposed by Max Plank explains the relationship between the wavelength and the energy carried by different colored lights. It indicates that one quantum of red light has the maximum wavelength and hence carries the least energy. The green light of same quantum has shorter wavelength and carries greater energy than red light. The greater energy carried by green light could be an important factor in stimulating the visual receptors faster, when compared to red light, producing a shorter response time [5]. The maximum sensitivity of scoptopic vision is approximately 500 nm i.e. for bluish – green light. This shows that red color (650-750 nm) is not at all sensitive to dim light. Thus in dim light, if blue and red colors need to be compared, blue can be made out easily. Likewise maximum sensitivity of photopic vision is about 560 nm i.e., for greenish –yellow light. Thus, in conclusion, human reaction time in females is more as compared to males and reaction time to red light stimuli is more as compared to green light stimuli in both sexes.

Ethical Clearance: as this is non invasive method no ethical aspects involved, still permission taken from ethical committe of index medical college.

Funding: Self

Conflict of Interest: Nil

REFERENCES

1. Das S, Gandhi A, Modal S. Effect of pre-menstrual stress on audiovisual reaction time & audiogram.Ind J Physiol Pharmacol 1997; 41: 67–70.
2. Mohan M, Thombre DP, Das AK, Subramanian N, Chandrasekar S. Reaction time in clinical diabetes Mellitus. Ind J Physiol Pharmacol 1984;28: 311–314.
3. Bruce J, Russell GFM. Premenstrual Tension: A study of weight changes and balances of Na+,water and potassium. Lancet 1962; 11: 267–271.
4. Asmita S Nene, Pushpa A Pazare. A study of auditory reaction time in different phases of the normal menstrual cycle. Ind J Physiol Pharmacol 2010; 54: 386–390.
5. Venkatesh D, Ramachandra DL, Baboo NS.Impact of psychological stress, gender and colour on visual response latency. Ind J Physiol Pharmacol 2002; 16: 333–337.

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Gender Differences and Anthropometric Variables in Prehypertensive Young Individuals

Subathra S[1], Neelambikai N[2]

[1]Assistant Professor, Physiology, Stanley Medical College, Chennai, [2] Professor & HOD, Physiology, Coimbatore Medical College, Coimbatore

ABSTRACT

Background & Aim: Prehypertension is a complex, multifaceted disease which is a risk factor for overt hypertension and increases the risk for coronary heart disease , stroke and other vascular complications. Lifestyle changes taking place with a stunning speed are favourable to the onset of prehypertension in young individuals itself. We aimed to assess the prevalence of prehypertension in young individuals and analyse the gender differences in the prevalence of prehypertension . The association of prehypertension with anthropometric parameters was also assessed. **Method:** In this cross-sectional study 250 males and 250 females were recruited from the College students of Coimbatore city. A detailed history was collected. Weight, height, waist circumference , hip circumference were recorded. From these parameters Body mass index and Waist Hip ratio were calculated. Blood pressure was recorded using a standardised mercury sphygmomanometer. **Results:** 15.6% of the study group were Prehypertensives. The prevalence of Prehypertension was more among males than females. Individuals with higher body mass index, waist circumference and waist hip ratio were at a greater risk of developing prehypertension. **Conclusion:** We conclude that by screening for and detecting prehypertension at an early age, patients can be advised regarding control of their blood pressure , change of lifestyle and prevention of progression to hypertension.

Keywords: *Prehypertension , Body mass index, Waist Hip ratio.*

INTRODUCTION

Non Communicable diseases like Cardiovascular diseases, cancers, diabetes, chronic respiratory diseases, and mental disorders now impose their greatest burden on low- and middle-income countries. Cardiovascular disease is one of the leading causes of death. Elevated arterial pressure is the commonest cardiovascular disorder posing a major public challenge to the population[1]. Patients with blood pressure above optimal levels (systolic BP 120 -139 mmHg and / or diastolic BP 80 – 89 mmHg), but not clinical hypertension are defined as having prehypertension[2]. Prevalence of prehypertension is showing an upward trend in most countries , that too in younger individuals . About 7% of those with prehypertension progress to develop hypertension per year. It increases the risk for coronary heart disease, stroke and other vascular complications. Studies targeting younger age group would provide an estimate of the future magnitude of the problem and assist in developing strategies for control of prehypertension.

Hence in this study we aimed to assess the prevalence of prehypertension in young individuals, to compare the prevalence of prehypertension in males and females and to study the association of prehypertension with body mass index, waist circumference and waist hip ratio.

MATERIALS AND METHOD

Ethical clearance was obtained from Institutional Ethical Committee. Participation in the test was voluntary and informed consent was obtained from all participants.

Corresponding author:
Dr. S Subathra M.D.
Assistant Professor in Physiology, Stanley Medical College, Chennai. Mobile No: 8939235977
E mail id: s_subathra@yahoo.com

This is a cross sectional comparative study. This study was conducted in the Department of Physiology, Coimbatore Medical College, Coimbatore. A total of 500 subjects were included in the study of which 250 were males and 250 were females. They were of 18 – 23 years age group. The study subjects were randomly selected from the students of Coimbatore Medical College. The study subjects of both the sexes were divided into two groups based on their sex. Each group was subdivided into two based on their BP into two subgroups as follows. **Group I_A –** Prehypertensive males , **Group I_B** – Normotensive males, **Group II_A –** Prehypertensive females , **Group II_B –** Normotensive females. Known hypertensives, Known cardiac patients, Acutely ill patients were excluded from the study.

A detailed history was recorded from the study subjects. Thorough clinical examination was done. The participants were instructed to wear light clothing during their study visit. During anthropometric measurements the participants were instructed to stand erect with abdomen relaxed, arms at their side and feet together. Weight (in kilograms) was recorded using standard weighing machine. Height (in centimeters) was measured in standing and erect posture using a stadiometer. Body Mass Index (in kg/m^2) was calculated as the ratio of weight and square of Height in meters, using Quetelet Index. Normal cutoff value for BMI is 23 kg/m^2 men and women in Asian adults[3]. Waist circumference (in centimeters) was measured at the narrowest circumference between the bottom of the rib cage and top of the iliac crest, following normal expiration. Normal values in females < 80 cm, males < 90 cm^3 .Hip circumference (in centimeters) was measured at the largest point between the iliac crest and the symphysis pubis. The ratio of measured waist and hip circumference was taken as the Waist Hip ratio of that individual. Normal values in females ≤ 0.81 , males ≤ 0.88[4].

A standardized mercury sphygmomanometer , stethoscope , BP cuff of appropriate size were used to measure the blood pressure. BP was recorded in the right arm in sitting posture after 5 minutes of rest. The first and fifth korotkoff sounds were recorded as systolic BP and diastolic BP. Three recordings of BP were taken on three consecutive days. Average of the three readings was taken as the blood pressure of the subject[5].

RESULTS

We compared the prevalence of prehypertension among Group I and Group II. Prevalence of prehypertension is 15.6% in the study group . It is higher in males compared to females. Prehypertensive males and females had significantly higher levels of body mass index, waist hip ratio and waist circumference compared to normotensive males and females respectively.

Figure – 1: Comparison of prevalence of Prehypertension in males and females

Table 1: Blood pressure in prehypertensive and normotensive males

Variable	Group I_A (n=49)	Group I_B (n=201)	P value
SBP	124.79 ± 6.00	108.72 ± 6.54	<0.0001*
DBP	80.02 ± 4.71	72.69± 4.40	<0.0001*

Table 2: Blood pressure in prehypertensive and normotensive females

Variable	Group I_A (n=29)	Group I_B (n=221)	P value
SBP	118.63± 6.95	103.5± 7.75	<0.0001*
DBP	80.48± 4.85	68.88± 5.00	<0.0001*

Table 3: Comparison of anthropometric parameters in prehypertensive and normotensive males

Variable	Group I_A (Mean±SD)	Group I_B (Mean±SD)	p value
BMI	23.05 ± 2.96	21.38 ± 2.2	0.022*
WHR	0.84± 0.05	0.82 ± 0.04	0.01*
WC	78.39 ± 8.89	74.59 ± 6.90	0.004*

Table 4: Comparison of anthropometric parameters in prehypertensive and normotensive females

Variable	Group II_A (Mean±SD)	Group II_B (Mean±SD)	p value
BMI	23.67± 3.10	21.28±2.69	0.0001*
WHR	0.77 ± 0.04	0.76± 0.03	0.001*
WC	75.45± 8.27	69.67±7.96	0.001*

DISCUSSION

Prevalence of prehypertension in the current study was 15.6%. The prevalence rates estimated range from 14.5% in Turkish adults[6], 32.3% in affluent North Indian population[7], 47 % in rural adult people in China[8] and 54.1% in Omani adults[8]. Prevalence of prehypertension was higher in males (19.6%) compared to females (11.6%). This finding of higher blood pressure in men compared to women have been reported in the other studies[7,8,9] .This appears to be due to the protective effect of estrogen. Estrogen has a direct effect on blood vessel endothelial cells resulting in immediate vasodilation mediated by estrogen receptors. It exerts an antiarteriosclerotic effect on blood vessels[10].

Those with prehypertension had increased body mass index and waist hip ratio compared to normotensives[7,11]. BMI is the strongest modifiable predictor of prehypertension[12]. Being overweight was associated with a definite higher risk of developing prehypertension[9,13]. Obesity is characterized by increase in total blood volume and cardiac output. Elevated cardiac output appears to be required to support the excessive metabolic needs of adipose tissue . This leads to elevated arterial pressure[5]. The long term effect of weight control has substantiated that weight reduction could lower the odds of hypertension by 77% , so losing weight is necessary for prehypertension people[14].

CONCLUSION

The current analysis suggests that 15.6% of the group is already at risk for future cardiovascular disease. As a large proportion of people with prehypertension progress to clinical hypertension, targeting these people with effective public health education and early life – style modification interventions aimed at healthy dietary habits , weight loss and increased physical activity can provide important long-term benefits . Conscientious counselling and patient education may forestall the need for pharmacologic measures intended to reduce coronary risk[5].

Conflict of Interest : Nil

Source of Funding : Self

REFERENCES

1. Park.K. Park's Textbook of Preventive and Social Medicine. 20th Edn.,323- 326.
2. Chobanian AV et al. The Seventh Report of the Joint National Committee on Prevention, Detection , Evaluation and Treatment of High Blood Pressure: the JNC 7 report. JAMA. 2003 ; 289(19): 2560-72.
3. Snehalatha C et al. Cutoff Values for Normal Anthropometric Variables in Asian Indian Adults. Diabetes Care. 2003; 26 (5): 1380-84.
4. Misra A et al. Waist circumference cutoff points and action levels for Asian Indians for identification of abdominal obesity. International Journal of Obesity. 2006;30:106–111.
5. Fauci KB, Jameson HL. Harrison's Principles of Internal Medicine.16th Edn., 1425 – 26,1465.
6. Erem C et al. Prevalence of prehypertension and hypertension and associated risk factors among Turkish adults: Trabzon Hypertension Study. J Public Health(Oxf). 2009 ; 1(1): 47-58.
7. Yadav S et al. Prevalence & risk factors of prehypertension & hypertension in an affluent north Indian population . Indian J Med Res. December 2008; 128: 712-720.
8. Sun ZQ et al. Prevalence and risk factors of the Rural adult people Prehypertension status in Liaoning Province of China. Circ J 2007; 71**:** 550 - 553.
9. Shyam S Ganguly et al. Prevalence of Prehypertension and associated Cardiovascular risk profiles among Prediabetic Omani adults. BMC Public Health. 2008; 8:108.
10. Jonathan S.Berek. Novak's Gynecology . 13th edn. 2002. P.1124-25.

11. Natali A et al. Metabolic characteristics of prehypertension: role of classification criteria and gender. J Hypertens. 2009 Dec;27(12): 2394-402.
12. Israeli E et al. Prehypertension and obesity in adolescents: a population study. Am J Hypertens 2006;19(7): 708-12.
13. James E Rohrer et al. Obesity and pre-hypertension in family medicine: Implications for quality improvement. BMC Health Services Research .2007; 7: 212.
14. Jiang He et al. Long-Term Effects of Weight Loss and Dietary Sodium Reduction on Incidence of Hypertension. *Hypertens.* 2000;35:544.

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Comparison of Blood Pressure Readings, Recorded by Different Measuring Devices

Madhura V Motagi[1], Bindu C B[2]

[1]Associate Professor, Dept of Physiology, Subbaiah Institute of Medical Sciences,
[2]Professor, Dept of Physiology, Amala Institute of Medical Sciences, Thrissur - Kerala

ABSTRACT

Aim- Aim of our study is to measure the BP by using all the three devices to find out the standard difference of BP between them. **Objectives-** Comparison of BP recordings, measured using mercury Sphygmomanometer, aneroid Sphygmomanometer and automated devices. **Material and method**- the study was conducted on normal healthy subjects between the age group of 18 to 25 years (MBBS and NURSING students) of Amala Medical sciences Kerala. We recorded the BP of all the healthy subjects using three different BP measuring devices (mercury, aneroid and automated BP apparatus) with gap of 5 minutes between the readings. **Statistical analysis**- independent "t" test was used for the analysis. **Results**-there was a significant difference ($p<0.0001$) among the SBPs and DBPs recorded by all the three devices except SBP of mercury and automated were the significant difference was less ($p<0.05$). **Conclusion**- After comparing the SBP and DBP by above three devices, we concluded that mercury shows higher reading compared to aneroid and automated devices and aneroid is showing lower values compared to mercury and automated.

Keywords: *Blood pressure, mercury sphygmomanometer, aneroid sphygmomanometer, automated BP device.*

INTRODUCTION

As we all know that blood pressure (BP) is a lateral pressure exerted by the moving column of blood on the walls of vessels. There are so many physiological factors like age, gender, meals, emotions, diurnal variation, climatic temperature, exercise, bladder distension, back ground noise, gravity posture etc, will affect BP[1]. From the beginning we know that effect gravity is one of the important factor, which affects BP. For every 'cm' below or above the heart level pressure increases or decreases by 0.77mmHg[2]. We always assume that sitting and supine BP readings are almost equivalent, as BP measurement is done in sitting positions in some clinics and in supine by most of the physicians, since they are often regarded as equivalent, but they are not[3]. Body posture is also one important factor, when measured in healthy individuals BP, drops on standing compared to sitting, supine and supine with crossed legs [4]. Another factor which will affect the BP measurement is type of device which we use to measure for example, manual Sphygmomanometer, Aneroid and the automated. From the beginning it is said that mercury Sphygmomanometer is the gold standard [5,6,7], though there are some limiting factors like subject bias, harmful effect of mercury[8, 9] and chances of getting White coat hypertension[10] office induced hypertension[11], but advantage is more accurate recording [6,12].On other hand if we see the aneroid Sphygmomanometer, limiting factors are, they are less accurate, need more maintenance and validated for accuracy against a standard mercury manometer at 6 months interval[13] ,advantage is inexpensive and portable and no harmful effect of mercury[14]. Automated devices although there is no subject bias, beat to beat measurement of BP, less chance of white coat hypertension, [10,11] still they also have limitations to use like they may fail to obtain the reading in conditions like in shock, patients having muscle tremors and abnormal heart rhythms and also the skill of measuring manual BP will be lost by the clinical staff [5]. Many studies have been done on these devices where they compared manual mercury Sphygmomanometer with aneroid Sphygmomanometer, some studies felt mercury Sphygmomanometer is better

Corresponding author :
Dr. Madhura V Motagi
Associate Professor, Dept of Physiology, Subbaiah Institute of Medical Sciences
E-mail: madhura.mv@ gmail.com, Mob.: 8943877358

[12] and some felt aneroid Sphygmomanometer is better [9,14] other studies compared mercury with Automated, in their study automated devices were better [10,11]. No study has compared automated with aneroid .Aim of our study is to measure the BP by using all the three devices to find out the standard difference of BP between them.

Objectives

1. Comparison of BP recordings, measured using mercury Sphygmomanometer, aneroid Sphygmomanometer and automated devices

METHOD

It is a descriptive comparative study:

The study was conducted on normal healthy subjects between the age group of 18 to 25 years (MBBS and NURSING students) of Amala Institute Medical Sciences Kerala. Before the start of study, detail explanation of the study protocol was explained to all the student volunteers and informed consent was taken.

Inclusion criteria- both boys and girls between the age group of 18 to 25 years

Exclusion criteria- those who are suffering from both acute and chronic diseases, hypertension, diabetes, and cardiac diseases.

Protocol

Student volunteers were asked to come to Physiology lab during the afternoon between 3.30 to 4pm, their Height (Ht), weight (Wt) was taken, Body mass index (BMI) was calculated. Posture and position of the arm during BP measurement routinely followed as, Subject was in supine position, back was supported, legs were uncrossed, subject was completely relaxed, measuring of BP was done after 5 to 10 min of rest [15] , 5 to 7 subjects were asked to come in a day (depending on student's free time, if 7 students come, they were numbered from 1 to 7, if 10 come, they were numbered from 1 to 10), all had taken rest for 5 min, first on subject numbered 1, mercury sphygmomanometer cuff was tied on right arm, which is kept at the level of the heart, then SBP and DBP by auscultatory method was recorded, then same procedure was followed on remaining subjects with same instrument by the same person. At the end of 7th subject reading, Ist subject would have rested for more than 5 min, so then we have recorded BP using aneroid sphygmomanometer and noted SBP and DBP for all subjects one after the other using same aneroid instrument by the same person. Then last reading is by using automated device. Here again by the time we finished aneroid BP measurement for 7th subject, Ist subject would have rested for more than 5 min, then we took both SBP and DBP for all subjects one after the other using same automated device.

As the order of measurement was first mercury, second was aneroid, so just to avoid time bias, pilot study was done on 72 subjects, half with the reverse order of recording (first with aneroid and then with mercury). Statistical analysis showed there is no time bias.

Mercury Sphygmomanometer - This includes a mercury manometer, an upper arm cuff, a hand inflation bulb with a pressure control valve and requires the use of a stethoscope to listen to the Korotkoff sounds. Relies on the auscultatory technique. Instrument used was from Diamond.

Aneroid Sphygmomanometer - As for a mercury sphygmomanometer, except an aneroid gauge replaces the mercury manometer. The aneroid gauge may be desk mounted or attached to the hand bulb. Relies on the auscultatory technique. Instrument used was from Diamond Dial deluxe blood pressure apparatus.

Automated Device - This includes an electronic monitor with a pressure sensor, a digital display and an upper arm cuff. An electrically driven pump raises the pressure in the cuff. Devices may have a user-adjustable set inflation pressure or they will automatically inflate to the appropriate level, about 30 mmHg above the predicted systolic reading. On operation of the start button the device automatically inflates and deflates the cuff and displays the systolic and diastolic values. Pulse rate may also be displayed. Devices may also have a memory facility that stores the last measurement or up to 10 or more previous readings. Battery powered. Uses the oscillometric technique. Instrument used here was OMRON HEM-713 which is passed by AAMI=Association for the Advancement of Medical Instrumentation and recommended by BHS=British Hypertension Society [16].

STATISTICAL ANALYSIS

Sample size was calculated using SD of DBP from previous study, SD of DBP one device was 9.7 mmHg

and by other device was 9.33 mmHg, mean difference was 2.36, alpha - 5 %, power 80%, around 434 sample size according to calculation.

RESULTS

Independent t test

SBP: Table 1

Group	N	Mean	Std. Deviation	p value
Mercury	418	104.48	9.313	0.0001
Aneroid	418	99.70	10.810	

SBP: Table 2

Group	N	Mean	Std. Deviation	p value
Mercury	418	104.48	9.313	0.055
Automated	418	103.19	10.180	

SBP: Table 3

Group	N	Mean	Std. Deviation	p value
Aneroid	418	99.70	10.810	0.0001
Automated	418	103.19	10.180	

DBP:Table 4

Group	N	Mean	Std. Deviation	p value
Mercury	418	68.34	7.167	0.0001
Aneroid	418	63.57	6.173	

DBP:Table 5

Group	N	Mean	Std. Deviation	p value
Mercury	418	68.34	7.167	0.0001
Automated	418	64.57	6.603	

DBP:Table 6

Group	N	Mean	Std. Deviation	p value
Aneroid	418	63.57	6.173	0.024
Automated	418	64.57	6.603	

Table:7: Manual HR & Automated HR

Group	N	Mean	Std. Deviation	Std. Error Mean	p value
Manual HR	418	74.41	8.646	.423	0.847
Automated HR	418	74.28	10.937	.535	

Table: 8: Correlation with BMI

Variable	Pearson Correlation coefficient(r)	p value
Mercury SBP	0.246	0.0001
Mercury DBP	0.224	0.0001
Aneroid SBP	0.287	0.0001
Aneroid DBP	0.306	0.0001
Automated SBP	0.303	0.0001
Automated DBP	0.198	0.0001
Manual HR	-0.086	0.079
Automated HR	-0.078	0.111

DISCUSSION

As per the results done by statistical analysis using independent T test, it is clear from the tables 1 to 6(except table 2) there is significant difference of SBP and DBP readings recorded by the all three different devices. From the table 1 and table 4 it is clear that mercury device is showing significantly higher values in both SBP and DBP compared to aneroid which is comparable to other studies [14]. From the table 2 and 5, mercury device showed higher values in both SBP and DBP compared to automated which is comparable to previous study results [11], but only DBP is significant. From the table 3 and 6, automated showed significantly higher value compared to aneroid in both SBP and DBP. So over all mercury is showing higher values compared to aneroid and automated and aneroid is showing lower values compared to mercury and automated. These SBP and DBP values are statistically significant with the mean difference of 2, not clinically. Further studies have to be done for clinical significance keeping the mean difference of 5.

While taking these reading, with two students who found to be having higher readings for both SBP and

DBP by mercury (140/90), aneroid (142/84) but didn't show the same range with automated device (124/70), so it is not clear weather automated device will be helpful to identify the BP of individuals who are likely to be hypertensive. Advantage of automated device is According to previous studies automated will reduce the office induced hypertension [10, 11] and also they have memory for at least some 10 previous readings, but for consumers, whether medical or lay, accuracy should be of prime importance when selecting a device to measure blood pressure [16].

As in table 7 we compared manual to automated HR, there is no significant difference between them.

Pearson correlation was done with BMI as we can see in table 8, there is a significant correlation showing as the BMI increases there is increase in both SBP and DBP by all the three different devices.

In this study we tried to avoid biases like investigator bias as same person has taken all the readings, time bias, posture was also in supine for all subjects.

CONCLUSION

After comparing the SBP and DBP by above three devices, we concluded that mercury shows higher reading compared to aneroid and automated devices and aneroid is showing lower values compared to mercury and automated.

Conflict of Interest – Nil

Source of Funding- Self

Ethical Clearance – Got from institutional ethics committee

REFERENCES

1. Pickering TG, Hall JE, Appel LJ, Falkner BE, Graves J. Martha N. Hill MN. Recommendations for Blood Pressure Measurement in Humans and Experimental Animals Part 1: Blood Pressure Measurement in Humans A Statement for Professionals From the Subcommittee of Professional and Public Education of the American Heart Association Council on High Blood Pressure Research Circulation. 2005;111:697-716.
2. Khurana I. Text book of medical Physiology. Ist ed. Noida. Elsevier. 2006
3. Netea RT, Lenders JW, Smits P, Thien T. Both body and arm position significantly influence blood pressure measurement. J Hum Hypertens. 2003 Jul;17(7):459-62.
4. Eşer I, Khorshid L, Güneş UY, Demir Y. The effect of different body positions on blood pressure. J Clin Nurs. 2007 Jan;16(1):137-40
5. Blood Pressure Measurement Devices -Mercury and Non-mercury DB2000/3(NI) NOVEMBER 2000
6. Kevin E. ABC of blood pressure measurement British medical journal 1979
7. O'Brien E, Fitzgerald D. The history of blood pressure measurement. J Hum Hypertens 1994; 8: 73–84.
8. Ide CW. Demise of the mercury manometer [letter]. Scott Med J 1998; 43: 87–88.
9. Vincent CJ, Jensen PL, schwatz GL. Are aneroid sphygmomanometers accurate in hospital and clinical setting? Ach intern med 2001:161;729-31
10. Myers MG Godwin M ,Dawes M, Kiss A, Tobe SW, Kaczorowski J. Conventional versus auto mated measurement of blood pressure in primary care patient s with systolic hypertension: randomized parallel design controlled trial J BMJ 2011;342: d286
11. Myers MG, Godwin M, Dawes M, Kiss A, Tobe SW, Kaczorowski J. Conventional versus automated measurement of blood pressure in the office (CAMBO) trial Family Practice 2012; 29: 376–382
12. Burke MJ, Towers HM , Malley KO, Fitzgerald DJ, brien ETO. Sphygmomanometers in hospital and family practice: British medical journal 1982 vol: (285) 489-491
13. Bailey H, Bauer JH. Review of common errors in t he indirect measurement of blood pressure. Sphygmomanometry. Arch Intern med 1993;153: 2741-2748
14. Saxena1Y, Saxena V, Gupta R. Clinical validation of aneroid sphygmomanometer Indian j physiol pharmacol 2012; 56(3) : 255–261
15. O'Brien E measurement of blood pressure. LIP-04.qxd 8/18/06
16. O'Brien E, Waeber B, Parati G, Staessen J, Myers MG. Blood pressure measuring devices: recommendations of the European Society of Hypertension BMJ 2001;322:531–6.

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Variation of ABO and RH Blood Groups among Male and Female Medical Students of KIMS, Hubli, Karnataka, India

Varsha M Shindhe[1], Maheshkumar M Shindhe[2] ,Venkappa S Mantur[3], Kammar K F[4]

[1]Assistant Professor, Department of Physiology, Jawaharlal Nehru Medical College, Belagavi, Karnataka,
[2]Assistant Professor, Departments of Community Medicine, Belgaum Institute Medical Science, Belagavi, Karnataka,
[3]Senior Lecturer, Dept. of Physiology USM-KLE International Medical College, Belagavi Karnataka,
[4]Principal Professor and Head of Department of Physiology, Karnataka Institute of Medical Science, Hubli, Karnataka.

ABSTRACT

Background and objective: Knowledge of distribution of ABO and Rh blood groups is useful in health care planning, appropriate allocation of resources and also certain diseases or malignancies have predilection for certain blood groups. This study is aimed to determine frequency distribution of ABO and Rh blood groups as well as to determine the trend of prevalence of blood groups among medical students of KIMS, Hubli. **Materials and method**- This observational cross sectional study was done at department of physiology (haematology Lab) KIMS, Hubli, Karnataka, South India. A total 524 medical students, out of which 359 males and 165 females in the age group of 18-21 years were randomly selected for the study. **Results-** Statistical analysis was done using Chi-square test to determine statistical significance at "p" value of < 0.05. The distribution of ABO blood groups follow following pattern: O=34.92%, B=27.86% A =25.19%, AB=12.02% .There is no statistical significant relationship between male and female students in their blood groups.

Conclusion- Among our medical students O +ve and O-ve are most common and AB+ve and AB -ve are least common. Rh positive blood group seen in 94.9% of the students. Only 5.1 % of the students in our study group were Rh negative. Among Males 95.26% are Rh positive and 4.73% are negative. Among females 93.93% are Rh positive and 6.06% are negative.

Keywords*: ABO and Rhesus blood group, medical students,*

INTRODUCTION

Clinically the most important blood groups to be considered are ABO and Rhesus blood groups[1] .Knowledge of distribution of ABO and Rh groups is useful in health care planning, appropriate allocation of resources and also certain diseases or malignancies have predilection for certain blood groups[2]. The discovery of ABO blood groups by Karl Landsteiner was done in 1901[3]. Forty years later both Landsteiner and weiner discovered Rh D antigen[4]. Rhesus blood group system is the second most important blood group system due to its immunogenicty in Rhesus negative individuals in blood transfusion or pregnancy[5]. In order to avoid transfusion reaction and death related to it the single most important test performed in blood bank is to determine ABO blood groups[6]. These days, to eliminate the risk of transfusion reactions, the practice of autologous transfusion is followed by most of the physicians[7].

Based on the presence or absence of these inherited antigenic substances on the surface of RBCs individuals are divided into 4 major blood groups. A, B, AB and O in ABO system and Rh positive and Rh negative in Rh system (world edge), these antigens are complex oligosaccharides that differ in their terminal sugar[8]. On red cells these are mainly glycosphingolipids whereas in other tissues these are glycoproteins[9]

In addition to blood these antigens are found in many tissues that include salivary glands, saliva, pancreas, kidney, liver, lungs, testes and amniotic fluid [10].

The distribution of ABO and Rh blood groups varies in populations throughout the world. Previous literatures have found that the distribution of ABO and Rh blood groups varies from race to race. Studies conducted on western Europeans have shown the following observations-42%-group A , 9% group B,3% group

AB, and remaining 46% group O majority of eastern Europeans have a higher proportion of group B of up to 40% americans generally have frequencies of A ,B, AB and O blood groups of 41%, 10%, 4% and 45% respectively reports also indicate that although 85% of the Caucasians are Rh positive and 15% Rh negative over 99% of Asians are Rh positive[11]

By observing the above mentioned facts we were interested in finding the distribution of ABO and Rh blood groups among the students at our medical college KIMS, Hubli as the distribution pattern has not been studied extensively in this part of Karnataka (north Karnataka), and further to prepare a database for the blood bank of this institution and also to create awareness as who is exposed to which of the disease.

MATERIALS AND METHOD

This observational cross sectional study was conducted at department of physiology (haematology Lab) KIMS, Hubli, Karnataka, South India from july 2012 to sep 2012. A total 524 medical students from first to fourth year, out of which 359 were males and 165 were females were included in the study. Both males and females in the age group of 18-21 years were selected randomly for the study. An informed written consent was taken from all the students prior to the test. The sample blood was collected by finger prick method. The ABO and rhesus grouping was done by the tile method. A drop of blood from each student was diluted with 0.9% normal saline. This blood diluted with normal saline was transferred to three clean glass slides. These slides were labeled as A slide, B slide, D slide. A drop of monoclonal reagent anti A, anti B, and anti D were added to the drop of blood on these slides respectively with the help of separate droppers. Both blood and antisera were mixed well with the help of separate smooth glass rods. Results of agglutination were recorded immediately. Blood groups were determined on the basis of haemagglutination. Micro-agglutination was confirmed under the microscope.

STATISTICAL ANALYSIS

Statistical analysis was done using Chi-square test to determine statistical significance at p value of < 0.05.

RESULTS

Among 524, 359 were males and 165 were female medical students. The distribution of ABO blood group follows following pattern: O=34.92%, B=27.86% A =25.19%, AB=12.02%.

There is no statistical relationship between male and female students in their blood groups.

Table No: 01 Distribution of ABO associated with Rh positivity or negativity is as follows:

Blood group	No of students	% of students
O+ve	172	32.82
O-ve	11	2.09
B+ve	136	25.95
B-ve	10	1.9
A+ve	128	24.42
A-ve	4	0.76
AB+ve	61	11.64
AB-ve	2	0.38
	524	100

Table No: 02 ABO Blood Group Distribution among the Students (n = 524).

Sex	Blood group A	Blood group B	Blood group AB	Blood group 0	TOTAL
Male	94 (17.93%)	99(18.89%)	42 (8.01%)	124 (23.66%)	359
Female	38 (7.25%)	47 (8.96%)	21(4%)	59(11.25%)	165
Total	**132(25.19%)**	**146 (27.85%)**	**63 (12.01%)**	**183(34.91%)**	**524**

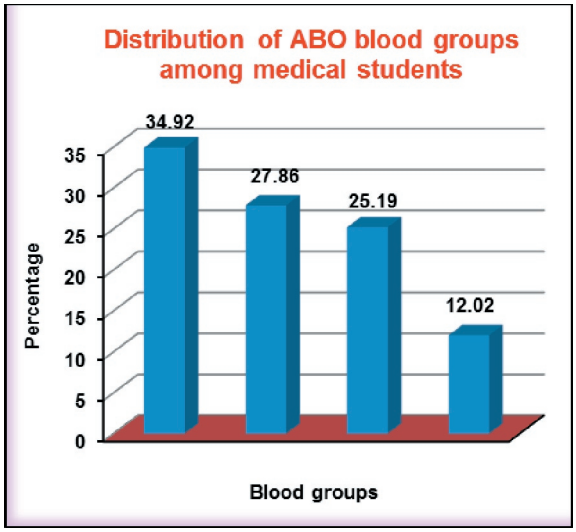
There is no significant relationship between male and female students in their blood group. Chi-square value = 0.415 and P-value = 0.9372 which is greater than 0.05.

Table No: 03 Rh blood group distribution among the Students (n = 524).

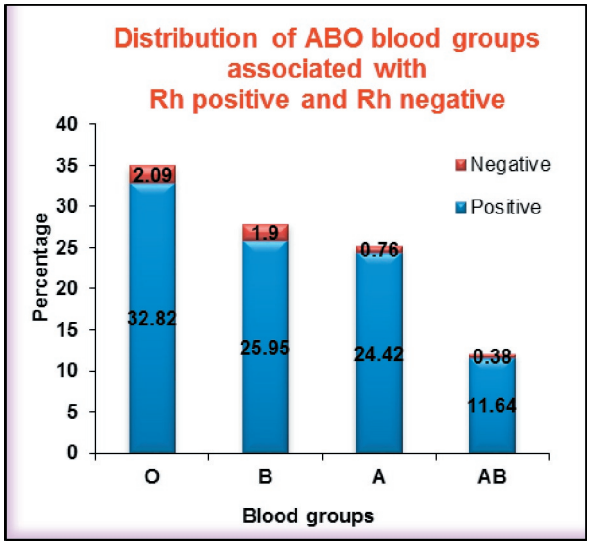
ABO Blood Group	*Rh Positive	* Rh Negative
A	128 (24.42%)	4 (0.76%)
B	136 (25.95%)	10(1.90%)
AB	61 (11.64%)	2(0.38%)
O	172 (32.82%)	11 (2.09%)
Total	497 (94.83%)	27 (5.13%)

* There is no significant difference between Rhesus positive and Rhesus negative students.

At p value >0.05 chi square value 2.849



Graph No: 01 Distribution of ABO blood groups



Graph No: 02 Distribution of ABO blood groups among medical students associated with Rh positive and Rh negative

DISCUSSION

The need for blood group prevalence study is not only important for transfusion medicine but also for organ transplantation. Results of a study done by Ahmed khurshid pasha et all at Nishtar medical college (NMC) Multan showed that the distribution of ABO blood groups in students revealed that blood group B was predominant among the students in order of B>O>A>AB[7]. Blood group B was also most common blood group in both the genders. However blood group A, AB and O were more common in male students.

Results of Shaik ya et all showed the predominance of blood group O similar to our study. [12]A prevalence study done by Nwache C A et all, from Nigerian population showed that blood group O>A>B>AB which is in contrast to our results which show B>A. However blood group O is most common AB is least common blood group in both the studies. [13]In Ravalpindi , a study done by Muhammad Iqbal, Alauddin Niazi showed that Blood group B+ve was the most frequent (31.2%). AB -ve was the least frequent (0.6%) which was similar to our study. The percentage of Rh+ve and Rh-ve blood groups was 92.2% and 7.8% respectively. [14]

The trends of prevalence of blood groups are same among total students, as well as among male and female medical students. There is no significant difference between Rh positive and Rh-negative students at p=o.o5, chi square value 2.849.Similar pattern of distribution is also observed in other studies. Rh negative blood group is documented as 5.5% in south India, 5% in Nairobi Kenya, 4.5% in Nigeria, 7.5% in Lahore, 7.7% in Ralwalpindi studies (Das et al, 2001; Mawuagi, 1999; Omatade et al, 1999; Majeed and Hayee, 2002; Bhatti and Amin, 1996). [15 16]

Like in many other studies blood group O has been found to be the most common blood group in our study. Here also blood group O +ve and O-ve have been found to be the most common among KIMS Medical students. The trend of prevalence of ABO and Rh groups among all medical students is: O>B>A>AB. Among Male students- O>B>A>AB. Among Female students - O>B>A>AB. Among our medical students O +ve and O-ve are most common and AB+ve and AB -ve are least common.

CONCLUSION

Among our medical students O +ve and O-ve are most common and AB +ve and AB -ve are least common. The same observation has been found separately among male and female medical students.

The trends of prevalence of blood groups are same among total students, as well as among male and female medical students.

Knowledge of blood groups is very important as this not only saves lives of patients when a transfusion is required but also predicts who is prone to which of the diseases as many diseases have association with certain blood group such as blood group o is a risk factor for duodenal ulcer.

Study conducted by maliyanna itgappa among medical students of SSIMS Davangeri and show that commonest ABO blood group in males was B group followed by O, A and AB groups. The frequency of Rh positive was 95% while Rh –ve 5% and group O was predominant in females and B group predominant in males.

Present study could have several significant implications .It provides information to various blood banks for transfusion purposes and to prepare a data base for blood bank of this institution. To link ABO blood groups to certain diseases and to create awareness as who is exposed to which of the diseases.

Acknowledgments: Nil

Ethical Clearance: Taken

Source of Funding: Self

Conflict of Interest: Nil

REFERENCES

1. Seeley RR, Stephens TD, Tate P. Anatomy and Physiology. 4th edition. The McGraw Hill Companies, Inc. USA 1998; p.1098.
2. Qureshi MA1, Bhatti R.Frequency of ABO blood groups among the diabetes mellitus type 2 patients. J Coll Physicians Surg Pak. 2003; 13(8):453-5.
3. Younis Abed EL-WahhabSkaik, Amany Samir Alhawary, Alaa Salem Shbair, Basma Bashir Hamouda, Frequncy of ABO and Rh (D) blood groups in Five goverenorates in Gaza-Strip, Pak J Med Sci, 2007;23; 924-927.
4. Imranud Din Khattak, TajMuhammed Khan, Purdil Khan, Syed Mukhtar Ali Shah, SaniaTanveerKhattak, Anwar Ali , Frequency of ABO and Resus blood group in District Swat, Pakistan, J Ayub Med Coll Abbottabad 2008: 20(4):127-29.
5. Dennis et all in U. G. Egesie, O. J. Egesie[1], I. Usar[2] and T. O. Johnbull[3]Distribution of ABO, rhesus blood groups and haemoglobin electrophoresis among the undergraduate students of niger delta university nigeriaNigerian Journal Of Physiological Sciences, 2008; 23(2), p 5-8.
6. Honig CL, Bore JR. Transfusion associated fatalities: A review of Bureau of Biologic reports 1976 – 1978. Transfusion. 1980; 20:653 – 661.
7. Ahmed Khurshid Pasha, Muhammad MujtabaHasir, ShireenKhawar, Frequency of ABO blood groups among Medical students, Journal of Surgery Pakistan 2009;14(2) 14.
8. Fauci AS, Braunwald E, Kasper DL, Hauser SL, Longo DL, Jameson JL, Loscalzo J. Transfusion biology and therapy in: Harrison's Principles of Internal Medicine 17th ed, United States of America, New York,Mc Graw Hill Medical Publishing Division,2008;707-13
9. Variation of ABO and Rh Blood Groups Among Medical Students of SSIMS & RC, Davanagere, Karnataka, India *Maliyannar Itgappa1 ,M SubhasChandrappa2 , M VidyaNadigere3 , G M Raju4 ,R Dinesha5 , SS Thammannagowda5 IJPCR, October – December 2011, 3(4) ,70-72.
10. Ahmad M A, Bakar M A, NazmulAhsan, Pattern of ABO and Rhesus (Rh) blood group donors, TAJ Dec 2002; 15, 2
11. Pramanik T, Pramanik S. Distribution of ABO and Rh blood groups in Nepalese students: a report. Eastern Mediterranean Health J. 20006(1): 156 –158.
12. Shaik YA, Alhawary AS, Shbair AS, Hamouda BB. Frequency of ABO and Rh D blood groups in five governorates in Gaza-Strip. Pak J Med Sci 2007; 23:924-27.
13. Nwauche, C.A. and O.A. Ejele, 2004. ABO and rhesus antigens in a cosmopolitan Nigeria population. Niger J. Med., 13(3): 263-266. Asian

J. Med. Sci., 2011;3(3): 106-109.

14. Muhammad Iqbal, Alauddin Niazi, Mohammad Tahir. Frequency of ABO and Rh blood groups in Healthy Donors,,Journal of Rawalpindi Medical College (JRMC); 2009;13(2):92-94.
15. Das PK, Nair S C , Harris V K , Rose D, Mammen JJ, Bose Y N, Sudarsanam A, Distribution of ABO and Rh blood groups among the blood donors in a tertiary care center in South India, Trop Doct 2001;3:47-8
16. Omotade, O.O., A.A. Adeyemo, C.M. Kayode, S.L. Falade and S. Ikpeme,. Gene frequencies of ABO and Rh (D) blood group alleles in a healthy infant population in Ibadan, Nigeria. West Afr. J. Med., 1999; 18: 294-297.

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Effect of Occupational Stress on Autonomic Modulation

Prashanth N Dixit[1], Vijaynath Itagi[2], Y P Raghavendra Babu[3], Prakash S B[4]

[1]Associate Professor, Department of Physiology, [2]Professor and Head Department of Physiology, [3]Professor and Head Department of Forensic Medicine, [4]Assistant Professor Department of Physiology, KIMS Koppal

ABSTRACT

Driving is a hazardous occupation and the drivers exposed to this profession undergo autonomic changes. HRV, the non-invasive technique is used to assess the autonomic adjustment in the cardio vascular system is used to assess the stress induced autonomic modulation in drivers. The time and frequency domain of HRV were recorded in 61 truck drivers in normal and deep breathing condition. The result of time domain of HRV showed that HRV decreased with experience. Also while the LF component increases with experience, the HF component decreases. Thus the results indicate that as the duration of driving increased the sympathetic activity increased and parasympathetic activity decreased.

Keywords:- *HRV, LF,HF, stress, occupational hazards.*

INTRODUCTION

In the present day world every occupation induces various degrees of stress on individual although the perception may vary in individual to individual and in certain occupation it is greatest and such occupations are called hazardous occupation. Stress induces a wide range of physiological and or behavioral changes that have evolved along phylogeny which take place under different situations[1].

Shift work is associated with an increased rate of cardiovascular disease and accidents. Discordance between circadian rhythm of stress related biological variables and the work sleep schedule explains the reduced efficiency of work.

Ha M et al (2001)[2] showed that there is an increase in both systolic and diastolic blood pressure according to shift duration.

Long duty taxi driving raises blood pressure and may increase cardiovascular risk. It is shown that as a conflict between circadian rhythm of autonomic activity, and work activity at night may also result in increased cardiovascular risk[7].

Corresponding author:
Dr. Prashanth N Dixit
Associate Professor, Department of Physiology
KIMS, Koppal

Heart rate variability (HRV) is a non invasive test to asses the cardio vascular autonomic regulation[5]. HRV has become the conventionally accepted term to describe variations of both instantaneous heart rate and RR intervals[6]. HRV analyzes the tonic base line autonomic functions[3,4].

Martica Halll et al (2004)[8] showed that changes in HRV with acute stress may represent one pathway to disturbed sleep. It is also evident from the study that stress related changes in heart rate variability are associated with significant morbidity and increased risk of mortality[8].

There was a significant decrease in HRV in shift workers. These results show that there are negative health effects by shift work on cardiovascular system[6].

It has shown that continuous weekly changes in working time alter the HRV in the cardiovascular diseases in shift work[9].

Apparies et al (1998)[10], showed that there was a decreased HRV and increased heart rate in drivers who were driving longer combination vehicles, and also Suggested that fatigue contributes to driving related accidents and fatalities.

The stress normally operate through cortico hypothalamo autonomic nerves system axis. The degree of intensity of the stress on individual can be better

studied by the autonomic modulation takes place in that individual.

So in this study the autonomic changes of one of the hazardous occupation in which drivers were evaluated to predict or prevent any hazardous occupation induced health disorder that may set in as to precipitate in future, may help them to improve their life expectancy of health.

MATERIALS AND METHOD

Subject: Volunteer's among the truck drivers from the VRL logistics Ltd participated in the health clinic of the college. The healthy males (61) were agreed to participate in this study. Time of the visit was between 10.00AM. to 11.30 AM, they were requested to come in a relaxed condition and quiet mood.

INCLUSION CRITERIA

1. Healthy males.
2. Males between the age group 18-48 years.
3. Taken regular duties as truck drivers.

EXCLUSION CRITERIA

1. with known hypertension.
2. with known cardiac disease.
3. on treatment for any other disease.
4. Complaint of fever.

Parameters: Duration of occupation and HRV

Measurement of HRV:

ECG appliances (BPL) with Jelly and electrode.

- Digital data Acquisition system
- HRV soft 1.1 VERSION, AIIMS, NEW DELHI.

A high quality ECG recording was taken under standardized condition to minimize artifacts. The ECG signal was first recorded in analog and then digitally converted. HRV was than analyzed by using the software HRV soft 1.1 version, AIIMS, New Delhi. The software used automatically gives the values in the time domain and frequency domain.

Method of recording : In normal and deep breathing.

Duration of occupation: obtained orally from the individual

STASTICS: The stastical analysis was done using ANOVA (Analysis of variance), student's unpaired -T test, Mannwhitney U test.

RESULTS

The 61 subjects were grouped according to their work experience into two groups.

The drivers (36) whose working experience was less than 5 years were included in group I and their mean work experience was 2.8 ±1.5 years. The group II contains 25 subjects with work experience more than 5 years. The mean experience of group II was 9.7±3 years.

The time domain and frequency domain of these two groups HRV in normal and deep breathing condition were compared and analyzed.

Table I shows the analysis in normal breathing and table II shows the analysis in deep breathing.

Tab: I Effect of experience on time and frequency domain heart rate variability

EXP	N	MEAN	Std deviation	Z
HRV <=5 >5	36 25	27.1108 15.1648***	8.74463 5.66055	4.96400 P<0.001
LF <=5 >5	36 25	26.3116 55.8047***	19.10114 6.26252	5.48500 P<0.001 vhs
HF <=5 >5	36 25	50.7886 23.7040***	21.54542 9.56846	5.00100 P<0.001 vhs

***-Very highly significant

The time domain HRV analysis showed that the mean HRV in normal breathing of group I was 27.1±8.7 and in group II was 15.1±5.6. The HRV in group I was significantly higher than that of group II (p=0.001), when compared with the group II.

The deep breathing showed that the mean HRV of group I was 33.7±20.0, which was significantly higher (p=0.001) than the group II 20.0 ±5.5. .

Further the frequency domain analysis of LF and HF, in normal breathing showed the following. The mean LF of group I was 26.3±6.2 and that of group II was 55.8±19.1, the LF of group II value was significantly more than group I (p=0.001). But the HF also showed significantly (p=0.001) higher value in group I (50.79) when compared with the group II (23.70).

The deep breathing record of frequency domain analysis showed that the mean LF of group I was 58.5±14.7and that of group II was 81.4 ±14.3. When analyzed statistically, group II showed very highly significant when compared to group I (p=0.001). Also in deep breathing the mean HF of group I was 17.8±6.06 and of group II was 11.2±5.2. It showed group I value was very highly significant than the group II (p=0.001). (table II)

Tab: II Effect of experience on time and frequency domain heart rate variability in deep breathing

EXP	N	MEAN	Std deviation	Z
HRV DB <=5 >5	36 25	33.7953 20.0084***	8.66530 5.59081	5.55800 P<0.001 vhs
LF DB <=5 >5	36 25	58.5880 81.4114***	14.30321 14.77274	4.79500 P<0.001 vhs
HFDB <=5 >5	36 26	17.8819 11.2992***	6.06355 5.22939	3.79800 P<0.001 vhs

***-Very highly significant

DISCUSSION

In India main source of transportation of goods is land transport, on which the economy is dependent which is mainly carried out by the way of trucks. Truck drivers are the one who drive long distance and these drivers may have to drive vehicles for 11-14 hours a day, even in nights, holidays and week ends. These drivers are exposed to the various hazardous atmospheres while driving, so the occupation of the drivers is said to be hazardous occupation. These drivers because of the working life style are more prone for increased stress and related health hazards.

Though the heart has its own rhythmicity it is regulated by the autonomic nervous system on time to time adjustment needed to cope up body's need. Most of the cardiac ailment is precipitated due to involvement of the autonomic nervous activity. A decrease in HRV indicates increase in sympathetic activity and decrease in parasympathetic activity, which may tend to cardiac problems. On the other hand an increase in HRV indicates increase in parasympathetic activity which is more or less having cardio tonic effect. During deep breathing the vagal activity is increased due to respiratory maneuver which spills over the cardiac tissue and the HRV under deep breathing condition is better indicator of parasympathetic role in heart.

In this study, the time domain analysis of HRV showed as the experience increases the HRV decreases, indicates the shifting of dominance towards sympathetic activity proportionate to experience.

Studies showed that changes in HRV with acute stress may represent one pathway to disturbed sleep. It is also evident from the study that stress related changes in heart rate variability are associated with significant morbidity and increased risk of mortality [8].

Shift work is associated with an increased rate of cardiovascular disease and accidents. Discordance between circadian rhythm of stress related biological variables and the work sleep schedule explains the reduced efficiency of work. It has shown that continuous weekly changes of time of work increases cardiovascular diseases in shift work[9].

In our study increased experience associated with decreases in HRV may be due to work related stress, as the drivers are exposed to a various degrees of stress during driving.

In order to find out the degree of shift in the autonomic nervous system (sympathetic and parasympathetic) affected most, the frequency domain analysis was also carried out in these subjects.

Accordingly, the results showed that there was an increase in the LF component and decrease in HF component as experience increases, this indicates while sympathetic activity increases, parasympathetic activity decreases.

The study of effect of HRV in driving mental fatigue, found that sympathetic activity of the subjects enhanced after the simulated driving while HF component decreased[11]. The study of effect of different vibration frequencies on HRV and driving fatigue showed that there is a significant decrease in all indices of HRV, where there is increase in the LF component and decrease in the HF component [12] was in agreement with the study.

In our study with the increase in the experience there is increase in the LF component, where as there is a decrease in the HF component that may be due to these stress factors involved in the driving.

CONCLUSIONS

Based on this study, the following conclusions are drawn.

- The present work atmosphere of truck drivers has created a high stress factor on the individual.
- Because of stress, there has been a profound influence on the autonomic nervous system.
- Sympathetic over activity which is related to STRESS has a major impact on health status of the individual as evident from HRV analysis.

RECOMENDATION

Stress factor should not be overlooked by the companies recruiting the drivers.

1) Pre recruitment health checkups

2) Giving good amount of time for the recruit before taking up the job so that they get enough time for preparation.

3) Changes in the working patterns, give them adequate rest before starting new schedule.

4) Post recruitment half yearly/yearly detailed health examination, counseling.

Ethical Clearance- Taken from institutional ethical committee KIMS Koppal

Source of Funding- Self

Conflict of Interest: Nil

REFERENCES

1) Vugys M. ER Vsalin, R Kventnansky and J Axelrod. Problems of definition of stress stimulus and specificity of stress response, in stress role of catecholamine and the neurotransmitters. Gorden and Breach sci public 1984;25:27-35.

2) Ha M, Kim J, Park J, Chung HK. Blood pressure and heart rate variability in workers of 8-hour shifts. J Hum Ergol. 2001; 30(1-2):229-33.

3) Juan S. Heart rate variability; a non invasive electrocardiographic method to measure the autonomic nervous system. Swiss Med wkly 2004; 134: 514–522.

4) Madanmohan, Prakash ES, Bhavanani AB. Correlation between short term heart rate variability indices and heart rate, blood pressure indices, pressor reactivity to isometric handgrip in healthy young male subjects. Indian J physiol pharmacol. 2005;49(2):132-8.

5) Herbert, J. D., & Gaudiano, B. A. Heart rate variability andThought Field Therapy. Journal of Clinical Psychology, 2001; 57(10): 1207-1214.

6) Kristal Boneh E, Raifel M, Froom P, Ribak J. Heart rate variability in health and disease. Scan J Work Environ Health 1995;21:85-95.

7) ensen-Urstad, Kerstin Heart rate variability and vascular function in healthy subjects and in patients with insulindependent (Type 1) diabetes mellitus. 1997:272-276.

8) Martica Hall, Raymond Vasko, Daniel Buysse, Hernando Ombao, Qingxia Chen, J. David Cashmere, BS, David Kupfer, and Julian F. Thayer.

.Acute Stress Affects Heart Rate Variability During Sleep Psychosomatic Medicine2004; 66:56-62.

9) Furlan R, Barlic F, Piazza S et al., Modifications of Cardiac autonomic profile associated with a shift schedule of work. Circulation 2000; 102 (16): 1912 -6.

10) Apparies RJ, Riniolo TC, Porges SW. A psychophysiological investigation of the effects of driving longer-combination vehicles. Ergonomics. 1998; 41(5):581-92.

11) Jiao K, Li Z, Chen M, Wang C. Synthetic effect analysis of heart rate variability and blood pressure variability on driving mental fatigue. Sheng Wu Yi Xue Gong Cheng Xue Za Zhi. 2005;22(2):343-6.

12) Jiao K, Li Z, Chen M, Wang C, Qi S. Effect of different vibration frequencies on heart rate variability and driving fatigue in healthy drivers. Int Arch Occup Environ Health. 2004; 77(3):205-12.

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The Correlation of Breath Holding Time between Non Addict or Addicts (Smoker & Chewer) Male and Female Elderly Indian Population

Ramita Raheja[1], Mohan Lal Arora[2], Raj Kumar[3]

[1]Associate Professor, Physiology Department, Glocal Medical College Sup. Hospital & Research Centre, Mirzapurepole, (Saharanpur), [2]Associate Professor, Physiology Department, Govt. Medical College, Orai, [3]Assistant Professor, Anatomy, Department, Glocal Medical College Sup. Hospital & Research Centre, Mirzapurepole, (Saharanpur)

ABSTRACT

The collect a substantial amount of data relating to physical fitness in elderly peoples and this findings may be helpful for cardiologist with maximum safety and minimum mortality and morbidity or clinicians in reaching the appropriate diagnosis.

Breath holding time was performed on 110 healthy (84 male and 26 female) subjects aged 60 years and above. 49 subjects addict to either tobacco smoking or tobacco chewing and 61 were non-addict for tobacco. They were divided into 4 groups: Group I (60–64 years), Group II (65–69 years), Group III (70–74 years) and Group IV (75 years and above). In the (84) elderly male (60yrs above) the average breath holding time (BHT) was 28.20 ± 8.51/sec and the elderly non Addicts male (37) mean were 28.48 ± 7.20/sec and addict (Smoker and Chewer) 47 elderly male 28.06 ± 9.59/sec . The elderly (26) females (60 yrs above) mean were 26.11 ± 6.63 sec and non addict elderly female (14) mean 28.5 ± 8.28/sec and addict (12) elderly female (smoker and chewer) mean 24.o7 ± 3.73/sec. Breath holding time shows a declining pattern with age in all the age groups of men, which is statistically significant ($p < 0.5$). However, in female although the breath holding time also shows an apparent declining pattern with age in all age groups but the relationship is statistically insignificant ($p > 0.05$).

Keyword:- *Stop watch, elderly peoples (Male & Female), Indian population,*

INTRODUCTION

In India, the first step towards such type of the survey named as 'General Health Survey' was conducted in the rural field practice area of the Singur Health Centre of All India Institute of Hygiene & Public Health, Calcutta (Lai and Seal, 1949).[1] Since then various surveys have been done by various public health workers.

In the era of changing patterns of health and disease in developing country like India and also due to breaking up of various social and economic barriers, and increased ratio of older age population, the importance of health surveys is increasing day by day. The knowledge about the changing pattern of health and disease and the allied information regarding the health status of older age group can only be projected by carrying on such survey from time to time in various parts of the country.

Nandel and Widdicomtpa(1975)[2] concluded that the inhalation of tobacco smoke causes an immediate rise in airway resistance which persists for at least an hour. This rise of resistance in the airway is a reflex response of dust particles in the epithelial lining of the larynx, the trachea, and larger bronchiole.

Anderson et al. (1978)[3] in their WHO publication quoted that Framingham longitudinal studies indicated that high physical performance, capacity, i.e., a strong hand grip, high vital capacity and a low resting heart rate, are associated with a lower than average incidence and severity of cardiovascular pathology.

Quantitative assessment of physical fitness in the elderly age group Is the most complex and controversial problem in applied physiology. This situation arises in part from lack of general agreement as what constitutes fitness for withstanding various types of stresses and from lack of agreement as what measurement exposed

to the same stress.

Another problem with the older age group is the higher risk for the various tests based on exercise.

Therefore, in the present study the physical fitness of this age group is assessed by the various cardiorespiratory parameters at rest as also advocated by "Royal Air force of England".

As early as 1967 Jain, et al.[4]reported that there was a stiffness of the thoracic cage and also loss of elastic recoil of lungs in elderly people. So there was deterioration in the strength of respiratory muscles. They also showed the loss of elastic recoiling prevents the closure of the respiratory bronchioles during expiration. Various factors were responsible for the reduction in ventilatory function in the elderly age group[5] .

MATERIAL AND METHOD

The present study "The Cardiorespiratory Function Tests" was conducted on a randomly selected 110 apparently healthy subjects of 60 years and above age group belonging to both the sexes at Agra.

Breath holding time was performed on 110 healthy (84 male and 26 female) subjects aged 60 years and above. 49 subjects addict to either tobacco smoking or tobacco chewing and 61 were non-addict for tobacco. They were divided into 4 groups: Group I (60–64 years), Group II (65–69 years), Group III (70–74 years) and Group IV (75 years and above).

Breath Holding Time is measured by stopwatch. The subject was asked to take a quiet inspiration and hold it as long as possible. Duration of breath holding was measured by stopwatch.

The following Cardiorespiratory function tests were carried out on these subjects:

1. Breath holding time in seconds.

Breath Holding Time:- The instrument used was the stop watch. The subject was asked to take a quiet inspiration and hold it as long as possible. Duration of breath holding was measured by stopwatch. Three readings were taken. Best of the three was taken for record.

Precautions:

(i) The subject was instructed to take rest for at least 3 minutes.

(ii) Three consecutive readings with an interval of one minute were taken. If the rates were not same then the subject was instructed to take more rest.

STATISTICAL ANALYSIS

The data were analyzed using Microsoft Excel, SPSS version 21, Mean and standard deviation (SD) were calculated. p-value $P \geq 0.05$ was considered statistically insignificant.

OBSERVATIONS

The present study of evaluation of cardio-respiratory functional ability in the elderly age group was conducted with the objective to determine the effect of male and female in the elderly population**,** affect these parameters. Under this endeavor, very simple multidimensional group of various cardiorespiratory function tests comprising of breath holding time, was carried out and studied compare with male and female in elderly population. Out of these 110 subjects, 84 were male and 26 females. showing table no.1

49 subjects addict to either tobacco smoking or tobacco chewing and 61 were non-addict for tobacco. Showing table no 2.

The details of these findings in various age groups and different sexes are shown in Tables no 3.

Following cardio-respiratory function tests were performed on these subjects

Breath holding time (BHT) in seconds

For the sake of convenience the subjects were grouped in male and female subgroups. Each subgroup was further divided in four subgroups as follows :

Group I	: 60 yrs to 64 yrs
Group II	: ↓65 yrs to 69 yrs
Group III	: ↓70 yrs to 74 yrs
Group IV	: ↓75 yrs and above.

For each group the mean age, mean height, and mean weight were calculated as shown in Table 3.

The mean values and standard deviation of all the parameters with respect to age group, comparative evaluation of these parameters in the corresponding

age group of male and female subjects were calculated and the findings are tabulated. Also the assessment of correlation of effect of tobacco addiction (tobacco smoking and tobacco chewing)'with all the parameters studied was done.

Finally, the statistical correlation in the form of r, t and p values of each parameter was calculated as shown in each table. Though a number of workers have reported the respiratory parameters on Indians, most of the data are on much younger age groups and especially in students. Amongst the reported data available on the elderly population, our values are much closer to the values obtained by Pathak and Mehrotra et al. (1989)[6] who studied the respiratory function tests in the elderly population of Bombay and Bhargava et al. (1973)[7] who conducted the respiratory function tests in elderly subjects in Bhopal.

The findings of our study are much lower as compared to European contemporary subjects reported by Dreyer et al.[8]

Deterioration of respiratory function tests with age might be the resultant effect of a number of factors, including the deterioration in the lung tissue; a reduction in the strength of the respirator muscles and an increase in stiffness of the thoracic cage. The intrapulmonary changes are probably partly due to an impairment of the nutrient blood supply from the bronchial arteries; a diminished permeability of cell membrane and an alteration in the molecular structure of the collagen and other tissue, collagen fibers increase in number and change in quality with age.

The changes are likely to have the effect of increasing the rigidity and reducing the tensile strength of the tissue as well as by reducing both the viability of the cells and their recuperative powers. The time course of these manifestations of the process of ageing varies from one individual to another and also in male and female sexes. The ethnic difference between the Indians and others may be aggravated by damages caused by exposure to polluted atmosphere, low socio-economic status, genetic differences, body built and other climatic variables.

The ventilatory capacities show a consistent decline with age. The decline is further augmented by smoking/chewing tobacco. The ventilatory capacity is a function of the strength of the respiratory muscles and the resistance to movement of the lung and the chest wall and the reduction that occurs with age is probably due to change in all these variables. An assessment of the relationship between the effects of tobacco addiction and lung function in both the sexes, it was revealed that the magnitude of decline of respiratory function tests is far more in tobacco addict than non-addict subjects and the finding happens to be statistically significant in both the sexes for vital capacity ($p < 0.01$) but the relationship was insignificant for BHT ($p > 0.05$) and PEFR ($p > 0.05$) in both the sexes.

The present study reveals a statistically significant deterioration of all the cardiorespiratory function tests with the increase of age in both the sexes and the deterioration was more tobacco addict subjects (tobacco smokers and tobacco chewers) as revealed by the p-values depicted in the tables no.2

Greater decline in respiratory function tests in tobacco addicts again enjoys a massive support from other workers (Donald I. Peterson et al., 1968[9]; George W. Gomstock et al., 1970[10]; Lower and Khosla, 1972[11]), In their separate work on the effect of smoking and respiratory function tests, these workers have also reported a declining pattern in respiratory function tests in tobacco addict. Similar studies were conducted by Carl C, Seltzer et al. (1974)[12], Manfeda et al. (1982)[13], Damodar et al. (1983)[14], Douglas et al. (1985)[15] and they also reported a declining lung function test in chronic smokers.

Tobacco smoking carries a number of substances which may exert an effect on the body. They include particles of dust which disturb the function of airway, carbon monoxide, which hampers the respiratory function of the blood and possibly damages the myocardium, tar and oxides of sulphur and nitrogen, which exert an irritant effect on the bronchial epithelium and may predispose to emphysema and nicotine which increases the cardiac frequency and elevates the systolic B.P. The magnitude of the effects of these agents upon the respiratory tract varies with the type of tobacco and its preparation. The inhaling of tobacco smoke causes an immediate rise in the airway resistance which persists for at least an hour. Nandel and Widdicomba(1975)[2] have shown that this change is a reflex response to the deposition of particles of dust upon the epithelial lining of the larynx, the trachea and the larger bronchial, but the intensity of response varies from individual to

individual. Smoking may reduce the volume of the blood in lung capillaries.

RESULT

In the (84) elderly male (60yrs above) the average breath holding time (BHT) was 28.20 ± 8.51/sec and the elderly non Addicts male (37) mean were 28.48 ± 7.20/Sec and addict (Smoker and Chewer) 47 elderly male 28.06 ± 9.59/sec . The elderly (26) females (60 yrs above) mean were 26.11 ± 6.63 sec and non addict elderly female (14) mean 28.5 ± 8.28/sec and addict (12) elderly female (smoker and chewer) mean 24.o7 ± 3.73/ sec. Breath holding time shows a declining pattern with age in all the age groups of men, which is statistically significant($p < 0.5$). However, in female, although the breath holding time also shows an apparent declining pattern with age in all age groups but the relationship is statistically insignificant ($p > 0.05$).

No statistical difference in pulse rate between tobacco addicts compared with non-addicts, was observed ill the present study.

Table -1: Comparative evaluation of breath holding time of total number of male and female subjects studied (n = 110)

Sex	No.	Mean	S.D
Male	**84**	**28.20**	± 6.63
Female	**26**	**26.11**	± 6.63

t = 1.39, P >0.05

Table – 2: Correlation of breath holding time between non-addicts and addicts (tobacco smokers & tobacco chewers) male and female subjects studied (n - 110)

Type	No.	MALE		NO	FEMALE	
		MEAN	S.D		MEAN	S.D
Non-Addict	37	28.48	± 7.20	14	28.5	± 8.28
Addict (Smoker + Chewer)	47	28.06	± 9.59	12	24.07	± 3.73

Table no.3: Comparative evaluation of breath holding time of different age groups in male and female subjects studied (n=110)

Age Group in years	BREATH HOLDING TIME (IN SECONDS)					
	No.	Male (n =84)		Female (n=26)		
		Mean	S.D.	No.	Mean	S.D.
60 – 64	26	36.96	± 9.8	11	27.72	± 8*67
↓ 65 – 69	20	32.25	± 4.63	8	27.33	± 5.26
↓ 70 – 74	17	26.94	± 9.61	4	26.50	2.17
↓ 75+	21	26.65	± 4.83	3	23.75	± 2.51

CONCLUSIONS

Under this Endeavour (a) a predesigned Performa (as suggested by W.H.O) was filled up to obtain the details for subjective evaluation, and (b) very simple multidimensional groups of various cardiorespiratory function test comprising of d breath holding time was carried out.

From the study point of view, all the subjects were grouped in four subgroups i.e., 60-64 yrs, 65-69 yrs, 70-74 yrs and 75+ yrs. The values obtained were statistically evaluated in terms of p values.

The present study reveals a statistically significant deterioration of all the cardiorespiratory function tests with the increase of age in both the sexes and the

deterioration was more tobacco addict subjects (tobacco smokers and tobacco chewers) as revealed by the p-values depicted in the tables no.2

Ethical Clearance:-Yes

Source of Funding :-Self

Conflict of Interest:- None

REFERENCES

1. Lai, R.B. and Seal, S.C. (1949). General Health Survey of Singur Health Centre 1944; Govt. of India Press, Calcutta, 1949.
2. Nandel and Widdicomba. Lung function Assessment and Application in Medicine by J.E.Cotes, III ed, 1975; p.366.
3. Habitual Physical Activity and Health. WHO Publ.European series No.6, 1978; 1-3.
4. Jain SK, Kumar R, Gupta CK. Lung function studies in healthy men and women over forty. Ind J Med Respr 1967;55:612-9.
5. Goyel R, Venkatraman C, Rastogi SK, et al. Normal standards and prediction of lung function tests in Indian armed forces personnel. Med J Armed Forces of India 1984;40:151-6
6. Mehrotra, P.P.,Pathak, J.D., Joshi, S.D., Shah, P.H.: Pulmonary functions of elderly Indian subjects. Trends of decline with age. Ind.J.Physiol. Phanaacol. 1989; 33:3, 157-162.
7. Bhargava, R.P., Mishra, S.M., Gupta, N.K. Ventilatorytests and lung volumes in M.P. Ind. J. Physiol. & Pharm. 1973, 17:266-272.
8. Dreyer, G. : Lancet 2:227, quoted from Ind. J. Physiol. &Pharmac. 1989; 33:3.
9. Donald, I., Peterson, M.D., Lester, H. et al. Smokingand Pulmonary Functions. Arc. Env. Health, 1968; Feb. 16, 215-218.
10. George, W. Comstock, M.D., Wilpred, J., Brownlow,M.D., Baltimore, Richard, W., Stone, M.D., Philip, E., Startwell, M.D. Cigarette smoking and changes in respiratory findings. Arch. Env. Health, 1970; July, Vol. 21:50.
11. Lower, C.R. and Khosla, T. Chronic Bronchitis in Ex-coal miners working in the steel industry. Br. J. Indust. Dis. 1972; 29:45-49.
12. Carl, C., Seltzer, A.B., Slegelaub et al. : Difference in pulmonary function related to smoking babbits and race. Am. Rev. Resp. Dis. 1974; 110:598.
13. Manffcedg, J. Sidwall, Mami, K., West, P. and Charmick, R.M.: Respiratory abnormalities in employees of hard rock mining industry. Am. Rev. Resp. Dis. 1982; 126(4):629-634.
14. Damodar, Agarwal, D. and Sharma, P.M. : Changes inventilatory capacities due to exposure to talk dust. Ind. J. Chest Dis. & Allied Sc. 1983; 25:21-24.
15. Douglas, D.B., Douglas, R.B., Okes, D. and Scott, G.Pulmonary functions in London Firemen. Br.J.Indust.Med. 1985; 42:55-58.

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Physiology of ABO and Rhesus Blood Group System and its Prevalence and Correlation with Possible Transmission of Infections During Screening in Hassan District

Yathish T R[1], Purushotham R[2], Sudhanva S[1], Sudharshan C R[3]

[1]Assistant Professor, Department of Physiology, [2]Associate Professor, Department of Pathology, [3]Professor and HOD, Department of Physiology, HIMS, Hassan, Karnataka, India

ABSTRACT

Introduction: With the discovery of blood group system, blood transfusion has become routine interventional modality for various blood disorders. Blood grouping and cross matching are pre-requisites to ensure safe compatible transfusion. Many diseases are transmitted during transfusion. This hazards can be minimized by proper donor selection and screening. The present study was conducted to study the physiology of ABO and Rhesus blood group system and its prevalence and correlation with possible transmission of infections during screening in Hassan district.

Materials and method: This retrospective study was conducted at the blood bank of a Hassan Institute Medical Sciences for a period of three years from January 2014 to December 2016. The blood was collected from all donors, grouped by standard procedures and was screened for various diseases. The data was be statistically analyzed.

Results: ABO and Rhesus blood group of 14,413 donors was determined. The most and least prevalent blood group was O positive (39.04%), and AB negative (0.36%) respectively. Prevalence of Rh positive donors (95.32%) was more than Rh negative donors (4.68%). A total of 0.92% was found to be positive for diseases. Prevalence of Human Immunodeficiency Virus, Hepatitis B virus, Hepatitis C virus and Syphilis are 0.076%, 0.8%, 0.014% and 0.02% respectively. Statistically significant association was found between HIV and Hepatitis B infection with blood groups (P<0.05).Higher prevalence of HIV, HBV, HCV and syphilis was found in O positive, B negative , A positive and O positive blood group respectively. However subclinical asymptomatic malaria positive donors were not found in present study.

Conclusion: The most prevalent blood group in Hassan population was O positive. The most common Transfusion transmitted infections seen is Hepatitis B infection.

Keywords: *ABO, Rhesus Blood group, Transfusion transmitted infections, Human Immunodeficiency Virus, Hepatitis B virus, Hepatitis C virus, Syphilis, Malaria parasite.*

INTRODUCTION

With the discovery of blood group system by Karl Landsteiner in 1900 and Rhesus system by Karl Landsteiner and Weiner in 1940, blood transfusion has become routine interventional modality for various blood disorders.[1] More than 30 blood group system are discovered based on the antigens present on the surface of red cell membrane. Out of more than 400 antigens only A and B are found to be immunologically significant.[2] These antigens are complex oligosaccharides and glycoprotein that differ in terminal sugar moieties and exhibit Mendelian dominant inheritance. Based on these two antigens individuals are classified into four major blood groups A, B, AB and O. In Rhesus system

Corresponding author:
Dr. Yathish T R,
Assistant Professor, Department of Physiology,
Hassan Institute of Medical Sciences, Hassan -573201,
Karnataka, India. Ph.No 9448410163,
Email:dryathishtr76@gmail.com

only D antigen is immunologically significant. Based on presence or absence of D antigen individuals are classified into Rh D positive and Rh D negative groups. Prevalence of ABO and Rhesus Blood Groups varies in different races, ethnic groups, geographical areas etc.[3,4,5] 'H' antigens is present on membrane of all blood groups which is formed by H gene, which codes for fucose transferase and adds terminal fucose. 'A group' individual contains additional N-acetylgalactosamine and 'B group' individual contain additional galactose on the H antigen which is expressed by different tranferases.[3]

Need of blood transfusion has been increasing tremendously nowadays. Modern blood banking techniques has helped to transfuse not only whole blood but also blood components like plasma components, white blood concentrates, packed red cells, platelets etc. Blood grouping and cross matching are pre-requisites to ensure safe and compatible transfusion. Many diseases like cardiovascular diseases, cancer, diabetes, peptic ulcer, carcinoma cervix, skin diseases and Personality traits are found to be associated with blood groups.[6] Genes encoding and regulating the expression of these blood group antigens and natural defence mechanism of the individual may be responsible for increased or decreased susceptibility of the individual to various diseases.[7] Many diseases like hepatitis, Acquired Immuno-Deficiency Syndrome (AIDS), Syphilis, infectious mononucleosis, toxoplasmosis etc are transmitted through blood during transfusion. Genetic and environmental factors, interaction of organisms with antigens on membrane may be cause for genesis and transmission of diseases.[8-10] The risk increases in patients receiving multiple transfusions. The hazards of transmission of diseases can be minimized by proper donor selection and screening.[9]

OBJECTIVE

To study the physiology of ABO and Rhesus blood group system and its prevalence and correlation with possible transmission of infections during screening in Hassan district.

MATERIALS AND METHOD

This retrospective, qualitative study was conducted at the blood bank of a Hassan Institute Medical Sciences, Hassan for a period of three years from January 2014 to December 2016. Data was collected from the blood bank. A Blood sample of 14413 apparently healthy voluntary donors and relative donors (replacement donors) who were not on any treatment, within the age group of 18-60 years, with Hemoglobin more than 12.5 gram% and body weight above 45-50 kg was collected after fulfilling all the eligibility criteria of a healthy donor. Written consent was obtained for various tests to be carried out for the transfusion transmitted diseases and their data usage for research or transfusion purposes from each donors as a routine blood bank procedure. ABO grouping and Rh typing was done by agglutination method by using commercially available standard antiseras i.e. anti A, anti B, and Anti D (Bhat Bio-Tech India private Ltd). Weak D antigens (Rh D^u) were recognized by most reliable Rh D^u test and positives were considered as Rh positive (Coomb's method).[11,12] Then all blood samples were screened for Human Immunodeficiency Virus (HIV-1 & 2), Hepatitis B virus (HBV), Hepatitis C virus (HCV), Syphilis and Malaria Parasite (MP). Third generation enzyme linked immunosorbant assay (ELISA -Erba Lisa ® HIV Gen 3 from Transasia Bio-medicals Ltd) was used to detect antibodies to HIV-1 and HIV-2 virus in human serum and plasma. High sensitive enzyme linked immunosorbant assay (ELISA-Erba Lisa ® SEN HBsAg from Transasia Bio-medicals Ltd)) was used to detect surface antigen of Hepatitis B (HBsAg) virus in human serum and plasma. HCV ELISA test Hepa-scan (Bhat Bio-Tech India private Ltd) was used to detect antibodies to Hepatitis C virus (HCV).Then samples were sent to central laboratory for Individual donor nucleic acid testing (ID-NAT) for earlier detection of viral nucleic acid which are in window period of HIV, HBV and HCV infections. ID-NAT helps to detect the presence of viruses missed by ELISA. Its regular use in blood banks would ensure safer blood transfusion.[13, 14] Rapid plasma reagin test (RPR-SPAN- Arkray Healthcare Pvt Ltd) was used to diagnose syphilis. And peripheral smear of all donors are examined for Malaria parasite.

STATISTICAL ANALYSIS

The data was statistically analyzed using Statistical Package for Social Sciences (SPSS) for windows and EpiInfo software by simple percentage and comparison. Chi-square test was carried out to evaluate the significance in different groups. The mean difference will be significant at $P<0.05$ level. Conclusion was drawn based on outcome of this statistical treatment.

RESULTS

ABO and Rh blood group of 14,413 donors was determined using antisera. Majority of donors belonged to age group between 18-40 years. The percentage distribution of voluntary and replacement or relative donor (ratio 2.1:1) and males and females (ratio 20.4:1) are shown in table 1.In Hassan population the distribution of the ABO and Rh blood group system are as shown in table 2.The most prevalent blood group in Hassan district was O positive (39.04%), and least prevalent was AB negative (0.36%).The prevalence of other blood groups like A+,A-,B+,B, AB+,O- are 24.63%,1.22%,25.47%,1. 11%,6.16% and 1.98% respectively(O>B>A>AB). The prevalence of Rh positive donors (95.32%) was more than Rh negative donors (4.68%).

All the blood samples were screened and the results are as shown in the table 3 and table 4. A total of 132 donors (0.92%) were found to be positive for one or more diseases. Out of which 124 (93.94%) was Rh positive and only 8(6.06%) was Rh negative. And these Rh negative donors were found to be infected by hepatitis B infection. Prevalence of HIV, HBV, HCV and syphilis are 11(0.076%), 116(0.8%), 2(0.014%) and 3(0.02%) respectively (table 3). Statistically significant association was found between HIV and Hepatitis B infection with ABO and Rh blood groups (P<0.05). There was no statistically significant association between Hepatitis C and Syphilis infections with blood groups (P>0.05). Higher prevalence of HIV was found in O positive blood group 7(0.124%) followed by B positive 2(0.0.054%), A positive 1(0.03%). Higher prevalence of HBV was found in B negative blood group 3(1.86%) followed by O negative 5(1.75%), AB positive 11(1.24%), B positive 33(0.89%), O positive 39(0.69%), A positive 5(0.7%). Higher prevalence of HCV was found in A positive 1(0.028%) followed by O positive blood group 1(0.017%). Higher prevalence of syphilis positive was found in O positive blood group 2(0.035%) followed by B positive 1(0.03%).However subclinical asymptomatic malaria positive donors were not found in present study. And all symptomatic clinical malaria positive donors were excluded from our study.

Table 1: Distribution according to type of donors and gender

Samples in year	Total Donors	Voluntary Donors (%)	Replacement Donors (%)	Males (%)	Females (%)
2014	4578	2791(60.96)	1787(39.08)	4300 (93.92)	278(6.07)
2015	4912	3583(73.94)	1329(27.05)	4683(95.33)	229(4.66)
2016	4923	3470(70.48)	1453(29.5)	4757(96.62)	166(3.37)
Total	14413	9844(68.29)	4569(31.7)	13740(95.33)	673(4.66)

Table 2: Distribution according to type of blood group and in percentage

Samples in year	Total Donors	A + (%)	A-(%)	B+ (%)	B –(%)	AB+ (%)	AB- (%)	O+ (%)	O- (%)
2014	4578	1111 (24.26)	60 (1.31)	1124 (24.55)	50 (1.09)	272 (5.94)	09 (0.19)	1843 (40.25)	109 (2.38)
2015	4912	1214 (24.71)	65 (1.32)	1272 (25.89)	52 (1.05)	320 (6.51)	21 (0.42)	1880 (38.27)	88 (1.79)
2016	4923	1225 (24.88)	51 (1.03)	1276 (25.91)	59 (1.19)	297 (6.03)	22 (0.44)	1904 (38.67)	89 (1.8)
Total	14413	3550 (24.63)	176 (1.22)	3672 (25.47)	161 (1.11)	889 (6.16)	52 (0.36)	5627 (39.04)	286 (1.98)

Table 3: Distribution according to infected (positive) blood donors in each year

Samples in year	Total Donors	HIV (%)	HBV (%)	HCV (%)	Syphilis (%)	MP (%)	Total
2014	4578	05(0.11)	31(0.67)	01(0.02)	03(0.06)	0(0)	40(0.87)
2015	4912	03(0.06)	45(0.91)	01(0.02)	0(0)	0(0)	49(0.99)
2016	4923	03(0.06)	40(0.81)	0(0)	0(0)	0(0)	43(0.87)
Total	**14413**	**11(0.07)**	**116(0.8)**	**02(0.013)**	**03(0.02)**	**0(0)**	**132((0.92)**

Table 4: Distribution of infected (positive) donors according to blood group type

Blood group	Total donors	HIV (%)	HBV (%)	HCV (%)	Syphilis (%)	MP (%)	TOTAL (%)
A Positive	3550	1 (0.03)	25 (0.7)	1 (0.03)	0	0	27 (0.76)
A Negative	176	0	0	0	0	0	0
B Positive	3672	2 (0.054)	33 (0.89)	0	1 (0.03)	0	36 (0.98)
B Negative	161	0	3 (1.86)	0	0	0	3 (1.86)
AB Positive	889	1 (0.11)	11 (1.24)	0	0	0	12 (1.35)
AB Negative	52	0	0	0	0	0	0
O Positive	5627	7 (0.124)	39 (0.69)	1 (0.017)	2 (0.035)	0	49 (0.87)
O Negative	286	0	5 (1.75)	0	0	0	5 (1.75)
Total	14413	11 (0.076)	116 (0.8)	2 (0.014)	3 (0.02)	0	132 (0.92)
Statistical Significance (SS)		P<0.05 SS	P<0.05 SS	P>0.05 Not SS	P>0.05 Not SS	0	

DISCUSSION

In the present study majority of donors belonged to age group between 18-40 years. Voluntary: Replacement donor ratio is 2.1:1 which is due to motivation and regular blood camps. The Male: Female ratio is 20.4: 1. Lack of motivation, fears, cultural habits, social inhibition, anemia during menstruation, low body weight etc could have prevented the females from blood donation. Hence, Females need to be motivated and made aware of advantages of blood donation.[5]

The most prevalent blood group in Hassan district was O positive group (39.04%) in comparison to earlier studies.[4, 5] Least prevalent blood group was AB negative (0.36%).The frequency was given by (O>B>A>AB) where as it was (B>O>A>AB) in other studies.[4, 5] Prevalence of Rh positive donors (95.32%) was more than Rh negative donors (4.68%).

After screening, 0.92% were found to be positive for one or more diseases compared to 3.48 %, 0.5% and 2.25% respectively in earlier studies. [9, 10, 15] Among the total reactive group, 93.94% were Rh-D positive and remaining 6.06% were Rh-D negative donors. Rh-D negative donors were found to be infected from hepatitis B infection. Prevalence of hepatitis B infection was

more in B negative group (1.86%) when compared to O negative group (1.75%). Sreedhar Babu et al found that among the total HBV and HCV seroreactive group, 93.7% and 93.1% had Rh-D positive blood group and remaining 6.3% and 6.9% had Rh-D negative blood group respectively.[16]

In the present study, prevalence of HIV, HBV, HCV and Syphilis are 11(0.076%), 116(0.8%), 2(0.014%) and 3(0.02%) respectively. This can be compared with earlier studies in which seroprevalence of HIV, HBV, HCV, and syphilis was 0.1%, 0.57%, 0.05%, and 0.05%, respectively.[17] Statistically significant association was found between HIV and Hepatitis B infection with ABO and Rh blood groups (P<0.05). Higher prevalence of HIV, HBV, HCV and Syphilis was found in O positive (0.124%), B negative (1.86%), A positive (0.03%), O positive blood group (0.035%) respectively. Lekha Mandodar et al study showed HIV was seen majorly in B-ve group, HBsAg in A –ve, HCV in B –ve and VDRL in A –ve blood group.[18] There was no statistically significant association between Hepatitis C and syphilis infections with blood groups (P>0.05).This goes in support of earlier studies.[10]

Getaneh Alemu et al studied ABO/Rh Blood group association with asymptomatic Malaria and found that blood group is significantly associated with malaria infection. High rate of parasitemia was seen in O blood group donors compared to other ABO blood groups.[19] However subclinical asymptomatic malaria positive donors were not found in present study. All symptomatic clinical malaria positive donors were excluded from present study.

CONCLUSION

The most prevalent blood group in Hassan district was 'O positive' (39.04%), and least prevalent was AB negative (0.36%). Prevalence of Rh positive donors (95.32%) was more than Rh negative donors (4.68%). A total of 0.92% was found to be positive for one or more diseases. Out of which 93.94% was Rh positive donors and 6.06% were Rh negative. Rh negative donors were found to be positive for hepatitis B infection. Prevalence of HIV, HBV, HCV and VDRL are 11(0.076%), 116(0.8%), 2(0.014%) and 3(0.02%) respectively. Higher prevalence of HIV, HBV, HCV and Syphilis was found in O positive (0.124%), B negative blood group (1.86%), A positive (0.03%) and O positive blood group (0.035%) respectively. The most common Transfusion transmitted infections seen in Hassan district is Hepatitis B infection.

Conflict of Interest – Nil

Source of Funding- Self

Ethical Clearance – Obtained from Institutional Ethical Committee

REFERENCES

1. Jain AK,editor. Textbook of physiology.4th ed. India: Avichal publishing company; 2010:106-113.
2. Pal GK.editor. Textbook of practical physiology.4th ed. India: Universities press private limited; 2016: 93-100.
3. Kim E Barrett, editor. Ganong's Review of Medical physiology.23rd ed. New York: The McGraw-Hill Companies; 2010:527-530.
4. Chandra T, Gupta A. Prevalence of ABO and Rhesus Blood Groups in Northern India. Blood Disorders Transf 2012; 3(5):1-3.
5. Garg P, Upadhyay S, Chufal SS, Hasan Y, Tayal I. Prevalance of ABO and Rhesus Blood Groups in Blood Donors: A Study from a Tertiary Care Teaching Hospital of Kumaon Region of Uttarakhand Journal of Clinical and Diagnostic Research. 2014; 8(12): 16-19.
6. Amjadi O, Rafiei A, Ajami A, Valadan R, Hosseini-khah Z, Hajilooi M, Janbabaei G. Blood groups: in Health and Diseases. Res Mol Med. 2015; 3 (4): 1-9.
7. David. J. Anstee. The relationship between blood groups and disease. Blood 2010; 115(23): 4635-4643.
8. Transfusion Transmitted Infectious Diseases. International Society of Blood Transfusion Vox Sanguinis, .The international journal of transfusion medicine 2013; 105 (2): 1–132.
9. Tyagi S, Tyagi A. Possible correlation of transfusion transmitted diseases with Rh type and ABO blood group system. Journal of Clinical and Diagnostic Research. 2013; 7(9): 1930-1931.
10. Mohammadali F, Pourfathollah A. Association of ABO and Rh Blood Groups to Blood-Borne

Infections among Blood Donors in Tehran–Iran.Iranian J Publ Health 2014; 43(7):981-989.

11. Tayyab M, Malik AR, Khan AS. Du Phenotype - A review. JAMC 2000; 12(3):41-44.
12. Acharya S, Kumar R, Acharya A, Kudesia S, Kishore S. Weak D antigen - Revisited Indian Medical Gazette 2011:342-345.
13. Chatterjee K , Coshic P, Borgohain M, Premchand, Thapliyal RM, Chakroborty S, Sunder S. Individual donor nucleic acid testing for blood safety against HIV-1 and hepatitis B and C viruses in a tertiary care hospital. Natl Med J India. 2012 ;25 (4):207-9.
14. Hans R, Marwaha N. Nucleic acid testing benefits and constraints. Asian J Transfus Sci. 2014 ; 8(1): 2–3.
15. Nigam JS, Singh S, Kaur V, Giri S, Kaushal RP. The prevalence of transfusion transmitted infections in ABO blood groups and Rh type system Hematology Reports 2014; 6:71-72.
16. Sreedhar Babu KV, Bandi S, Kondareddy S, Madithadu A. Association of ABO and Rh blood groups to HBV, HCV infections among blood donors in a blood bank of tertiary care teaching hospital in Southern India: A retrospective study. International journal of research in medical sciences 2015; 3(7):1-4.
17. Bharadva S, Vachhani J, Dholakiya S. ABO and Rh association to transfusion transmitted infections among healthy blood donors in Jamnagar, Gujarat, India. J Res Med Den Sci 2016; 4(1):58-62.
18. Mandodar L, Shetty A, Chowdappa V. Distribution of ABO, Rhesus Blood Groups, Transfusion Transmitted Diseases and Adverse Donor Reactions in a Blood Bank of a Tertiary Care Hospital: A Five Year Study.National Journal of Laboratory Medicine. 2016; 5(3): 26-30.
19. Alemu G, Mama M. Assessing ABO/Rh Blood Group Frequency and Association with Asymptomatic Malaria among Blood Donors Attending Arba Minch Blood Bank, South Ethiopia. Malaria Research and Treatment 2016; 1-8.

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Prevalence of Anxiety, Depression and Stress among First Year Undergradute Medical Students

Mythri G[1], Nandini BN [2], Manjunath ML[3]

[1]Assistant Professor, Department of Physiology, Subbaiah Institute of Medical Sciences, Shimoga,
[2]Assistant Professor, [3]Professor and Head, Department of Physiology, Shimoga Institute of Medical Sciences, Shimoga

ABSTRACT

Background: The goal of medical education is to train knowledgeable, competent and professional physicians to care for the nation's sick, advance the science of medicine and promote public health. Medical school can impose significant psychological stress on medical students mainly through time pressure, large amount of new information, excessive working hours and knowing that at the end of their training they will be directly responsible for the health and welfare of others.

Aims and Objectives: To determine the prevalence of anxiety, depression and stress in first year undergraduate medical students in Shimoga.

Materials and Method: A cross-sectional, questionnaire based survey was conducted among 200 First Year MBBS students aged between 18-22 years at SIMS, Shimoga using DASS-42 Scale.

Results: Out of 200 students, about 65% had anxiety, 42% had depression and around 58% were found to be under stress. Female students were 6 times more likely to develop stress.

Conclusion: The challenges to all medical colleges are to promote student well-being and provide students with the coping tools to deal with stress throughout their medical education. They should incorporate more leisure activities in their curriculum, promote better interaction between the students and the faculty, have advisory services and peer group counseling at the campus and instigate rehabilitation programs for victims of anxiety and depression.

Keywords: *Anxiety; Depression; Stress; First year medical students.*

INTRODUCTION

In the more competitive environment that accompanied the increasing industrialization of the 20th century, there has been a widespread increase in stress-related mental disorders. It is estimated that by the year 2020, anxiety and depression will be the second most common cause of disability worldwide. [1]

The goal of medical education is to train knowledgeable, competent and professional physicians to care for the nation's sick, advance the science of medicine and promote public health.[2] Medical school can impose significant psychological stress on medical students mainly through time pressure, large amount of new information, excessive working hours and knowing that at end of their training they will be directly responsible for health and welfare of others.[3]

A considerable degree of psychological morbidity has been reported in medical students ranging from stress, interpersonal problems and suicidal ideation to psychiatric disorders. These reports have given rise to concern on how students' distress can affect their learning, professional development and patient contacts .Psychological problems from medical school stress may predict later mental health problems; students seldom seek help for their problems. [4]

Correspondence:
Dr Mythri G
Assistant Professor, Department of Physiology,
Subbaiah Institute of Medical Sciences, Shimoga,
Karnataka. E-mail: g.mythri@gmail.com
Mob: +91-9886025007

There is a paucity of such studies in South India. Hence, this study was carried out to see the prevalence of anxiety, depression and stress among first year undergraduate medical students in SIMS, Shimoga.

MATERIALS AND METHOD

The study was carried out among 200 first year undergraduate medical students of SIMS, Shimoga in January –February around five months after the commencement of the course. It was a cross-sectional study which included all First year medical Undergraduate students in the age group of 18-22 years.

Method of collection of data:

1. The study was done after obtaining Institutional Ethical Committee Clearance.

2. Details of the study protocol were explained to all those who volunteered for the study.

3. Informed consent was obtained.

4. The tests were carried out on the students in small batches of 20-30.

5. They were given a questionnaire (DASS 42 Scale) to be filled by themselves individually.

6. The students were explained the aim of the study and the fact that their co-operation in the form of giving honest answers was necessary.

7. Students were also assured that their anonymity would be maintained.

8. Score was noted based on DASS Scoring. [5]

9. Data was expressed in terms of percentage.

Statistical analysis: Statistical analysis was done using SPSS software version 21. p value < 0.05 was considered significant.

RESULTS

200 first year undergraduate medical students aged 18-22 years of whom 120 were males and 80 females were included in the study.Mean age was around 19.5± 1.33. Score was interpreted based on DASS-42 scoring .Prevalence of Anxiety , Depression and Stress among these medical students are shown Table 1.In the study, anxiety was more prevalent (65%) , compared to stress (58%) and depression (42%).

Among those with anxiety, 32% had mild degree of anxiety, 17% had moderate anxiety , 11% had severe anxiety and 5% had extremely severe anxiety (Figure 1).Among those who had depression, 22% had mild depression, 11% had moderate level of depression 7% had severe depression and 2% were found to have extremely severe depression(Figure 2).Among those who were stressed, 16% had mild stress, 21% were moderately stressed, 12% were under severe stress, and 9% were found to be extremely stressed out(Figure 3).

Table 2 shows the gender differences in prevalence of various grades of anxiety, depression and stress. The present study showed that prevalence of anxiety was equal (65%) among both the genders. Table 2 shows 24% of the females were moderately anxious whereas only 12% males had moderate anxiety.

There was no significant gender difference in the prevalence of mild/ severe anxiety. There was no significant difference in the prevalence of depression among males and females. However prevalence of moderate to severe depression was significantly more among females compared to males ($p < 0.05$).

Table 2 shows that prevalence of stress in females was 80%, whereas it was 43% among males. Table 3 shows prevalence of stress was 6 times higher in females compared to their male counter parts ($p <0.0001$). 45% of females were under severe- extremely severe stress compared to 5% in males indicating female medical undergraduate students significantly suffered from severe-extremely severe stress ($p<0.05$).

Table 1: Prevalence of anxiety, depresssion and stress among first year medicl students

	Present		Not Present	
	No. of Partcipants	**Percentage (%)**	**No . of Partcipants**	**Percentage (%)**
Anxiety	130	65	70	35
Depression	84	42	116	58
Stress	116	58	84	42

Table 2: Gender wise distribution of anxiety, depression and stress among first year medical students

	Grades	Males		Females		Total	
		No. of Individuals	%	No. of Individuals	%	No. of Individuals	%
Anxiety	Normal	42	35	28	35	70	35
	Mild	38	31.5	26	32.5	64	32
	Moderate	15	12.5	19	24	34	17
	Severe	17	14	5	6	22	11
	Extremely Severe	8	1	2	2.5	10	5
Depression	Normal	91	76	25	31.2	116	58
	Mild	22	18	22	27.5	44	22
	Moderate	04	3.4	18	22.5	22	11
	Severe	02	1.7	12	15	14	07
	Extremely Severe	01	0.9	03	3.8	04	02
Stress	Normal	68	57	16	20	84	42
	Mild	12	10	20	25	32	16
	Moderate	34	28	08	10	42	21
	Severe	04	03	20	25	24	12
	Extremely Severe	02	02	16	20	18	09

Table 3: Association of gender with stress

	STRESS	NO STRESS	ODDS RATIO VALUE (95% CONFIDENCE INTERVAL)	P-VALUE
FEMALES	64 (80%)	16 (20%)	6.1818 (3.1751 to 12.0359)	P<0.0001 (<0.05) SIGNIFICANT
MALES	52 (43%)	68 (57%)		

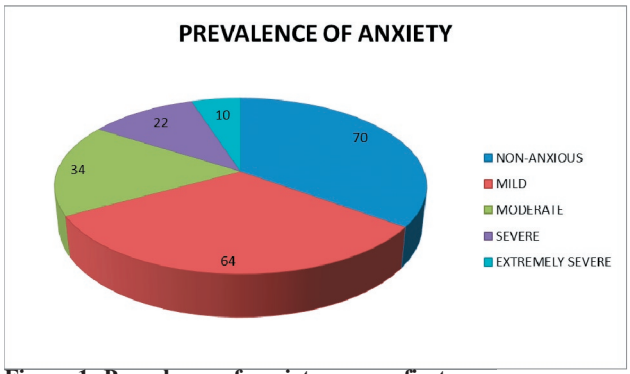

Figure 1: Prevalence of anxiety among first year undergraduate medical students (n=200)

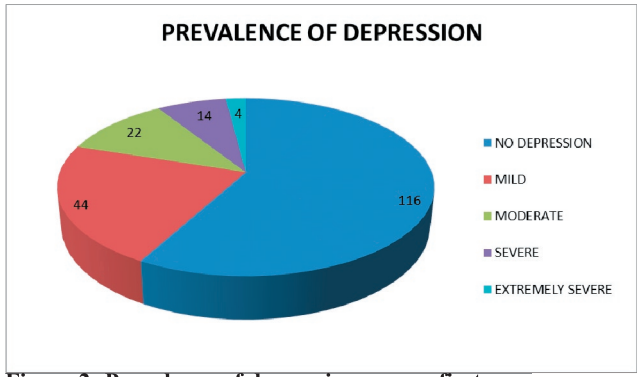

Figure 2: Prevalence of depression among first year undergraduate medical students (n=200)

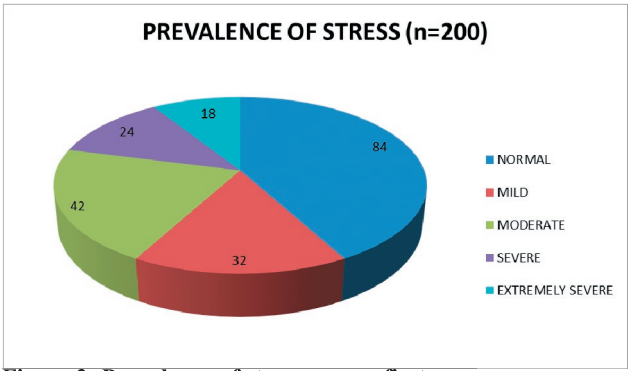

Figure 3: Prevalence of stress among first year undergraduate medical students (n=200)

DISCUSSION

Psychological well-being is important for medical students, for the patients they met and for their future medical practice. Current education process in medical training exposes their students several types of stressors, some are exogenous such as adaptation to medical curriculum, vastness etc. and some are endogenous like gender, personality traits etc. We have used the reliable and valid depression and anxiety screening tool, DASS-42.

A similar cross-sectional study done using DASS 42 questionnaire showed that. More than half of the respondents were affected by depression (51.3%), anxiety (66.9%) and stress (53%). Females reported higher score as compared to their male counterparts. Perception of self assessment in academics was strongly associated with the higher score.[6]

A cross-sectional study carried out on 815 medical students at Nishtar Medical College, Multan showed a high prevalence of anxiety and depression (43.89%) . Prevalence of anxiety and depression among students of first, second, third, fourth and final years was 45.86%, 52.58%, 47.14%, 28.75% and 45.10% respectively. Female students were found to be more depressed than male students (OR = 2.05, 95% CI = 1.42-2.95, p = 0.0001). There was a significant association between the prevalence of anxiety and depression and the respective year of medical college (p = 0.0276).[7]

In a study done on 252 students, prevalence of anxiety and depression in students of 4th year, 3rd year, 2nd year and 1st year was 49%, 47%, 73% and 66% respectively. It was significantly higher in 1st year and 2nd year, as compared to 3rd and 4th year ($p < 0.05$).[8]

Medical students go through not only the stress imposed by medical education but also routine everyday life stressor which may explain the level of severe stress noted among medical students. It was found in our study that females were 6 times more likely to develop stress. The reason may be because in South India most girls are brought up in a conservative environment and once they join the medical school they may end up staying away from home and find it difficult to cope up with the changes around them.

The reasons that can be attributed to the severe stress among 1st year students are large content of the text to be learnt, tests/examinations and no sufficient time to review what has been learnt. These calls for introducing early intervention strategies so that students who are entering in the medical education system can learn to cope with the pressure induced by medical education timely.

Interaction between students and faculties should be encouraged so that the signs of stress, anxiety and depression can be detected and addressed at the earliest. Prevention strategies should take into consideration the wide variety of factors that are inducing stress, depression or anxiety among students. Adding electives can also allow flexible learning options in the curriculum and may offer a variety of options including clinical electives, laboratory postings or community exposure in areas that students are not normally exposed as a part of regular curriculum. This will also provide opportunity for students to do project, enhance self directed learning, critical thinking and research abilities.

It is possible that few students have already an inherent tendency of taking stress and being anxious at their entry in M.B.B.S course may be aggravating it. Such students should be identified by psychological screening tests at the time of their entry only. Recreation facilities should be provided within the campus for the students as it is proved that inadequate social activity and impaired psychological health are interlinked and also that leisure activities can reduce stress among students. Relaxing exercises, yoga and meditation should be studied to relieve stress among medical students

CONCLUSION

This study has found that majority of First year undergraduate medical students experience stress. Proper guidance and counseling by faculties may help

to improve the present scenario. A physician is like a flower in the society. For spreading its fragrance into the society, it needs to be nurtured healthily providing a sound mental built up from the curricular activities supported adequately by their families.

LIMITATIONS

Lack of generalization of our results to other medical schools in India is an important limitation of this study. As it is a questionnaire based study, reporting bias can't be eliminated. This study was restricted to only one medical college. The sample size was small and unequal. Further studies taking large and proportionate sample size would minimize bias.

The study was done only in first year medical students and did not involve the students of other phases. The main reasons that surfaced were the sensitive and personal nature of the study as well as the length of questionnaire.

Source of Funding: None

Conflict of Interest: None

Ethical Clearance: Ethical clearance obtained from Institutional ethical committee.

REFERENCES

1. Lopez AD, Murray CC. The global burden of disease. Nature medicine, 1998, 4(11):1241–3.
2. Dyrbye LN, Thomas MR, Shanafelt TD. Systematic review of depression, anxiety, and other indicators of psychological distress among U.S. and Canadian medical students. Acad Med 2006; 81: 354–73.
3. N Karaoglu, M Şeker. Anxiety and Depression in Medical Students Related to Desire for and Expectations from a Medical Career. West Indian Med J 2010; 59 (2): 196
4. Tyssen R, Vaglum P, Gronvold NT, Ekeberg O.Suicidal ideation among medical students and young physicians: a nationwide and prospective study of prevalence and predictors.J Affect Disorders 2001; 64: 69–79.
5. Lovibond, S.H. & Lovibond, P.F. (1995). Manual for the Depression Anxiety Stress Scales (2nd. Ed.). Sydney: Psychology Foundation.
6. Iqbal S, Gupta S and Venkatrao E. Stress, anxiety & depression among medical undergraduate students & their socio-demographic correlates. Indian J Med Res 141, March 2015; 354-357.
7. Jadoon NA[1], Yaqoob R, Raza A, Shehzad MA, Zeshan SC.Anxiety and depression among medical students: a cross-sectional study. J Pak Med Assoc. 2010 Aug;60(8):699-702.
8. Inam SN, Saqib S and Alam E.Prevalence of anxiety and depression among medical students of a private university. J Pak Med Assoc. 2003 Feb; 53(2):44-7.

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A Comparative Study of Cognitive Functions in Occupational and Recreational Computer Users

Juno Mariam Cyril[1], Sowmya Rajaram[2]

[1]Post-Graduate Student, [2]Assistant Professor, Department of Physiology, Bangalore Medical College & Research Institute, K R Road, Fort, Bengaluru

ABSTRACT

Background: Computers have become an integral part of our modern world. Computer use is an interactive activity. Participation in cognitively challenging activities is associated with higher level of cognitive performance. However, effect of computer use on cognitive function is not well understood. Hence this study was taken up to evaluate the effect of occupational computer use on cognition.

Methodology: A total of 50 occupational (using computer for work for >40hrs/week) and 50 recreational (<15hrs/week) computer users who were graduates in the age group of 21-35yrs were tested for 'Mental Speed' by Digit Symbol Substitution Test (DSST), 'Sustained Attention' by Digit Vigilance Test (DVT), 'Response Inhibition' by Stroop Test and 'Learning & Memory' by Auditory Verbal Learning Test (AVLT) & Complex Figure Test (CFT).

Results: Results were statistically analysed using student 't' test. Occupational computer users performed better than the controls in DSST (p=0.041), DVT (p=0.027), Stroop Test (p=0.004) and Complex Figure Test (p=0.02) which were statistically significant. However, no statistically significant difference was observed in AVLT between the two groups.

Conclusion: Occupational computer users have better mental speed, sustained attention, response inhibition and visual memory compared to recreational computer users.

Keywords: *Cognition, Occupation, Recreational, Computer Use.*

INTRODUCTION

Computers have become an integral part of our modern world[1]. It is being used in every aspect of life from calculating grocery bills, banking operations, telecommunications, IT field, education & medical care[2]. However along with its benefits, it is associated with visual fatigue, musculoskeletal disorders, stress and decreased sleep due to their time bound work[3, 4]. Computer related morbidity has become an important occupational health problem[2].

The concept of cognition (from the Latin word cognoscere, "to know" or "to recognize") refers to the capacity for information processing, applying knowledge and changing preferences. Cognition involves memory, attention, executive functions, perception, language and psycho-motor functions[5]. Several studies have suggested that engaging in cognitively challenging activities, such as reading books or newspapers, playing games, making crossword puzzles and listening to music, is associated with maintenance or even improvement of cognitive skills[6].

Some studies have shown that greater use of computer will be associated with higher levels of cognitive performance[1]. Whether adults with better cognitive abilities tend to use the computer more (due to socio-economic status/occupation, better computer attitudes or other factors) or the computer use helps to maintain or improve cognitive abilities, is still unclear[7]. Few studies have also shown that computer use has no effect on cognitive function[8].

To date, only a limited number of studies have actually focused on the impact of computer use on cognitive functions. Hence this study was undertaken, to evaluate the effect of occupational computer use

on cognition and to settle down the contrary results in previous studies.

MATERIAL AND METHOD

Study was conducted on computer users in Bangalore after obtaining clearance from the Institutional Ethical Committee. Study was carried out between April and June 2016. Informed written consent was obtained from every subject after explaining the study protocol. 100 computer users in the age group of 21–35 years who were graduates were selected for the study according to the eligibility criteria.

A detailed history taking and relevant clinical examination was done for all subjects. Following which, subjects who had BMI > 30kg/m^2, Perceived Stress Scale Score > 13, Pittsburgh Sleep Quality Index Score 5 were excluded from the study. Also, individuals with diabetes mellitus, hypertension, psychiatric illness, neurological disorders, smoking, alcohol intake or any substance abuse were not taken up for the study. Subjects receiving medications like sedatives and hypnotics were also excluded. Of the 100 participants, 50 were **occupational computer users** who used computer for work for >40hrs/week and 50 were **recreational computer users** who used computer for <15hrs/week for recreational purposes. In this modern era of technology, since it is difficult to get a non-user of computer, recreational computer users were chosen as the control group.

Cognitive Function Tests were administered according to the instructions provided in the NIMHANS Neuropsychology Battery[9]. Time taken for test was noted with the help of a stopwatch. Following tests were administered in a fixed order during a single session in a quiet room for all participants:-

Domain	Function	Test
Speed	Mental Speed	Digit Symbol Substitution Test (DSST)
Attention	Sustained Attention	Digit Vigilance Test (DVT)
Executive Functions	Response Inhibition	Stroop Test
Learning & Memory	Verbal	Auditory Verbal Learning Test (AVLT)
Learning & Memory	Visual	Complex Figure Test

Digit Symbol Substitution Test: DSST consists of a sheet in which numbers 1–9 are randomly arranged in 4 rows of 25 squares each. Subject substitutes each number with a symbol using a number-symbol key given on top of the page. First 10 squares are for practice. Time taken to complete the test forms the score. Lower score indicates better mental speed.

Digit Vigilance Test: DVT consists of numbers 1–9 randomly ordered and placed in rows on a page. There are 30 digits per row and 50 rows on the sheet. Digits are closely packed on the sheet. Subject has to cancel the digits, 6 and 9 as fast as possible without missing the targets or cancelling wrong numbers. Time taken to complete the test forms the score. Lower score indicates better sustained attention.

Stroop Test: Colour names Blue, Green, Red and Yellow are printed in capital letters on a paper. Colour of the print occasionally corresponds with the colour designated by the word. Words are printed in 16 rows and 11 columns. Subject was asked to read the words column-wise as fast as possible. Time taken to read all the 11 columns were noted down. Next, the subject was asked to name the colour in which the word was printed. The time taken to name all the colours in column wise was noted down. *Reading time* and *naming time* were converted into seconds. Reading time was subtracted from the naming time to get the Stroop effect score. Lower score indicates better executive function.

Auditory Verbal Learning Test: AVLT consists of words designating familiar objects like the vehicles, tools, animals and body parts. There are two lists A and B, with 15 words in each list. Words in list A were presented at rate of 1 word per second in the same order for 5 trials. Each trial consisted of the presentation of all 15 words, immediately followed by the recall of the same by the subject. Response was noted down. After the completion of 5 trials of List A, words in List B were

presented once and an immediate recall was taken for the same. Presentation of List B serves as interference. This was followed by *immediate recall* of words from List A. After a delay of 20 min, words from List A were again recalled to form the *delayed recall* score. Following delayed recall, *recognition trial* was done in which, 30 words [15 words from List A & 15 new words were randomly mixed] were called out one at a time and the subject indicated whether each word belonged to list A or not. Hits and errors were recorded. Total number of words correctly recalled over 5 trials form the L*earning Score*. Number of words recalled correctly in immediate recall trial, delayed recall trial and recognition trial form the *Memory Score.*

Complex Figure Test: An 8.5 inch by 11 inch card containing complex figure and a paper of same size is placed in front of subject. Subject has to copy the figure on the paper without using rulers; erasers may be used. Then, the subject is asked to recall the figure twice – 3 minutes after copying *(Immediate Recall)* and 30 minutes later *(Delayed Recall)*. A score of 0, 0.5, 1 or 2 was assigned to each unit of figure based on the accuracy and placement criteria; total score was calculated.

Statistical Analysis: Data presented as mean ± standard deviation. Independent Student's t-test (two tailed) was used to compare the two groups. P-value < 0.05 was considered statistically significant. LibreOffice Calc was used for statistical analysis and to generate tables and graphs.

RESULTS

Table 1 shows demographic details of both the groups. Both the groups were age, BMI and gender matched.

Table 1: Demographic Details

	Occupational Computer Users	**Recreational Computer Users**	**P-Value**
Age (yrs)	28.1 ± 3.76	27.08 ± 3.26	0.151
BMI (Kg/m^2)	23.12 ± 1.8	23.75 ± 1.98	0.096
Males	27	23	
Females	23	27	

Table 2 shows mean ± SD values of the scores of different tests for both the groups. It was observed that occupational computer users performed better in DSST, DVT, Stroop Test and Complex Figure Test which was statistically significant. However, no statistically significant difference was observed for AVLT score between the two groups.

Table 2: Scores of different tests of both the groups

	Occupational Computer Users	**Recreational Computer Users**	**P-Value**
DSST Score	159.32 ± 13.37	164.28 ± 10.39	**0.041***
DVT Score	371.02 ± 18.39	378.88 ± 16.47	**0.027***
Stroop Score	92.82 ± 5.78	96.74 ± 7.35	**0.004***
AVLT – Learning Score	62.16 ± 3.59	60.9 ± 5.64	0.186
AVLT – Memory Score	44.04 ± 3.63	44.72 ± 2.79	0.296
CFT – Copy	35.08 ± 1.1	34.76 ± 1.42	0.212
CFT – Immediate Recall	26.2 ± 2.06	24.99 ± 2.98	**0.02***
CFT – Delayed Recall	25.83 ± 2.53	24.52 ± 3.03	**0.021***

DISCUSSION

The present study reveals that occupational computer users have better mental speed, sustained attention, response inhibition and visual memory compared to recreational computer users. 'Mental Speed' requires rapid processing of information which in-turn requires coordination of different areas of brain. 'Sustained Attention' refers to the capacity to attend a task for a required period of time. Right fronto parietal network mediates sustained attention. 'Response Inhibition' measures the ease with which a perceptual set can be shifted both to conjoin changing demands and by suppressing a habitual response in favour of an unusual one. Pre-frontal areas are essential for response inhibition. 'Verbal / Visual Learning and Memory' is the capacity to learn and remember verbal / visual material[9].

Computer use requires continuous inputs from the users and therefore provides mental stimulation. Computer use is an interactive activity which requires visuomotor control in their operation: visual-cognitive input (i.e., viewing a screen) and manual output (i.e., manipulation of peripheral devices such as a keyboard and mouse) [10].

Procedural memory is required to activate the routines that are necessary to use a computer program, e.g. to launch a Web browser, and to execute specific commands in that browser. To keep track of information already processed or to decide on the next action to take, working memory is required. Executive functions come into play when strategies are made to perform a task efficiently. Visual search, information processing and attention processes are recruited in order to find relevant cues, to evaluate which information is relevant within a given context, and to focus on those cues while ignoring or inhibiting irrelevant cues[6]. Therefore, it is possible that having and maintaining a job that involves a computer also requires more mental activities such as organizing and multi-tasking[1].

Researches have shown that structural differences emerge in brain, when exposed to divergent sensory experience. So the external conditions can transform the course of brain development. This phenomenon is referred as neural plasticity[11]. Computer experience is associated with altered neural activation in frontal regions which are consistent with the computer's demands on multitasking, involving shifting of attention and interactive coordination of motor, sensory and cognitive skills. Thus coordinating and scheduling all of these component activities may help to maintain good cognitive function[1]. And this cognitively stimulating activity may enhance functional connections contributing to cognitive reserve[12].

Findings in the present study are consistent with the results from a study done by Patricia A.Tun et al in 2010. They found that frequent computer activity is associated with good cognitive function particularly executive control[1]. Slegers K et al in 2012 also reported similar findings. Their study was quiet similar to ours in terms of tests used. They used Visual Verbal Learning Test to measure verbal memory, Letter–Digit Substitution Test to measure processing speed and Stroop Colour Word Test for selective attention and susceptibility to interference. They also found protective effects of the computer use for measures of selective attention and memory in both older (>50yrs) and younger (24-49yrs) participants[6]. But contrary to above results, Slegers K et al in 2009 observed that learning to use a computer, does not benefit older adults with respect to many domains of cognitive functions[8]. It could be because, it was an intervention study in which participants used computer for 1 year and just 1 year of computer use may not be enough to cause changes in cognitive functions. Also, in our study, computer use was self-initiated, while in intervention studies participants are asked to use computer. As a result, individuals might have differed in their motivation to use computers.

There were few limitations in the present study. Larger and more diverse population including varied age groups should have been more representative of the population. Longitudinal studies are required to examine the causal mechanisms in the relationship between cognitive performance and computer use. Further research using functional MRI can provide better insight into the mechanisms.

CONCLUSION

Computer use has positive effects on cognition. Computer use may be one of the easily accessible activity that helps to remain mentally active. Computers are useful tools which should be suitably & thoughtfully integrated within the educational system. Computer use can be promoted to lessen the chances of developing cognitive impairments like Alzheimer's disease and age-

related cognitive decline.

Conflict of Interest: Nil

Source of Funding: Self

REFERENCES

1. Tun PA, Lachman ME. The association between computer use and cognition across adulthood: use it so you won't lose it? Psychol Aging. 2010;25(3): 560–568.
2. Sharma AK, Khera S, Khandekar J. Computer related health problems among information technology professionals in Delhi. Indian J Community Med. 2006;31(1):36.
3. Suparna K, Sharma A K, Khandekar J. Occupational Health Problems and Role of Ergonomics in Information Technology Professionals in National Capital Region. Indian J Occup Environ Med. 2005;9(3):4–7.
4. Babu GR, Mahapatra T, Detels R. Application of onmixed methods for exploration of the association of job stress and hypertension among software professionals in Bengaluru, India. Indian J Occup Environ Med. 2013;17(2):41–47.
5. Nehlig A. Is caffeine a cognitive enhancer? J Alzheimer's Dis. 2010;20.
6. Slegers K, van Boxtel MPJ, Jolles J. Computer use in older adults: Determinants and the relationship with cognitive change over a 6 year episode. Comput Human Behav. 2012;28(1):1–10.
7. Fazeli PL, Ross LA, Vance DE, Ball K. The relationship between computer experience and computerized cognitive test performance among older adults. Journals Gerontol - Ser B Psychol Sci Soc Sci. 2013;68(3):337–346.
8. Slegers K, van Boxtel MPJ, Jolles J. Effects of computer training and internet usage on cognitive abilities in older adults: a randomized controlled study. Aging Clin Exp Res. 2009;21(1):43–54.
9. Rao SL, Subbakrishna DK, Gopukumar K. NIMHANS neuropsychology battery. 2004.
10. Johnson GM. Cognitive processing differences between frequent and infrequent Internet users. Comput Human Behav. 2008;24(5):2094–2106.
11. Chirico D. Building on Shifting Sand: The Impact of Computer Use on Neural & Cognitive Development. Wald Educ Res Inst Bull. 1997;2.
12. Geda YE, Silber TC, Roberts RO, Knopman DS, Christianson TJH, Pankratz VS et al. Computer Activities, Physical Exercise, Aging, and Mild Cognitive Impairment: A Population-Based Study. JMCP. 2012;87(5):437–442.

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Alterations in the Vascular Physiology of Young Adults with Family History of Type 2 Diabetes Mellitus

Kanimozhi S[1], Poornima KN[2], Meenakshi S[3], Prakash G[4], Balaji R[5], Anandhalakshmi S[6], Saravanan A[7]

[1]Associate Professor, [2]Assistant Professor, Department of Physiology, [3]Associate Professor, Department of Internal Medicine, [4]Assistant Professor, Department of Radiology, [5]Associate Professor, Department of Community Medicine, [6]Professor, [7]Professor & Head, Department of Physiology, SRM Medical College, Hospital & Research Centre, Potheri, Kattankulathur, India

ABSTRACT

Background: Type 2 diabetes mellitus (T2DM) is a leading cause of morbidity and mortality, particularly from cardiovascular diseases. Family history of diabetes appears to increase the risk of coronary artery disease (CAD), even in non-diabetic subjects. They are insulin resistant and carry a risk of premature atherosclerosis, the extent of which can be estimated by measuring the carotid artery intima media thickness (CIMT).

Aim & objectives: To compare the CIMT in offsprings with (FH^+) of T2DM and offsprings without (FH^-) of T2DM. Subjects in both groups are apparently healthy individuals with no known cardiovascular risk factors.

Method: We studied 69 young (18-25 years), adult offsprings with (FH^+) of T2DM and 50 control subjects without (FH^-) of T2DM (age, sex, BMI and blood pressure matched). A FH^+ of T2DM was defined as having one or both parents with type 2 diabetes. All subjects underwent high resolution B-mode ultrasonographic evaluation of common carotid artery intima–media thickness. Plasma glucose and lipid profile were measured after an overnight fast of 10-12 hours.

Results: Compared to controls, subjects with FH^+ had increased CIMT, (0.46 mm ± 0.01 Vs 0.56 mm ± 0.01, $P<0{\cdot}001$). Metabolic parameters were within normal limits and there was no statistical difference among both groups. Pearson's correlation established a significant and stronger association between CIMT and metabolic variables (fasting blood glucose, triglycerides and very low density lipoprotein cholesterol) only among FH^+ subjects.

Conclusion: These results suggest that a genetic predisposition to T2DM may accelerate the development of atherosclerosis and increase the risk for CHD.

Keywords: *Type 2 diabetes mellitus, coronary heart disease, carotid artery intima media thickness, blood glucose.*

INTRODUCTION

It is well established that type 2 diabetes mellitus (T2DM) is a leading cause of morbidity and mortality, particularly from cardiovascular disease. The risk of heart disease increases even in non-diabetic subjects with family history of T2DM. They approximately have a 40% life time risk of developing T2DM[1]. Though, present life style with excess calorie dense food and limited physical activities are attributed for the development of T2DM, a genetic predisposition seems to be an important trigger in initiating the metabolic dysregulation that leads to the development of T2DM[2]. Subjects with family history of T2DM are often insulin resistant and carry a risk of premature atherosclerosis. Measurement of carotid artery intima media thickness (CIMT) by high resolution ultrasonography is being

Corresponding author:
Dr. Kanimozhi Sadasivam, MD
Associate Professor, Department of Physiology,
SRM Medical College, Hospital & Research Institute,
Potheri, Kattankulathur, Chennai- 603203.
Tamilnadu, Phone: +91-9500061772
Email: dr_kani2002@yahoo.co.in

used as an approved surrogate marker for subclinical atherosclerosis[3], since it is an excellent non-invasive marker of generalized atherosclerosis. There are many reports that suggested that the carotid and cerebral arteries and the aorta undergo the atherosclerosis at the same age as the coronary arteries[4]. It is also a strong predictor of future cardiovascular events[5]. Hence, a family history of diabetes, even in non-diabetics subjects without any cardiovascular disease risk factors, is regarded as an increased coronary heart disease risk. Carotid ultrasonic measurements can be an important early atherosclerosis marker. The objective of this study is to analyse the structural characters of the carotid arteries in subjects with and without a family history of T2DM, both groups with no other known cardiovascular risk factors.

MATERIALS AND METHOD

Research design & subjects

In this cross-sectional study, we studied a total of 103 subjects between the ages of 18-25 years of both sexes. Among which 69 were cases with positive family history of T2DM and 34 were controls with negative family history for T2DM. Few control subjects included in the present study were the same in whom we investigated the effects of family history of coronary artery disease on carotid intima media thickness[6]. A positive family history of T2DM was defined as having one or both parents with T2DM and a negative family history of T2DM was defined as having either parents or relatives up to third generation without T2DM. Cases were recruited among the offsprings of patients who visited the Diabetic clinic and controls were subjects who visited the same hospital for physical fitness certificates prior to employment. The study was done in the Department of Physiology in conjunction with the Department of General Medicine and Radiodiagnosis at SRM Medical College, Hospital and Research Centre, kattankulathur, India for a total duration of 22 months from August 2014 till May 2016. To reduce the effect of other confounding factors we excluded subjects with smoking history, alcohol intake, coronary artery anomaly, arrhythmia, heart failure, stroke, transient ischaemic attack, obesity, who are already being treated for CAD/diabetes and/ anaemia, hepatic and other chronic illness that might affect glucose homeostasis and endothelial function. Thus participants in both groups were metabolically well defined individuals with no other known cardiovascular risk factors other than family history of T2DM in cases.

Ethics statement:

The study was initiated after obtaining approval from the institutional ethics committee (659/IEC/2014) and conducted in accordance with the Declaration of Helsinki, including written informed consent from each participant.

Blood pressure and anthropometric measurements:

All those who agreed to participate were given a questionnaire to obtain information on smoking, alcohol consumption, history of diabetes, hypertension, family history of vascular disease and diabetes. Each subject underwent a detailed clinical examination and BMI was calculated after measuring anthropometric variables like height and weight according to standardized protocols[7]. Blood pressure was measured as a mean of three readings taken at 2 minutes interval using a periodically calibrated mercury sphygmomanometer[8].

Sample collection and blood investigations:

Fasting venous blood samples were collected between 8-10 am in the morning after 10-12 hours of fasting to estimate blood sugar levels and lipid profile. Blood glucose levels were estimated by the glucose oxidase method[9]. Lipid profile included measurement of total cholesterol (TC), triglyceride (TG), high-density lipoprotein cholesterol (HDL-C), low-density lipoprotein cholesterol (LDL-C) and very low-density lipoprotein (VLDL-C) cholesterol using standardized commercially available SIEMENS kit[8]. Serum LDL-C and VLDL-C were calculated from the estimated values of TC, TG and HDL-C, using Frieldwald's equation[10].

Ultrasonography measurements:

CIMT was measured with high resolution ultrasound of the right and left carotid arteries using PHILIPS HD 7 ultrasound machine with L12-3 broadband linear probe. The study protocol involved scanning the bilateral cervical carotid arteries in cross section to see the luminal patency and for the presence of plaques in the longest extension possible from the base of the neck to the carotid bulb and bifurcation. Then longitudinal images were obtained and the distance between the far two echogenic lines representing the intima media thickness

(IMT) of the arterial wall of the distal common carotid artery (CCA) was measured within 1 cm proximal to the carotid bulb. The maximal IMT at this site in the right and left CCAs was measured by manual technique using electronic callipers[11]. The lumen diameter between the near and far wall intima media interfaces was imaged at this site on both sides. All measurements were made by a single trained radiologist who was unaware of the subjects' status.

STATISTICAL ANALYSIS

Data were analysed by using Microsoft excel and statistical software SPSS version 21.0. Descriptive statistics such as mean & standard deviation were used to describe the continuous variables and frequency & percentages were used to describe the categorical variables. Inferential statistics such as Independent T test was used to analyse the difference in the means between the groups. Pearson correlation was used to find out the correlation between continuous variables. P value less than 0.05 was considered to be statistically significant.

FINDINGS

The data on anthropometric and clinical characteristics of our study subjects is presented in table 1. Our data shows that there is no difference in the mean value between both groups, thus making them comparable. Also the BMI and other clinical characters like blood pressure and its derivatives were within normal limits in both groups, indicating our subjects to be apparently healthy individuals. As expected, from table 2 it is evident that there was no significant difference among both groups with respect to blood glucose and lipid profile.

Table 3 summarizes the ultrasonographic findings of the carotids. Subjects with a positive family history of T2DM had greater intima media thickness (right, left and average IMT) compared to those with a negative family history. No difference was observed for carotid lumen diameter.

Table 4 shows the results of the logistic regression analyses of CIMT(dependent variable) and metabolic parameters like fasting blood glucose and lipid profile among our study subjects (n=103). It is observed that mean CIMT was significantly associated with FBS, TG and VLDL cholesterol. When we did subgroup analyses we noted a significant and stronger association between CIMT and metabolic variables (FBS, TG and VLDL) only among those with a positive family history of T2DM (Table 5).

DISCUSSION

It is a well-established fact that genetic predisposition to type 2 diabetes is associated with higher risk of coronary artery disease (CAD). Many authors have shown an increased CIMT values in diabetic individuals compared to non-diabetic controls[12]. Also a positive relation was found between duration of diabetes and CIMT[13]. Mohan et al[14] in their study showed a linear increase in mean CIMT values with increased post prandial blood glucose level, corroborating a greater damage to the vessel wall. However, a similar observation among young adults with genetic predisposition to T2DM is very scarce.

To the best of our knowledge this is the first Indian study reporting observations with regards to heritability of CIMT. Our results show that healthy, young offspring of parents with T2DM have significantly increased CIMT compared with the offspring of non-diabetic parents (Table 2). Statistical significance is retained even after adjustment for a range of confounders, suggesting an independent association between CIMT and family history of diabetes (Table 4 & 5). Thickness of the intima-media complex in large vessels is the first evidence of atherosclerosis at subclinical stage. A closer look at the chronology of atherosclerosis- the first to set in is endothelial dysfunction, followed by increase in intima-media thickness. Thus an increased CIMT in our study suggest the possibility of accelerated atherosclerosis at subclinical stage and these individuals though apparently healthy are at greater risk of CAD compared to controls. Pannacciulli et al[15] demonstrated higher CIMT in young normal, overweight and obese glucose tolerant offsprings of T2DM patients compared with control subjects. Balletshofer et al[16] established association between endothelial dysfunction and insulin resistance in young normotensive offsprings of diabetic subjects independent cardiovascular risk factors. The mechanism behind a raised CIMT in healthy offspring is still unclear. As mentioned earlier endothelial dysfunction plays a central role in the development of atherosclerosis- a disturbed endothelium dependent vasodilation is regarded as an early marker in the development of vascular disease and this occurs even before hyperglycemia becomes evident[17]. These vascular

derangements are believed to ensue at an early and faster pace in individuals with a genetic predisposition explaining the raised CIMT in our study population. The reason for such vascular derangements in people with family history of diabetes is still a topic of debate, however few studies point towards a link between decreased endothelium released nitric oxide production in susceptible population[18, 19]. Thus genetics along with the interplay of environmental factors, urbanization and detrimental lifestyle poses a higher risk of CAD for such individuals. Our study has some limitations; we were not able to match the cases and controls, as it was extremely difficult to recruit control subjects having either parents or relatives up to third generation without history of T2DM. Also, we only quantified the anatomical abnormalities of the vessel wall and did not assess the functional characters of the blood vessel.

Table: 1 Anthropometric & clinical characteristics of (FH^+) and (FH^-) subjects

Parameters	Positive family history (FH^+)	Negative family history (FH^-)
Mean age(yrs)	22.57 ± 0.52	23.64 ± 0.96
Male (%)	42/69 – 60.9	15/34 – 44.1
Mean Weight (kgs)	62.75 ± 1.38	60.42 ± 1.63
Mean Height (cms)	165.71 ± 1.20	165.33 ± 1.81
Mean BMI (kg/m^2)	22.80 ± 0.40	22.08 ± 0.45
Mean SBP (mm Hg)	109.32 ± 1.42	107.88 ± 1.93
Mean DBP (mm Hg)	72.59 ± 1.04	72.48 ± 1.62
MAP (mm Hg)	83.66	83
PR/min	74	77

BMI- Body mass index, SBP- Systolic blood pressure, DBP- Diastolic blood pressure, MAP- Mean arterial pressure, PR- Pulse rate

Table: 2 Ultrasonographic characters of blood vessel in study subjects

Parameters	Positive family history (FH^+)	Negative family history (FH^-)	T value	P value
CIMT- Right(mm)	0.56 ± 0.01	0.46 ± 0.01	5.814	0.0001*
CIMT- Left(mm)	0.57 ± 0.01	0.47 ± 0.01	6.888	0.0001*
CIMT- Average(mm)	0.56 ± 0.01	0.46 ± 0.01	7.154	0.0001*
Lumen diameter-Right(cm)	0.57 ± 0.00	0.57 ± 0.01	-0.272	0.786
Lumen diameter-Left(cm)	0.57 ± 0.00	0.56 ± 0.01	0.620	0.537
Lumen diameter-Average(cm)	0.57 ± 0.00	0.57 ± 0.01	0.197	0.844

CIMT- Carotid artery intima media thickness , *- Statistically significant

Table: 3 Biochemical profile of study subjects

Parameters	Positive family history (FH^+)	Negative family history (FH^-)	T value	P value
FBS(mg/dl)	83.35 ± 1.07	80.94 ± 1.58	1.281	0.203
TGL(mg/dl)	115.53 ± 3.94	107.03 ± 5.12	1.270	0.207
Total cholesterol(mg/dl)	133.40 ± 4.07	117.21 ± 4.11	2.487	0.015
LDL(mg/dl)	73.92 ± 4.18	53.75 ± 4.31	3.003	0.003
HDL(mg/dl)	36.37 ± 1.13	42.06 ± 1.61	-2.885	0.005
VLDL(mg/dl)	23.11 ± 0.79	21.41 ± 1.02	1.270	0.207

FBS- Fasting blood sugar, TGL- Triglycerides, TC- Total cholesterol, LDL- Low density lipoprotein, HDL- High density lipoprotein, VLDL- Very low density lipoprotein

Table: 4: Simple correlations between the CIMT and metabolic parameters in the study subjects (n= 103)

Parameters	Average CIMT	
	Correlation coefficient	P value
FBS(mg/dl)	0.267	0.007*
TGL(mg/dl)	0.263	0.008*
Total cholesterol(mg/dl)	0.247	0.013
LDL(mg/dl)	0.221	0.026
HDL(mg/dl)	-0.121	0.229
VLDL(mg/dl)	0.263	0.008*

FBS- Fasting blood sugar, TGL- Triglycerides, TC- Total cholesterol, LDL- Low density lipoprotein, HDL- High density lipoprotein, VLDL- Very low density lipoprotein,

*-Statistically significant

Table: 5 Simple correlations between the CIMT and metabolic parameters in (FH^+) & (FH^-) subjects

Parameters	Average CIMT			
	Positive family history (FH^+)		Negative family history (FH^-)	
	r value	P value	r value	P value
FBS(mg/dl)	0.223	0.007*	0.238	0.183
TGL(mg/dl)	0.215	0.002*	-0.105	0.562
Total cholesterol(mg/dl)	0.196	0.109	-0.232	0.194
LDL(mg/dl)	0.105	0.392	-0.152	0.398
HDL(mg/dl)	0.096	0.434	-0.119	0.511
VLDL(mg/dl)	0.205	0.001*	-0.105	0.562

FBS- Fasting blood sugar, TGL- Triglycerides, TC- Total cholesterol, LDL- Low density lipoprotein, HDL- High density lipoprotein, VLDL- Very low density lipoprotein

*- Statistically significant

CONCLUSION

Healthy, young individuals with family history of T2DM have increased CIMT (sub-clinical atherosclerosis) compared to family history negative controls. Thus these individuals, though apparently normal are at greater risk of CAD. Routine screening of such individuals with a quick, non-invasive ultrasound scan of carotid artery for intima-media thickness will go a long way in prolonging survival and improving quality of life by detecting and appropriate management of subclinical atherosclerosis at early stages.

Conflict of Interest: None

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REFERENCES

1. Eschwege E, Richard JL, Thibult N, Ducimetiere P, Warnet JM, Claude JR, Rosselin GE. Coronary heart disease mortality in relation with diabetes, blood glucose and plasma insulin levels. The Paris Prospective Study, ten years later. Hormone and metabolic research. Supplement series 1984 Dec;15:41-46.
2. Permutt MA, Wasson J, Cox N: Genetic epidemiology of diabetes. Journal of Clinical investigation 2005 115:1431–39.
3. Mancini GBJ, Dahlöf B, Díez J. Surrogate markers for cardiovascular disease: structural markers. Circulation 2004; 109 (Suppl IV):IV-22-30.

4. Tanganelli P, Bianciardi G, Simoes C, Attino V, Tarabochia B, Weber G. Distribution of lipid and raised lesions in aortas of young people of different geographic origins (WHO-ISFC PBDAY Study). World Health Organization-International Society and Federation of Cardiology. Pathobiological Determinants of Atherosclerosis in Youth. Arteriosclerosis, Thrombosis, and Vascular Biology 1993 Nov 1;13(11):1700-10.

5. Simon A, Gariepy J, Chironi G, Megnien JL, Levenson J. Intima–media thickness: a new tool for diagnosis and treatment of cardiovascular risk. Journal of hypertension 2002 Feb 1;20(2):159-69.

6. Sadasivam K, Nagarajan P, Durai I, Sundari M, Ayyavoo S, Ramamoorthy T. Carotid artery intima-media thickness in young adults with family history of coronary artery disease. Journal of clinical and diagnostic research 2015 Sep;9(9): CC01.

7. Arkansas Center for Health Improvement. A Training Manual for Height and Weight Assessment. Available at:http://www.achi.net.Manual.pdf. Accessed November 2010.

8. British hypertension society guidelines. Available at:http://guidance.nice.org.uk/ CG127/ NICEGuidance/pdf/English [August 24, 2011].

9. Trinder P. Determination of glucose in blood using glucose oxidase with an alternative oxygen acceptor. Annals of clinical Biochemistry. 1969 Jan;6(1):24-7.

10. Stadtman TC. Preparation and assay of cholesterol and ergosterol. Methods in Enzymology 1957;3: 392-94.

11. Friedewald WT, Levy RI, Fredrickson DS. Estimation of the concentration of low-density lipoprotein cholesterol in plasma, without use of the preparative ultracentrifuge. Clinical chemistry 1972 Jun 1;18(6):499-02.

12. Sidhu PS, Desai SR. A simple and reproducible method for assessing intimal-medial thickness of the common carotid artery. The British journal of radiology 1997 Jan;70(829):85-89.

13. Esposito K, Ciotola M, Carleo D, Schisano B, Sardelli L, Di Tommaso D, Misso L, Saccomanno F, Ceriello A, Giugliano D. Post-meal glucose peaks at home associate with carotid intima-media thickness in type 2 diabetes. The Journal of Clinical Endocrinology & Metabolism 2008 Apr;93(4):1345-50.

14. V. Mohan, R. Ravikumar, S Shenathi Rani, R Deepa – Intimal medical thickness of the carotid artery in South Indian diabetic and non-diabetic subjects: The Chennai Urban Population Study (CUPS). Diabetologia 2000;43;494-99.

15. Pannacciulli N, De Pergola G, Ciccone M, Rizzon P, Giorgino F, Giorgino R. Effect of family history of type 2 diabetes on the intima-media thickness of the common carotid artery in normal-weight, overweight, and obese glucose-tolerant young adults. Diabetes care 2003 Apr 1;26(4):1230-34.

16. Balletshofer BM, Rittig K, Enderle MD, Volk A, Maerker E, Jacob S, Matthaei S, Rett K, Häring HU. Endothelial dysfunction is detectable in young normotensive first-degree relatives of subjects with type 2 diabetes in association with insulin resistance. Circulation 2000 Apr 18;101(15):1780-84.

17. Ma S, Virkama A, Groop PH, Cockcroft J, Utriainen T, Fagerudd J, Yki-Ja H. Chronic hyperglycemia impairs endothelial function and insulin sensitivity via different mechanisms in insulin-dependent diabetes mellitus. Circulation 1996 Sep 15;94(6):1276-82.

18. Petrie JR, Ueda S, Webb DJ, Elliott HL, Connell JMC. Endothelial nitric oxide production and insulin sensitivity. Circulation 1995;93:1331–33.

19. Uusitupa M, Niskanen L, Sutonen O, Pyo¨ra¨la¨ K. Hyperinsulinemia and hypertension in patients with newly diagnosed non-insulin dependent diabetes. Diabetes Metabolism 1987;13:369 –74.

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Comparative Trends in Body Mass Index (BMI), in First Year Medical Students, in a Gap of Ten Years

Neeru Garg[1], Punam Verma[2], Sunita Mittal[3], Nidhi Jain[4] Priyanka Gupta[4]

[1]Associate Prof, [2]Prof, Department of Physiology, SGRRIM&HS, Dehradun, [3]Assoc Prof, Department of Physiology, AIIMS Rishikesh, [4]Post Graduate Student, Department of Physiology, SGRRIM &HS, Dehradun

ABSTRACT

Background & Objectives: Worldwide obesity has more than doubled since 1980. A large number of studies have explored the relationship between Body Mass Index (BMI) and mortality. Objective of this study was to screen out the overweight and obese category in present students and to evaluate the changing trends in a gap of ten years.

Method: Total participants (17-20 years of age) were divided into two groups of 400 each& were categorized into BMI based, normal ,overweight and obese groups.

Results : In the last four years about 43% students were overweight and obese while ten years ago data showed 21% students in these categories.

Interpretation & Conclusion: Comparing both the groups , it can be concluded that, a significant increase in overweight and obese category of students over a period of ten years is observed.

Keywords : *body mass index,overweight, obese.*

INTRODUCTION

Overweight and obesity i.e abnormal or excessive fat accumulation, in childhood, adolescence and adulthood is an increasing problem in many countries. Body Mass Index (BMI) as defined by World Health Organization in fact sheet updated in january, 2015- is a simple index of weight for height that is commonly used to classify overweight and obesity in adults. Worldwide obesity has more than doubled since 1980. A large number of studies have explored the relationship between Body Mass Index (BMI) and mortality, but in most of the studies, height and weight have been measured in adults[12]. As a consequence knowledge is limited about connection between obesity in adolesence and later mortality. It is known that obesity in adolescence also has other negative effects [3,4,5]. Adolescent obesity has been shown to be associated with early maturation, increased truncal deposition of fat [6,7]. It has lasting social effects on self esteem and body image [5,7,8]. Obesity in childhood/ adolescence also seems to be an important predictor of adult obesity, although research that includes long-term follow-up data is lacking [9,10].

BMI is not a perfect measure of adiposity in adolescents, but it has been shown to be a valid measure of fatness in adolescent[11]. In addition, a workshop on childhood obesity convened by the International Obesity Task Force in 1997 concluded that BMI offers a reasonable measure of fatness in children and adolescents[12]. Since height and weight measurements are simple and inexpensive to collect and often have been a routine part of health examinations, BMI can be calculated in many epidemiologic studies. On the basis of a proposal from the International Obesity Task Force workshop, Cole et al. proposed age- and sex-specific cutoff points to define overweight and obesity in adolescents. These cutoff points were linked to the adult categories for overweight (BMI, 25–30) and obesity (BMI >30) and may be used in international comparisons of the prevalence of overweight and obesity [13,14].

Corresponding author:
Neeru Garg
Associate Prof, Department of Physiology,
SGRRIM&HS, Dehradun

OBJECTIVES

- To screen out the overweight and obese category in present students of recent four years (2010-2013)and (2001-2004)

- To evaluate the changing trends in a gap of ten years.

MATERIAL & METHOD

- Present study was conducted on 800 subjects, first year medical students ,17-20 years of age of recent four years (2010-2013)and four years of (2001-2004).

- Total subjects were divided into two groups of 400 each. group-1 (2001-2004), group-2 (2010-2013).

- Anthropometric parameters height and weight were measured objectively with a calibrated scale.

- BMI or 'QUETELET - INDEX' was calculated as a ratio of weight (in kilograms)to height (in meters)squared.

- BMI= mass(kg)/height(m)^2.

BMI PRIME, a simple modification of BMI system was derived. It is the ratio of actual BMI to upper limit BMI (currently defined at BMI 25).

WHO CATEGORIES OF BMI

Table-1: Observation & Results Percentage of subjects under different categories of Body mass index are as shown in table 2.

Weight classification	BMI range (kg/m2)	BMI PRIME
Underweight	<18.5	<0.74
Normal	18.5-24.9	0.74-1.0
Overweight	25.0 – 29.9	1-1.2
Obese	>30.0	>1.2

Table-2

Body Mass Index (BMI)	Group A					Group B				
	2001	2002	2003	2004	Mean±sd	2010	2011	2012	2013	Mean±sd
<18.5 : Under weight	13	20	12	14	14.75±3.59	13	15	14	12	13.5±1.29
18.5-24.9: Normal	62	68	69	58	64.25±5.19	39	45	44	46	43.5±3.11
25.0-29.9: Over weight	16	5	13	19	13.25±6.02	8	22	29	27	21.5±9.47
>30 : Obese	9	7	6	9	7.75±1.50	40	18	13	15	21.5±12.5

DISCUSSION AND CONCLUSION

- Comparing groups A & B inTable-2 ,it can be concluded that there is a significant increase in overweight and obese category of students over a period of ten years.

- In the last four years about 43% students are overweight and obese while ten years ago data shows 21% students in these categories.

- BMI PRIME was derived individually to make them aware by what percentage their weight deviated from their upper weight limits.

- Nutritional problem in India is gradually shifting from undernourishment to obesity [15]. It is a condition, which has evolved with the advent of civilization, sedentary life style and high calorie diet [16]. Obesity is one of the causative factors for multiple co-morbid conditions leading to metabolic and cardiac disorders [17]. Growing number of evidences indicate association of obesity and sudden cardiac deaths [18,19].

- Students have been motivated to follow lifestyle

management to take care of their weight problem taking into consideration the various health issues associated and risk of developing a number of diseases**.**

Ethical Clearance: Approval by Institutional Ethics Committee.

Source of Funding: Self

Conflict of Interest: Nil

REFERENCES

1. The BMI in Diverse Populations Collaborative Group. Effect of smoking on the body mass index-mortality relation: empirical evidence from 15 studies. Am J Epidemiol 1999;150:1297–308.
2. World Health Organization Consultation on Obesity. Preventing and managing the global epidemic: report of a WHO Consultation on Obesity, Geneva, Switzerland, June 3-5, 1997. Geneva, Switzerland: World Health Organization, 1998:1–276.
3. Must A, Jacques PF, Dallal GE, et al. Long-term morbidity and mortality of overweight adolescents. A follow-up of the Harvard Growth Study of 1922 to 1935. N Engl J Med 1992;327:1350–5.
4. Dietz WH, Robinson TN. Use of the body mass index (BMI) as a measure of overweight in children and adolescents. J Pediatr 1998;132:191–3.
5. Must A, Strauss RS. Risks and consequences of childhood and adolescent obesity. Int J Obes Relat Metab Disord 1999;23(suppl 2):S2–11.
6. Hoffmans MDAF, Kromhout D, de Lezenne Coulander C. The impact of body mass index of 78,612 18-year-old Dutch men on 32-year mortality from all causes. J Clin Epidemiol 1988;41:749–56.
7. Dietz WH. Health consequences of obesity in youth: childhood predictors of adult disease. Pediatrics 1998;101(suppl):518–25.
8. Gortmaker SL, Must A, Perrin JM, et al. Social and economic consequences of overweight in adolescence and young adulthood. N Engl J Med 1993;329:1008–12.
9. Whitaker RC, Wright JA, Pepe MS, et al. Predicting obesity in young adulthood from childhood and parental obesity. N Engl J Med 1997;337:869–73.
10. Parsons TJ, Power C, Logan S, et al. Childhood predictors of adult obesity: a systematic review. Int J Obes Relat Metab Disord 1999;23(suppl 8): 1–107.
11. Pietrobelli A, Faith MS, Allison DB, et al. Body mass index as a measure of adiposity among children and adolescents: a validation study. J Pediatr 1998;132: 204–10.
12. Bellizzi MC, Dietz WH. Workshop on childhood obesity: summary of the discussion. Am J Clin Nutr 1999;70:173S–5S.
13. 13. Dietz WH, Bellizzi MC. Introduction: the use of body mass index to assess obesity in children. Am J Clin Nutr 1999;70:123S–5S.
14. 14. Cole TJ, Bellizzi MC, Flegal KM, et al. Establishing a standard definition for child overweight and obesity worldwide: international survey. BMJ 2000;320:1240.
15. Nageswari SK, Sharma R, Kohli DR. Assessment of respiratory and sympathetic cardiovascular parameters in obese school children. Indian J Physiol Pharmacol 2007; 51(3):235-43.
16. Younghee K, Youn KS, Haymie C. MBI and metabolic disorders in South Korean adults: Korea National Health and Nutrition Survey. Obes Res 2004;12: 445-453.
17. Yuko A, Hironobu Y, Mamoru K, Toshie S, Hiroshi E, Sukenobu I. VLCD Induced weight loss improves heart rate variability in moderately obese Japanese. Exp Biol Med 2001;226(5):440-5.
18. Kirsten LR, Harry H, Meena K, Eric B, Marek M, Michael M. Effects of moderate and vigorous physical activity on heart rate variability in british study of civil servants. Am J Epidemiol 2003;158: 135-43.
19. Frenco R, Bernard S, Andrea C, Tiziana G, Barbara DV, Ivana R et al.Assessment of cardiac autonomic modulation during adolescent obesity. Obes Rese 2003 April;11(4):541-548.

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Prediction Equations for Spirometry in Indian Population of Elderly Two (Male & Female) Group

Mohan Lal Arora[1], Ramita Raheja[2], Rajkumar[3], Vikram Singh[4]

[1]Associate Professor, Physiology Department, Govt. Medical College, Orai, [2]Associate Professor, Physiology Department, [3]Assistant Professor, Anatomy Department, Glocal Medical College Sup. Hospital & Research Centre, Mirzapure, Saharanpu, [4]Associate Professors, ECE-Department, Glocal University, Saharanpur, U.P

ABSTRACT

Aims and Objectives:- To establish numerical norms of cardio-respiratory functions and collect substantial amount of data relating to physical fitness in elderly peoples. The spirometer consists of a vessel placed inverted like a bell in jacket of water. A wide air passage through the Centre of the jacket communicates with the bell. The other end of the passage is connected through a corrugated impervious tubing to a mouth piece; when the subject breaths out through it, the expired air lifts the bell. A counter weight attached to a wire over a pully, balances the weight of the bell, and a pointer records the volume contained in the spirometer. The scale is marked on a wheel fixed over the pully.

Method:- The present study "The Cardiorespiratory Function Tests" was conducted on a randomly selected 110 apparently healthy subjects of 60 years and above age group belonging to both the sexes at Agra. The survey was conducted under the joint auspices of Department of Physiology and Department of Cardiology, S.N. Medical College, Agra.

Result:- In elderly man (60+) mean the average vital capacity (V.C) was 2334.3 ± 370.3 ml and in elderly women (60+) 2206.2 ± 297.5 ml.

Conclusion:- The prediction equations have been developed for spirometry variables in elderly group of Indian origin using the current ATS/ERS spirometry standardisation recommendations. The equations suggest an improvement in the lung health of the population over time in the middle-aged and the elderly. These equations should address a long-felt unmet need and enable a more appropriate evaluation of spirometry data in different chest diseases in Indian subjects. It can be applied clinically for improving balance in elderly population.

Keyword:- *Spirometer, Male & Female, elderly population, Indian.*

INTRODUCTION

Spirometry is a highly informative and by far the most commonly performed investigation to evaluate pulmonary function in patients with chest diseases. The technical aspects of equipment and test performance require a very meticulous attention to quality control and these have been well-standardised and revised from time-to-time. The most recent recommendations on standardisation were jointly formulated by the task force of the American Thoracic Society (ATS) and the European Respiratory Society (ERS) in 2005[1]. A few studies from different parts of India have reported prediction equations for spirometry over the last few decades.

6-9,12-14 These studies have varied in study population, sample size, instrumentation and statistical techniques used and may no longer be useful as these were carried out with equipment and measurement protocols that have since changed. Their current utility and validity are further questionable considering the evidence of a cohort effect that shows improvement in the lung health of a population over a long-term[2,3,4,5].

Thus, there is clearly an urgent need to develop these equations afresh for different regions of the country using current standardisation protocols recommended by the ATS-ERS[6,7].

Lack of locally relevant and valid prediction

equations is a widely felt unmet need in the field of pulmonary medicine in India hampering interpretation of data and patient management[1].

Therefore, we carried out a study to develop and validate prediction equations for spirometry in adults of north Indian origin. This was part of a larger multi-centric exercise supported by the Indian Council of Medical Research to develop prediction equations for lung function parameters for different regions of the country. Spirometry was carried out according to the 2005 recommendations of the ATS-ERS[1].

A non-heated Fleisch Pneumotach Spirometer (KOKO, nSpire, UK) was used with a filter and a re-usable sterile mouthpiece with side flanges to avoid any leakage. The spirometer was calibrated daily using a 1-L syringe according to the manufacturer's recommendations. The breathing procedure was explained and a demonstration of the test was given. In addition, the next subject to be tested was asked to sit nearby and watch. The manoeuvers were performed in the sitting position with a nose-clip applied. Tight clothing around the neck was loosened[1].

The role of ventilation in maintaining life was demonstrated by Vesalius (1514 - 1564)[8] who was able to restore the activity of the heart in an apnoeic dog by insufflating air into trachea through a Reed. Hook (1635 - 1703)[9] subsequently showed that the essential factor is the supply of fresh air which he allowed to escape through puncture holes in the pleura after the lung had been exposed. Boyle (1627 - 1691)[10] and, to lesser extent, Mayow (1643 -1679)[11] demonstrated that the constituent of air which supports combustion also supports life. Lower (1631 -R71691)[12] further showed that the uptake of air in the lung causes the blood to change colour. These discoveries laid the foundation for subsequent studies of gas exchange but their importance was not immediately apparent.

The shape of the population pyramid is gradually changing from a wide base/ narrow top, to a barrel-shaped form. People older than 60 years, constitutes one of the fastest-growing population segment with increase in the number of the older-old (persons above 80 years)[13].

In applied Physiology first time in 1679[14] the stroke output of the lung was measured and was used as a test of lung function in 1846. Borelli (1679)[14] measured the volume of air which a man can inhale during a single deep breath, subsequent work established that this value in an average adult is about 3.3 - 4.9 litre). Davy (1800)[15] was the first who measured the residual volume by a gas dilution method. Thackrah (1831)[16] showed the volume of air which a person can inhale during a single deep breath is less in women than in men. Hutchinson (1846) defined the vital capacity as the "greatest voluntary expiration following the deepest inspiration" and designed a spirometer for its estimation. He showed that vital capacity is related to the height that for every inch of height (from 5 ft. to 6 ft) eight additional cms inches of air at 60°F are given out by forced expiration. He further showed that the vital capacity decreases with age, excess weight and lung disease.

Danders (1849)[17] demonstrated the role of elastic recoil of the lungs causing expiration, was the first to measure the retractive force. The work was extended by Cloetta (1913)[18]. Peabody (1915)[19] gave an idea of the relationship of vital capacity to breathlessness. The term Forced Vital Capacity was used first time by Strohl (1919)[20]. Roher (1915)[21] tried to explain the relationship between the force exerted by the respiratory muscles and the rate of air flow on the basis of Newton's law. This work was further extended by Neergaard and Wirz (1927) using the pneumatochrograph of Fleisch. Neergaard in the same year (1927) also demonstrated the role of surface forces in the lung by comparing the relationship of lung volume to retractive force when the air in the lung was replaced by water.

Jansen, Knipping and Stromberger (1932)[22] calculated the equivalent minute volume froo kyaograph records of a forced vital capacity and introduced the term maximal breathing capacity as one of the lung function test. The measurement of maximal breathing capacity was made first time in 1933 by Hermannsen. Christie (1934) demonstrated the role of change in lung distensibility in causing breathlessness.

MATERIAL AND METHOD

The present study "The Cardiorespiratory Function Tests" was conducted on a randomly selected 110 apparently healthy subjects of 60 years and above age group belonging to both the sexes at Agra. The survey v/as conducted under the joint auspices of Department of Physiology and Department of Cardiology, S.N. Medical College, Agra.

The following Cardiorespiratory function tests were carried out on these subjects

1. Vital Capacity in ml.

The survey was conducted at Sheesh Mahal Teela, Taj Garden, Motilal Nehru Garden and Company Garden in Agra. Before assessment of various cardiorespiratory function tests a careful record of age, sex.

Those subjects on whom any suspicion of cardiorespiratory pathology was suspected, or were on any antihypertensive medicine, of any chronic respiratory disease, were not included in the survey study.

A demonstration of technique of the use of instruments was displayed to the subjects and before they were given the instrument to be handled, all of them were properly apprised of in s and outs of these instruments and of their use. Furthermore, they were explained quite at length about desired precautions to be observed under the process of recording of these parameters in order to avoid any mistake.

Methods for Recording:

(1) Vital Capacity : It is defined as maximum volume of air that a person can forcefully expire with maximum expiratory efforts after taking deepest possible inspiration. It is expressed in terms of litres.

Procedure :

The instrument used was Spirometer. Before starting the test, procedure was well demonstrated to the subject. The pointer was adjusted to zero level. The subject was asked to take the mouth piece in the grip of his mouth. Now the subject was instructed to take a deepest possible inspiration in order to fill the lungs with air to the maximum extent. The nose was closed with nose clip and then exhaled out the air with maximum expiratory efforts through mouth piece. Three readings were taken at the interval of five minutes. Highest of three was taken as final reading for the study.

Precautions:-

The following precautions were taken to obtain the best results:-

(i) The subject was explained the detailed procedure.

(ii) The subject was taken in full confidence before starting the test,

(iii) The spiroaseter was thoroughly checked for any zero error,

(iv) Measures were taken to avoid any leaks through nose or from around the mouth piece.

(v) Resistance and inertia of the instrument should be minimum. The air passage should be wide (more than 3.2 cm).

Before taking reading the subjects were given preliminary training/practice attempts to attain the best of their ability.

OBSERVATIONS

In the present study "Assessment of Cardio-respiratory function tests in Indian Population of 60 years and above Age Group", 110 subjects belonging to different both sexes were studied. Out of these 110 subjects, 84 were male and 26 female. The details of these findings in different sexes are shown in Tables no. 1.

Ageing is a progressive failure of body's homeostatic adaptive response resulting in increased vulnerability to environmental stress and disease. The physiological sign of ageing are gradual deterioration in function and capacity to respond to environmental stress. Ageing is a general physiological on-going process and despite intensive research the mechanisms of ageing are still to be explored. Even though the mechanism of ageing will probably be attributed to a number of different regulatory mechanisms; such as cellular or molecular function, the study of system-integration should remain an important topic in the scientific investigation of ageing (Shock, 1977)[23]. The performance of most human physiological functioning is dependent on the co-ordinated efforts of several organ systems.

Shock (1979)[23] demonstrated greater ageing decrements in the performance of integration system than in the separate variables themselves. One of the most rapidly declining and perhaps most devastating decrement in ageing is the declining functional ability of cardiorespiratory system.

The present study of evaluation of cardio-respiratory functional ability in elderly group was conducted with

the objective to determine the effect of two group on these functional abilities and also to compare and observed. we are studied in relation in both the sexes.

In elderly man (60+) mean the average vital capacity (V.C) was 2334.3 ± 370.3 ml and in elderly women (60+) 2206.2 ± 297.5 ml. The vital capacity shows a declining pattern with age in all age groups in men as well as in women and the relationship is statistically significant in both the sexes ($p < 0.01$ in men as well as in women).

Table - 1: Comparative evaluation of vital capacity of total number of male and female subjects studied (n= 110)

Sex	No. of Cases	Vital Capacity in ml	
		Mean	S.D.
Male	84	2334.30	± 370. 30
Female	26	2206.20	± 297.50

t = 7.1103 P < 0.01

CONCLUSION

The prediction equations have been developed for spirometry variables in elderly group of Indian origin using the current ATS/ERS spirometry standardisation recommendations. The equations suggest an improvement in the lung health of the population over time in the middle-aged and the elderly. These equations should address a long-felt unmet need and enable a more appropriate evaluation of spirometry data in different chest diseases in Indian subjects. It can be applied clinically for improving balance in elderly population.

Ethical Clearance - Approved

Source of Funding - Self

Conflict of Interest - Nil

REFERENCES

1. Miller MR, Hankinson J, Brusasco V, Burgos F, Casaburi R, Coates RA, et al. Standardisation of spirometry. Eur Respir J,2005;26:319-38.
2. 6. Jain SK, Ramiah TJ. Normal standards of pulmonary function tests for healthy Indian men 15-40 years old: comparison of different regression equations. Indian J Med Res1969;57:1451-66.
3. 9. Jain SK, Gupta CK. Age, height and body weight as determinants of ventilatory norms in healthy men above forty years age. Indian J Med Res1967;55:599-606.
4. 12. Udwadia FE, Sunavala JD, Shetye VM. Lung function studies in healthy Indian subjects. J Assoc Physicians India 1987;35:491-6.
5. 14. Vijayan VK, Kuppurao KV, Venkatesan P, Sankaran K, Prabhakar R. Pulmonary function in healthy young adult Indians in Madras. Thorax1990;45:611-5.
6. 15. Glindmeyer HW, Diem JE, Jones RN, Weill H. Noncomparability of longitudinally and cross-sectionally determined annual change in spirometry. Am Rev Respir Dis 1982;125:544-8
7. 16. Xu X, Laird N, Dockery DW, Schouten JP, Rijcken B, Weiss ST. Age, period, and cohort effects on pulmonary function in a 24-year longitudinal study. Am J Epidemiol 1995;141:554-66.
8. http://socialjustice.nic.in/social/sdcop/opersons.htm
9. 90. Vgsalius (1514-1564). Lung functions, Assessment and Application in Medicine, by J.E. Cotes, III ed, 1975; PP.3.
10. 44 Hook (1635-1703). Lung Functions Assessment and Application in Medicine, by J.E. Cotes, III ed, 1975; 5.
11. 10. Boyle (1627-1691). Early studies of lung function. Lung function assessment and application in Medicine; by J.E. Cotes, III ed, 1975; P.4.
12. 65. Mayow (1643-1679). Lung function, Assessment and Application in Medicine, by J.E.Cotes, III ed., 1975; PP.4.
13. 57. Lower (1631-1691). Lung functions, Assessment and Application in Medicine; by J.E. Cotes, III ed, 1975; P. 4.
14. 9. Borelli (1979). Lung function : Assessment and application in Medicine,by J.E.Cotes, III ed, 1975, p.5
15. 21. Davy (1800). Lung functions, Assessment and Application in Medicine, by J.E.Cotes, III ed, 1975; p.3t6.
16. 87. Thackrah (1831). Lung functions, Assessment and Application in Medicine by J.E. Cotes, III ed, 1975; PP. 5.

17. 19. Danders (1849). Lung functions. Assessment and Application in Medicine, by J.E. Cotes, III ed, 1975; p.6.
18. 17. Cloetta (1913). Text Book by J.E. cotes, III ed, 1975; P.6.
19. 75. Robinow, M.W.F., Hamilton, R.A. et al. The accuracy of clinical determination of blood pressure in children with value under normal and abnormal conditions. Am.J.Dis.Child, 1939; 58: 102-118.
20. 85. Strohl (1919). Lung Function, Assessment & Application in Medicine, by J.E. Cotes, III ed, 1975; 6.
21. 76. Roher (1915). ^ung function. Assessment and Application in Medicine, by J.E. Cotes, III ed, 1975; PP.6.
22. 49.Jansen, Knipping and Stromberger (1932). Lung Functions, Assessment and Application in Medicine, by J.E. Cotes, III ed., 1975; PP.6.
23. Shock (1972, 1979). Physical conditioning intervention in ageing : Quantitation epidemiology and clinical research; by Janet P. Wallace, 1983; 307.

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Effect of Aerobic Exercise Training on Body Composition Using Skin Fold Thickness

Madhura V Motagi[1], Sandhya T Avadhany[2]

[1]Associate Professor, Dept of Physiology, Subbaiah Institute of Medical Sciences,
[2]Professor, Dept of Physiology, St Johns Medical College, Bangalore

ABSTRACT

Aim- Aim- aim of our study was to see the effect of aerobic exercise training on body composition. **Objectives-** effect of aerobic exercise on skinfold thickness and % of body fat. **Material and method**- students between the ages 18 to 25 years under went treadmill aerobic exercise training for a period of 60 days (three days per week). Their biceps, triceps, calf skin folds, waist circumference, hip circumference all were recorded every 15 days and one month after detraining. **Statistical analysis**- repeated measures ANOVA of different parameters at different time interval during the exercise-training period with Bonferroni correction was used. **Results**-. There was a significant difference ($p<0.0001$) in the parameters like, Biceps, triceps and Calfskin fold over a period of exercise training of two months. % of body fat and BMI were decreased but not statistically significant. **Conclusion**- From our study we conclude that aerobic exercise training has a positive effect on body composition by reducing the skinfold thickness and also % of fat and BMI, possibly reducing the risk factors for cardiovascular diseases.

Keywords*: aerobic exercise, body composition, skinfold thickness, body fat.*

INTRODUCTION

Excess body fat produces severe adverse consequences on health, such as high blood pressure and changes in lipid profile constituents, including total cholesterol[1], in adolescents. One possible way of avoiding these health risks is prevention of overweight and obesity. This can be avoided by changing the life style like sedentary life, food habits[2]. Previous studies have shown that aerobic exercise-based interventions promote positive changes in the body composition of adolescents, such as reductions in body mass index (BMI) and body fat percentage (BF%)[3]. There are numerous techniques that are used to assess body composition. Estimates of body composition based upon simple straight-forward anthropometric measurements have been available for many years. The majority of these methods rely on the ability of measurements of subcutaneous fat folds or skin-folds at selected sites to predict accurately total body fatness[4]. Skin fold thickness is very easy and simple method of estimating the body composition specially in children, and also there are many equations available for estimating the body fat[5]. Study done by sarria et al[6], showed that Skinfold thickness measurements are better predictors of body fat percentage than body mass index. Regular aerobic exercise training can reduce the body fat and skinfold measurement and also improves the cardiovascular fitness[7]. Different studies used different aerobic exercise to see the effect of exercise on body fat composition and skinfold thickness like electromagnetically braked ERGO-FIT® brand cycle ergometer[8], treadmill[9] and Aerobic exercise program consists of two protocols with different intensity of the stretching and movement[10]. Aim of our study was effect of aerobic exercise training on body composition measured by using skin fold thickness and calculation of % of body fat.

Corresponding author :
Dr. Madhura V Motagi
Associate Professor, Dept of Physiology
Subbaiah Institute of Medical Sciences
E-mail: madhura.mv@ gmail.com, Mob.: 8943877358

OBJECTIVES

1. Effect of aerobic exercise training on body composition measured by using skin fold thickness,

2. Calculation of % of body fat.

METHODOLOGY

Male subjects in the age group of 18-25 years were recruited from the student and staff population of St Johns medical college and hospital Bangalore. A brief history, general and systemic examination was performed and healthy subjects were recruited based on the inclusion and exclusion criteria. To the Subjects detailed description of protocol was explained. Subjects were asked to come early morning in the post absorptive state written informed consent was obtained from the subjects.

Inclusion criteria: Males in the age group of 18-25 years, Normal BMI(18.5-24.9 kg/m2), fasting over night before the day of recording ,not regularly involved in extreme physical activity.

Exclusion criteria: Diabetes mellitus, Hypertension, Cardiovascular diseases, Any other chronic diseases, Smokers, Athletes

PROCEDURE

Students were asked to come to the department of Physiology early morning between 7-8 AM, after an overnight fast. The subjects were explained in detail about the procedure. Recording was done in a quite room. Subject's height, weight, triceps, biceps and calf skin folds were measured. Then the subjects underwent moderate intensity aerobic exercise training for half an hour thrice weekly [8,10], alternate day over a period of 8 weeks. Bruce 3rd grade of Treadmill exercise (Treadmill speed of 4.8 kph and inclination of 10 degree) was adopted. This 3rdGrade of exercise corresponded to 55% to 69% of Target heart rate (THR), which represents the moderate degree exercise; the detail explanation of this is mentioned in the Treadmill exercise protocol below. All the Anthropometric parameters were taken once every 15 days. After 1 month of detraining again one more measurement was taken.

Treadmill exercise training procedure:

A constant speed 4.8 kph and an inclination of 10 degrees were maintained for all the subjects.

Continuous monitoring of Heart rate was done during the treadmill exercise with the help of an instrument called Wellshallyn. Subjects were made to do moderate degree exercise, which they achieved by walking on the treadmill with 4.8 Kph as speed and 10 degrees of inclination. The moderate degree exercise was based on their heart rate what they achieved during the exercise which was between 107 beats/min to 139 beats/min. This range of heart rate we calculated because the moderate degree exercise is considered when heart rate is between 55% to 69% of maximum heart rate [11].

The age of the subject being between 18 to 25 years. Maximum heart rate (MHR) was calculated by MHR=220 - Age of the person

For example 220-18=202 is the MHR For example 220-25=195 is the MHR

During the half an hour period of moderate exercise the HR was monitored and was between 107 to 139 beats/min.

Body weight and height measurements

Weight was measured using digital scale (OEHNLE-WAAGEN GmbH & CO, Murrhardt, Germany) and height was measured to the nearest 0.1 cm using stadiometer (Holtain limited, CRYMYCH, DYFED, Made in Britain).

Skin fold measurement

Triceps Skin fold

Triceps skin fold is measured in the midline of the posterior aspect of arm, over the triceps muscle at a point midway between the lateral projection of the acromion process of the scapula and the inferior margin of the olecranon process of the ulna. The measurement ids determined by measuring the distance between the lateral projection of the acromion process of the scapula and the inferior margin of the olecranon process of the ulna using a tape measure with the elbow flexed to 90 degree. The mid point of these two is marked on the lateral side of the arm. The skin fold is measured with the arm hanging loosely and comfortably at the subjects side .The skin fold is picked up by the left thumb and index finger.

Biceps Skin fold

Biceps skin fold thickness is measured as the thickness of a vertical fold of raised on the anterior aspect of the arm, aver the belly of the biceps muscle. The skin fold is raised 1 cm superior to the line marked for the measurement of triceps skin fold thickness and arm circumference, on a vertical line joining the anterior

border of the acromion and the centre of the anti cubital fossa. The subject stands, facing the measurer with the upper extremity relaxed at the side.

Calf skin fold

For the measurement of the medial calf skin fold the subject sits with the knee on the side to be measured flexed to about 90 degree, with the sole of the corresponding foot on the floor. The level of the maximum calf circumference is marked on the medial aspect of the calf. The measurer raises the skin fold parallel to the long axis of the calf on its medial aspect, when viewed from the front, at a level slightly proximal to the marked site. The thickness of the fold is measured at the marked level to the nearest 0.1 cm. calf, hip and waist circumference were also measured using standard technique [12].

Percentage body fat (% BF) was calculated by using formula-

% BF = 42.42 + 0.003 × age (years) + 7.04 × gender (M = 1, F = 2) + 0.42 × triceps skinfold (mm) + 0.29 × waist circumference (cm) +0.22 × weight (kg) − 0.42 × height (cm) [13].

RESULTS

Table 1: Subject characteristics of the 18 normal healthy young adults between the age 18 to 25 years

Variables	Mean	SD
Age	20.44	± 2.24
Height (meters)	1.70	± 0.06
Weight (kgs)	61.49	± 7.99
BMI	21.65	± 2.22
SBP(mm Hg)	115.77	± 4.46
DBP (mm Hg)	74.77	± 5.16
HR (beats/min)	78.44	± 4.79
Waist circumference (cm)	72.78	± 6.80
Hip circumference (cm)	88.12	± 21.42
Calf circumference (cm)	33.36	± 2.28
Triceps skin fold (mm)	13.26	± 3.80
Biceps skin fold (mm)	7.47	± 2.72
Calf skin fold (mm)	11.67	± 3.84

Table 2: Repeated measures ANOVA of different parameters at different time Interval during the exercise training period including detraining period.

Variables	Baseline	15 days	30 days	45 days	60 days	1month	P
						Detraining	Value
Biceps	7.47(2.72)	6.76(2.33)	6.29(2.20)	5.95(2.11)	5.70(2.04)	6.62(2.42)	0. 0001
Triceps	13.26(3.92)	12.59(3.85)	11.69(3.65)	10.84(3.52)	10.29(3.57)	12.00(3.76)	0. 0001
Calf	11.67(3.84)	11.35(3.85)	10.95(3.90)	1046(3.94)	10.17(3.86)	11.19(3.92)	0. 0001

- **Values are Mean (S.D)**

Repeated measures ANOVA was done for different parameter measured during the exercise training period, There was a significant difference ($p<0.0001$) in the parameters like, Biceps, triceps and Calf skin fold over a period of exercise training of two months.

Table 3: Repeated measures ANOVA of different parameters at different time interval during the exercise training period excluding detraining period with Bonferroni correction

Variables	Baseline	15 days	30 days	45 days	60 days	P value
Biceps[1]	7.47(2.72)	6.76(2.33)	6.29(2.20)	5.95(2.11)	5.70(2.04)	0. 0001
Triceps[1]	13.26(3.92)	12.59(3.85)	11.69(3.65)	10.84(3.52)	10.29(3.57)	0. 0001
Calf[1,2]	11.67(3.84)	11.35(3.85)	10.95(3.90)	1046(3.94)	10.17(3.86)	0. 0001

.-Values are Mean (S.D

1 significant difference across 5 group using an ANOVA of repeated measures ($p<0.05$)

2 significantly different between the group's using a post-hoc Bonferroni-corrected pair-wise t-test

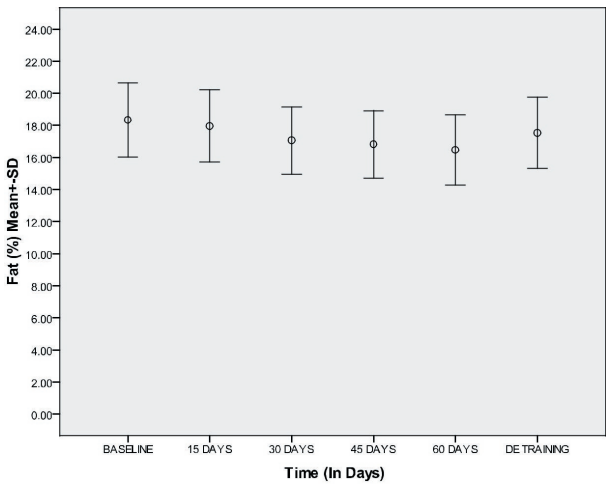

Figure 1: Repeated measures ANOVA of % fat

Repeated measures ANOVA of % fat was done to see the change in the % fat over a period of exercise training of two months, there is a change in the % fat over a period of two months exercise, but was not significant.

There is a decrease in the BMI over a period of 2 months of exercise but not significant.

DISCUSSION

According to our results as shown in table 2 and 3 we can see the significant ($P<0.001$) decrease in all the skin folds (triceps, biceps and calf folds) over a period of 60 days and also 1 month detraining effect where it showed significant increase in skin fold again. Our results were same as that of previous studies[14], there was significant decrease in all folds with all grades of exercise, except triceps where it was seen only with high amount vigorous intensity exercise. Study was done in undergraduates to see the effect of physical activity and inactivity on their BMI and different parameters of anthropometry. A higher fat mass Percentage was found in sedentary students compared with more Active ones [15], by using Electromagnetically braked ERGO-FIT® brand cycle ergometer, physical exercise program showed decreased triceps skinfold thickness[8], Aerobic exercise program consists of two protocols with different intensity of the stretching and movement [10].

This demonstrates that physical exercise can indeed promote positive changes in body composition even if no caloric restrictions are implemented [8].

According to the previous researches, aerobic exercise reduces fat mass and decreased body weight that followed. 4 weeks for $VO_{2\ max}$, 6 weeks and 8 weeks for body weight and BMI, body fat mass, and to change HDL levels in blood [16]. Regular exercise may be a gradual reduction of TG (triglycerol), TC(total cholesterol), LDL, BMI, body mass, body fat and increase HDL[17].

Aerobic exercise and physical activity significantly reduces body fat content for the treatment of heart disease, it is very important in cardiovascular exercise (aerobics) compared to other training. Since exercises are aerobic in nature are more effective in reducing body fat percentage[18]. Aerobic exercise increases skeletal muscle specific lipoprotein lipase activity, which actually has role in oxidation of fat and anti obesity effect, and also increase in capillary density, use of fatty acids may increase the blood levels of HDL[19].

In our study we did repeat measurement of skin folds after 1 month of detraining, where it was seen that the skin fold has started increasing significantly ($P<.0001$). % fat was calculated to see the change in the % fat over a period of exercise training of two months. There was a change in the % fat and BMI over a period of two months exercise, but was not statistically significant.

Thus, we feel exercise for a longer duration could perhaps be required for a significant reduction in body fat mass[20].

CONCLUSION

From our study we conclude that aerobic exercise training has a positive effect on body composition by reducing the skinfold thickness and also % of fat and BMI, possibly reducing the risk factors for cardiovascular diseases.

Conflict of Interest – Nil

Source of Funding- Self

Ethical Clearance – Got from institutional ethics committee.

REFERENCES

1. Candido, A.P. Cardiovascular risk factors in children and adolescents living in an urban area of Southeast of Brazil: Ouro Preto Study. European Journal of Pediatrics, Berlin 2009;168(11): 1373-382.
2. International obesity task force - iotf. Preventing childhood obesity. British Medical Association. Board of Science: IOTF, 2005.
3. Ben ounis, O. Effects of two-month physical-endurance and diet-restriction programmes on lipid pro les and insulin resistance in obese adolescent boys. Diabetes & Metabolism, France 2008;34(6):595-600, 2008.
4. Davies P S W. Body composition assessment recent advances in pediatric neurosurgery 1993.
5. Reilly J J, Wilson J, Durnin J V G A. Determination of body composition from skinfold thickness: a validation study. achrives of diseases in child wood 1995;73:305-10
6. Sarria A, Garcia-Llop LA, Moreno LA,Fleta J, Morellon MP, Bueno M . Skinfold thickness measurements are better predictors of body fat percentage than body mass index in male Spanish children and adolescents European Journal of Clinical Nutrition.1998; 52:573-76
7. Albert C H, Claudia K, Robert B S. Skinfold measurements oxygen uptake and exercise in adoloscents. Clinical journal of sports medicine1993;3:153-60.
8. deizo A S, EDio L, Andreia P.effects of aerobic exercise on the body composition and lipid profile of overweight adolescents Rev. Bras. Ciênc. Esporte, Florianópolis 2014;36(2) :295-309.
9. Michael R E, Henry N W. Relationship between post-exercise heart rate variability and skinfold thickness Williford Esco and Williford springerplus 2013; 2:389
10. Sayyed M M, Neda G B A, Fahimeh E, Hosein M, Gholamali G. Effects of Intensity of Aerobics on Body Composition and Blood Lipid Profile in Obese/Overweight Females. Int J Prev Med. 2013 Apr; 4(Suppl 1): S118–S25.
11. Fletcher GF, Balady GJ, Amsterdam EA, Eckel R, Fleg J,Froelicher VF et al. Exercise standards for Testing and Training A statement for healthcare Professionals From the American heart association 2001;04:1694-1740.
12. Lohman TG, Roche AF, Martorell R eds. Champaign IL Human kinetics books Anthropometric standardization Reference Manual 1998. P. 44-70.
13. Goel K, Gupta N, Misra A, Poddar P, Ravindra M, Pandey NK et all. Predictive Equations for Body Fat and Abdominal Fat with DXA and MRI as Reference in Asian Indians. Obesity 2008; 16: 451–56.
14. Slentz CA, Duscha BD, Johnson JL, Ketchum K, Aiken LB, Samsa GP et al Effects of the Amount of Exercise on Body Weight, Body Composition, and Measures of Central Obesity. Arch Intern Med 2004;164:31-39.
15. Tarnus E, Bourdon E. Anthropometric evaluations of body composition of ndergraduate students at the University of La Re´union. Adv Physiol Educ 2006;30: 248–53.
16. Blaak E E, van Aggel-Leijssen D P, Wagenmakers A J, Saris W H, van Baak M A. Impaired oxidation of plasma-derived fatty acids in type 2 diabetic subjects during moderate-intensity exercise. Diabetes. 2000;49:2102–07.
17. Stasiulis A, Mockiene A, Vizbaraite D, Mockus P. Aerobic exercise-induced changes in body composition and blood lipids in young women. Medicina (Kaunas) 2010;46:129–34.
18. De Souza e Silva M J, de Souza Rabelo A, Vale RG, Ferrão ML, Gonçalves LC, de Sá Rego Fortes M, et al. Effects of two kinds of aerobic training on body fat content and serum lipid profile in cadets. Biomed Human Kinet. 2009;1: 72–5.
19. Marques E, Carvalho J, Soares JM, Margues F, Mota J. Effects of resistance and multicomponent exercise on lipid profiles of older women. Maturitas. 2009;63:84–8.
20. Rahmaninia F, Hojati Z. The effect of selected exercise program on body composition and aerobic power of student girls. Motion J. 2001;5: 109–19.

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Sural Nerve Conduction Studies in Type 2 Diabetes Mellitus Patients with Clinically Undetectable Peripheral Neuropathy

Sanjeev Kumar Shrivastava[1], Ruchi Shrivastava[2], Asha Shrivastava[3], Rashmi Dave[4], Brajesh Sharma[5]

[1] Assistant Professor, [2] 3rd Year PG Student, Department of Physiology, Gandhi Medical College, Bhopal, [3]Professor, Department of Physiology, Mahaveer Institute of Medical Sciences, Bhopal, [4]Assistant Professor, Department of Physiology, Gandhi Medical College, Bhopal, [5]Assistant Professor, Department of Physiology, Mahaveer Institute of Medical Sciences, Bhopal

ABSTRACT

Background: Diabetic neuropathy (DN) is one of the most commonly occurring microvascular complications accounting for 28% of all the complications in diabetics [3].It is a progressive process that has a long asymptomatic stage

Aims &Objectives: The present study was planned to evaluate the Sural nerve conduction studies in type 2 diabetic subjects for early detection and quantification of peripheral neuropathy.

Material & Method: Study was done in Gandhi Medical College, Bhopal and The study was approved by the ethical committee of Gandhi Medical College. 40 Type 2 DM patients with clinically undetectable Peripheral Neuropathy and 40 age matched controls were selected for the study based on the inclusion and exclusion criteria and consent to participate in the study. For the nerve conduction study test , RMS EMG EP Mark II was used.

Results: Showed significant ($p<0.05$) increase of Distal latency and decrease of Conduction Velocity and Amplitude in sural nerve except conduction velocity of Right Sural nerve of the clinically undetectable peripheral neuropathy group as compared to control group.

Conclusion: Nerve conduction studies can diagnose Diabetic Neuropathy at a very early stage even before symptoms & signs set in. Thus nerve conduction velocity can be used as non-invasive method to assess early asymptomatic diabetic neuropathy in diabetic patients.

Keywords: *Type 2 Diabetes Mellitus, Diabetic neuropathy, Nerve conduction study, Sural nerve.*

INTRODUCTION

As the world shifts from a high prevalence of infectious diseases to chronic diseases, type 2 diabetes mellitus (T2DM) is becoming a major international health concern. India, in particular, is poised to become the world's leader in the prevalence of T2DM, and it already has a larger number of people with diabetes than any other country in the world.[1]

Diabetes mellitus (DM) is a group of metabolic disorders characterized by a chronic hyperglycemic condition resulting from defects in insulin secretion, insulin action or both. Permanent neonatal diabetes is caused by glucokinase deficiency, and is an inborn error of the glucose-insulin signaling pathway. The two broad categories of DM are designated type 1 and type 2. Type 1 diabetes is the result of complete or near-total insulin deficiency. Type 2 DM is a heterogeneous group of disorders characterised by variable degrees of insulin resistance, impaired insulin secretion, and increased glucose production. [2]

Diabetic neuropathy (DN) is one of the most commonly occurring microvascular complications accounting for 28% of all the complications in diabetics[3]. It is a progressive process that has a long asymptomatic stage [4].

It is important to identify neuropathy in the asymptomatic stages as the disease process progresses to the diabetic foot, a highly morbid condition that arises from the infection and the ulceration of the foot, finally leading to amputation [5]. It is estimated that 35% to 45%

of Type 2 diabetic patients have diabetic polyneuropathy (DPN). Advanced DPN causes serious complications, such as diabetic foot ulcers, gangrene, and Charcot joint, all of which worsen the quality of life in diabetic patients.[6]

Therefore, early detection of nerve dysfunctions is important to provide appropriate care for patients with DPN.

The diagnosis of diabetic peripheral neuropathy is mainly based on the characteristic symptoms.[7] But symptoms usually develop at any degree of neuropathic impairment or may not develop at all. This indicates the need for doing nerve conduction studies (NCS).[8]

It is reported that poor glycaemic control is responsible for microvascular complications.[9] Glycated haemoglobin (HbA1c) has not only been established as a marker of glycaemic control but it also indicates the risk of developing small vessel complications.[10]

Electro diagnostic tests can be used to detect diabetic neuropathy at an early stage (before development of the signs or symptoms of neuropathy).[11] Electrophysiological studies are more sensitive than clinical examinations as clinical examinations fail to offer quantitative results. It has been established that electrodiagnostic assessments are sensitive, specific and reproducible measures of the presence and severity of peripheral neuropathy and they also correlate with the morphological findings of nerve biopsy and thus define quantitative nerve dysfunction.[12]

Many authors have reported distal symmetric polyneuropathy in patients with type 2 diabetes mellitus (Chandrashekhar A ,Amanda J, Kakrani AL ,Kong X).[13,14]

In Type 2 diabetic patients decreased Nerve Conduction Velocity (NCV) is probably one of the earliest neuropathic abnormalities and is often present even at diagnosis. [15]

Demyelination and axonal loss of sural nerve was reported by Kong X et al (2008). [14]

It is well known that neuropathy has a metabolic component in its pathophysiology.[16] Hence early metabolic aberrations as seen in impaired glucose tolerance (IGT) may also lead to changes in the nerve conduction. Studies in the Caucasian population have shown that IGT is associated with dysfunction in peripheral nerves. [17]

Most of the nerve dysfunctions begin in the sensory nerves of the lower extremities. Thus this study was planned to measure the sensory function in the lower limb nerves by electrical stimulation in type 2 diabetics and for this Sural nerve was selected because it provides the highest diagnostic sensitivity.

With this background the present study was planned to evaluate the Sural nerve conduction studies in type 2 diabetic subjects for early detection and quantification of peripheral neuropathy.

METHODOLOGY

The present study was conducted in the Department of Physiology, Gandhi Medical College, Bhopal in collaboration with the Department of Medicine, Gandhi Medical College, Bhopal. The study was approved by the ethical committee of Gandhi Medical College. The biochemical investigations were done in post graduate Biochemistry laboratory of Department of Physiology.

- Study design- Case control study

MATERIAL

40 Type 2 DM patients with clinically undetectable Peripheral Neuropathy were selected for the study based on the inclusion and exclusion criteria and consent to participate in the study.

The subjects were introduced Michigan (MNSI) [324] questionnaire and Michigan examination for the screening of the peripheral neuropathy.

STUDY GROUP

- **Inclusion criteria**

1. Age 30-60 years.
2. Diagnosed cases of Type 2 diabetes mellitus with fasting plasma glucose (FPG) ≥ 126 mg/dl or 2 hrs postprandial glucose value (PPPG) ≥ 200 mg/dl. (ADA criteria 2015)
3. No known endocrinal and metabolic disorders other than diabetes.
4. Subjects not undergoing any kind of medical treatment with neurotoxic drugs.
5. Resting blood pressure not in hypertensive range (SBP ≥140mmHg, DBP≥90mmHg).

- **Exclusion criteria**

1. Age less than 30 years and more than 60 years.
2. Patient undergoing any drug therapy that may result in neuropathies as adverse effect.
3. History of peripheral neuropathies or nerve compression due to trauma or any other medical ailment.
4. Patients with other causes of neuropathy such as alcoholism, liver or renal disease, toxic exposure, other endocrine, metabolic or nutritional disorders, inflammatory diseases.
5. Patients not willing to participate.

CONTROL GROUP

Age & sex matched, 40 healthy non diabetic volunteers in the age range 30-60 served as controls.

- **Inclusion criteria**

1. Healthy, asymptomatic non diabetic subjects, aged 30-60 years.
2. Fasting plasma glucose <100mg/dl or 2 hrs postprandial glucose value (PPPG) < 140 mg/dl.
3. No diagnosed neuropathies.
4. Resting blood pressure not in hypertensive range (SBP ≥140mmHg, DBP≥90mmHg).
5. No known endocrinal, metabolic, renal or cardiovascular disorder.

Exclusion Criteria

1. Age less than 30 years and more than 60 years.
2. Subjects taking neurotoxic drugs.
3. Resting blood pressure in hypertensive range (SBP ≥140mmHg, DBP≥90mmHg).
4. Subjects not willing to participate.

2- EQUIPMENTS & INSTRUMENTS USED

a- RMS EMG EP MAK II

General instructions to the patients:

All the subjects will be briefed and the procedures will be demonstrated before carrying out the actual procedures.

Subjects will be instructed to-

i. Wear loose fitting clothes.

ii. Avoid chemicals, body oils and lotions over limbs.

Sural nerve conduction study

1. Position: This study was performed in the supine position.
2. Active electrode (A): Placement was such that the active electrode is over the dorsolateral surface of the foot at the midpoint of the 5th metatarsal and just lateral to extensor digitorum brevis tendon of the 5th toe. The reference electrode was distal.
3. Ground electrode (G): Placement was on the dorsum of foot.
4. Stimulation point (S): The cathode was placed 12 cm proximal to the active electrode behind the lateral malleolus.

Sural nerve recording

PARAMETERS RECORDED:

- History of present and past illness relevant to the research protocol
- Family history
- Personal history
- Drug history
- Complete clinical examination
- Anthropometric measurements
  - o Weight (Kg)
  - o Height (cm)
  - o Body mass index (Kg/m^2)
- Biochemical investigation: Fasting plasma glucose and Post Prandial Glucose (GOD-POD method) (Semi-Auto Analyzer Merck-300) and HbA1C
- Nerve conduction study was done using RMS EMG EP MAK II. Nerves studied were: Sural nerve sensory

Nerve conduction parameters recorded were:

- DL(Distal latency) for sensory nerves
- Nerve Conduction Velocity for sensory (SNCV) nerves.
- Sensory nerve action potential (SNAP) for

sensory nerves

STATISTICAL ANALYSIS PLAN

All the data were expressed as mean ± SD. The significance of difference between parameters recorded was calculated using unpaired Student's t-test for comparison between control & clinically undetectable Peripheral Neuropathy group. 5% level of significance will be considered. Statistical analysis was done using SPSS 16.0 (statistical package for social sciences)

RESULT

The mean age of control group and clinically undetectable peripheral neuropathy group were 43.82±8.37years and 39.6±9.1 years respectively (age range 30-60 years).

The body mass index was in normal range for the whole study population.

The mean values of cardiorespiratory parameters measured were in normal range in all the subjects at the time of investigations.

Analysis of electrophysiological variables recorded showed significant ($p<0.05$) increase of Distal latency and decrease of Conduction Velocity and Amplitude in sural nerve except conduction velocity of Right Sural nerve of the clinically undetectable peripheral neuropathy group as compared to control group.

Table 1 : Comparison of Sural Nerve Conduction Studies:- Latency (in milliseconds) Amp (in microvolts) & CV (in m/s), in Asymptomatic Diabetics and Healthy Controls.

Parameters	Variables	Diabetic (Mean±SD)	Controls (Mean±SD)	p-Value
R-Sural	Latency (ms)	3.25±1.02	2.42±1.04	<0.0006*
	Amplitude (μv)	5.84±5.71	11.34±9.82	<0.0030*
	Velocity (m/s)	45.08±15.57	48.33±16.86	NS
L-Sural	Latency (ms)	2.79±0.58	2.11±0.83	<0.0001*
	Amplitude (μv)	7.69±7.54	14.35±8.85	<0.0005*
	Velocity (m/s)	47.47±6.97	59.10±19.15	<0.0005*

**statistically significant, NS-not significant*

DISCUSSION

Diabetic neuropathy is the commonest of all neuropathies in developing countries. Since, diabetic population is increasing, the incidence of diabetic neuropathy is also expected to increase in the future.

Subclinical diabetic neuropathy or asymptomatic neuropathy has been defined as the presence of the nerve lesions associated with diabetes mellitus in the absence of abnormal clinical signs and symptoms .[373]

In study by Balaji Ret al (2015) patients without any symptoms of tingling or burning sensations had an incidence of 85.7% of neuropathy on NCS whereas patients with symptoms had an incidence of 91.7%, which signifies that patients even without any symptoms has a high incidence of neuropathy which showed the importance of NCS for the early diagnosis and treatment. [358] In our study neuropathy was detected electrophysiologically in all the patients without clinically detectable signs and symptoms like tingling or burning sensations .

Diabetes causes DPN by promoting neuronal apoptosis and inhibiting nerve regeneration, which leads to significant deficits in tactile sensitivity, vibration sense, lower-limb proprioception, and kinesthesia.[380]

Certain pro-inflammatory cytokines including IL-6 and TNF-α are also elevated during hyperglycemia and are thought to contribute to nerve cell damage.[381]

The result of present work is in conformity with Liu MS et al(2005) who studied clinical and neurophysiological features in 700 T2DM patients in China. They reported that subclinical Diabetic Peripheral neuropathy can be detected by elctrophysiological studies.[383]

In Pakistan, Niazi et al (2001) evaluated diabetic polyneuropathy by doing electrodiagnostic study on fourty-one patients in 2001. It was suggested that these studies are capable of diagnosing diabetic neuropathy even before clinical manifestations. [384]

Various studies states that in diabetic patient the sensory nerves are more affected than motor nerves and lower limbs are more affected than upper limbs.[354, 358] Kakrani et al(2014) performed nerve conduction study on 50 patients of diabetic neuropathy out of which all patients i.e. 100% had involvement of lower limb and 48% had involvement of upper limb. They also suggested that involvement of lower limb was more common due to length dependent dying back process. They also opinioned that nerve conduction studies detects neuropathy changes even before signs develop.[2]

Study by Xuan K(2008) showed that the sural nerve had abnormal Distal Latency in 58.3% and SNAP in 62.7%. Present study too had Axonal neuropathy in Sural nerve as compared to demyelinating neuropathy.[14]

According to Asad A et al, (2009) in all the components, amplitude (axonal neuropathy) is the strongest measure of neuropathic problems, also reported by the present study.[8]

CONCLUSION

The study concluded that NCS can diagnose Diabetic neuropathy at very early stage even before clinical signs symptoms set in. Early detection of Diabetic neuropathy is essential to decrease morbidity by early initiation of potential preventative measures, patient education, and effective therapeutic intervention.

The high reproducibility of nerve conduction studies and their close correlation with nerve fiber damage make these tests sensitive indicators of the peripheral neuropathy.

The observations of the present study confirmed the existence of predominantly Axonal sensory peripheral neuropathy in the nerves investigated in clinically undetectable Peripheral neuropathy patients.

It is also concluded from the study that peripheral neuropathy may be present in Type 2 DM patients without any clinically detectable signs and symptoms.

It is imperative to perform atleast one annual complete neurological examination and nerve conduction studies to facilitate early diagnosis of peripheral neuropathy.

Conflict of Interest: Nil

Funding: None

REFERANCE

1 Ghaffar A, Reddy KS, Singhi M. Burden of non communicable diseases in South Asia.BMJ 2004;328:807-10.

2 Kakrani AL, Gokhale VS, Vohra KV, Chaudhary N. Clinical and Nerve Conduction Study Correlation in Patients of Diabetic Neuropathy Journal of the association of physicians of India. 2014 JANUARY;62:24-27.

3 Tesfaye S, Stevens LK, Stephenson JM, Fuller JH, Plater M, Ionescu-Tirgoviste C et al. Prevalence of diabetic peripheral neuropathy and its relation to glycemic control and potential risk factors. The EURODIAB IDDM complications study. Diabetologia. 1996; 39:1377-1384.

4 Perkins BA, Bril V. Diagnosis and management of diabetic neuropathy. Curr Diab Rep 2002; 2: 495–500.

5 Partanen J, Niskanen L, Lehtinen J, Mervaala E, Siitonen O, Uusitupa M. Natural history of peripheral neuropathy in patients with non-insulin-dependent diabetes mellitus. N Engl J Med 1995; 333: 89-94.

6 Ogawa K, Sasaki H, Yamasaki H, et al. Peripheral nerve functions may deteriorate parallel to the progression of microangiopathy in diabetic patients. Nutr Metab Cardiovasc Dis. 2006;16:313-321.

7 Watanabe T, Ito H, Morita A, Uno Y, Nishimura T, Kawase H, et al. Sonographic Evaluation of the Median Nerve in Diabetic Patients Comparison With Nerve Conduction Studies. J Ultrasound Med. 2009;28:727–734.

8 Asad A, Hameed MA, Khan UA, Butt MU, Ahmed N, Nadeem A .Comparison of nerve conduction studies with diabetic neuropathy symptom score and diabetic neuropathy examination score in type-2 diabetics. The Journal of the Pakistan Medical Association. 2009;59(9):594-598.

9 Mayurasakorn K, Somthip N, Caengow S,

Chulkarat N, Wanichsuwan M.Glycemic control and microvascular complications among type 2 diabetes at primary care units. J Med Assoc Thai 2009;92:1094-101.

10 Chandalia HB, Krishnaswamy PR. Glycated hemoglobin.Current Science 2002;83:1522-1532.

11 Verma A ,Mahajan S, Khadayate P. Sensory Nerve Conduction Studies In Non-Insulin Dependent Diabetes Mellitus (NIDDM) Patients Without Symptoms Of Peripheral Neuropathy And Healthy Volunteers: A Comparative Study. International journal of basic and applied physiology. 2013 December; 2(1):158-62.

12 Soliman E. Diabetic neuropathy. e Medicine Journal.2002; 3. (http://author e Medicine.com/ Neuro/topic 88 htm).

13 ChandraSekhar A, Muralidhar MV, Munisekhar K. HEIGHT, WEIGHT, BMI, FBS, PPBS, CORRELATED WITH NERVE CONDUCTION VELOCITY IN TYPE II DIABETES MELLITUS PATIENTS. International Journal of Physiotherapy and Research. Int J Physiother Res. 2014; 2(1):388-93.

14 Kong X, Lesser EA, Potts FA, and Gozani SN. Utilization of Nerve Conduction Studies for the Diagnosis of Polyneuropathy in Patients with Diabetes: A Retrospective Analysis of a Large Patient Series. Journal of Diabetes Science and Technology. 2008 March; 2(2).

15 Vinik AI, Mitchell BD, Leichter SB, Wagner AL, O'Brian JT, Georges LP. Epidemiology of the Complications of Diabetes. In: Leslie RDG, Robbins DC, editors. Diabetes: Clinical Science in Practice. Cambridge: Cambridge University Press;1995: 221-87.

16 Sugimoto K, Nishizawa Y, Horiuchi S, Yagihashi S. Localization in human diabetic peripheral nerve of N-carboxymethyllysine-protein adducts, an advanced glycation end product. Diabetologia 1997;40:1380-7.

17 Singleton JR, Smith AG, Bromberg MB. Painful sensory polyneuropathy associated with impaired glucose tolerance. Muscle Nerve. 2001;24:1109-12.

18 Dyck PJ, Karnes JL, Daube J, O'brien P, Service FJ. Clinical and neuropathological criteria for the diagnosis and staging of diabetic polyneuropathy. Brain. 1985;108: 861-80.

19 Balaji R, Mayilanandhi K, Sarah Subashini, Rajasekaran D. NERVE CONDUCTION PROFILE IN TYPE II DIABETICS. Journal of Evolution of Medical and Dental Sciences2015 March;4(20): 3412-3417.

20 Bansal V, Kalita J, Misra UK .Diabetic neuropathy. Postgrad Med J. 2006;82: 95-100.

21 Chen YW, Hsieh PL, Chen YC, Hung CH, Cheng JT . Physical exercise induces excess hsp72 expression and delays the development of hyperalgesia and allodynia in painful diabetic neuropathy rats. Anesth Analg.2013; 116: 482-490.

22 Liu MS, Hu BL, Cui LY, Tang XF, Du H, Li BH. Clinical and neurophysiological features of 700 patients with diabetic peripheral neuropathy. Zhonghua Nei Ke Za Zhi .2005; 44:173-6.

23 Niazi PHK, Ahmad K, Hussain A, Butt AW, Alam A. Electrodiagnostic Evaluation of Diabetic Polyneuropathy. Pak Armed Forces Med J 2001; 51: 75-7.

24 Al – Shamma YMH, Khudhair SA, Al - Aridie MAK. Prevalence of Peripheral Neuropathy in Type 2 Diabetic Patients. Kufa Med Journal. 2011; 14(2):51-64.

25 Balaji R, Mayilanandhi K, Sarah Subashini, Rajasekaran D. NERVE CONDUCTION PROFILE IN TYPE II DIABETICS. Journal of Evolution of Medical and Dental Sciences2015 March;4(20): 3412-3417.

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Effect of Music on Aerobic Exercise

M Mythili[1], S Sudha[1]

[1]Assistant Professor, Department of Physiology, Thanjavur Medical College, Thanjavur

ABSTRACT

Background: Music has been suggested as an important component of mood enhancement and may help to make the aerobic workout more enjoyable and more beneficial for the individual.

Aim: The aim of the study is to investigate the effect of music on cycling with submaximal performance.

Materials and Method: Twenty participants of age group between 10-50 years were selected. Both sexes were included in this study. They performed cycling in Elliptical - vena -V950 model on two occasions. In the first session, the subject performs cycling without hearing music. The subjects were asked to do warm up for 3minutes with zero resistance, following this the resistance increased to 2 and the target heart rate maintained as 40% - 60% of maximal heart rate. In the second session, the subject listened music during cycling and follow the same procedure as he did in the previous session. At the end of each session the time duration of cycling and distance travelled were measured. RPE is measured once in every 5minutes. For measuring RPE Modified Brog's scale is used. Both the sessions were performed in morning before breakfast. The subjects with previous history of cardiovascular disease, hearing impairment, lower body deformities, metabolic & pulmonary diseases were excluded from the study. Alcoholic and smokers were also excluded. Informed written consent was obtained from the subjects.

Conclusion: This study shows that music improves distance and duration of cycling and music also causes reduction in RPE.

Keywords: *Music, Cycling, Rate of perceived exertion (RPE).*

INTRODUCTION

According to American college of sports medicine to remain healthy an individual should perform moderate intensity aerobic (endurance) physical activity for a minimum of 30 minutes for 5 days a week [(1)]. In the past few years there has been increase participation of people in aerobic activities to promote health and to reduce disease suffering. Recently fitness professionals realize that for complete benefit it is important not only to recruit these participants in recreational programme but also to retain them. Music has been suggested as an important component of mood enhancement and may help to make the repetitive aerobic exercise more enjoyable and more beneficial [(2,3)]. Music may aid in fostering recall of pleasurable memories and this may help to block the unpleasant feelings that could surface while workout[(4)].

During repetitive, endurance-type activities like cycling self-selected, motivational and simulative music has been shown to enhance affect, reduce ratings of perceived exertion, improve energy efficiency and lead to increased work output[(5,6,)]. There is evidence to suggest that carefully selected music can promote ergogenic and psychological benefits during high-intensity exercise, although it appears to be ineffective in reducing perceptions of exertion beyond the anaerobic threshold. The effects of music appear to be at their most potent when it is used to accompany self-paced exercise or in externally valid condition. The rhythm is beneficial to our muscles is that it has been proven that the muscles of our body will synchronize to the beat of the music. This means that the faster the musical rhythm the faster is our heart beat or the slower the rhythm the slower is

Corresponding author:
Dr. M Mythili, M.D Physiology,
Assistant Professor, Department of Physiology,
Thanjavur Medical College, Thanjavur

our heart beat. Music acts as a natural motivational tool. The right music can be used as a tool to 'psych up' in preparation for performance (arousal regulation), shift attentional focus (association/dissociation), boost self-efficacy and encourage psychological skills usage (e.g. mental imagery).

The purpose of this study is to examine the effect of fast tempo music on RPE, distance and duration of cycling in a bicycle Ergometer.

MATERIALS AND METHOD

Twenty participants of age 10-50years were selected. They performed cycling in Elliptical - vena - V950 on two occasions. In the first session, the subject performs cycling without music in a bicycle ergometer at a constant speed of 2-4 rpm, initially subject is asked to do warm up for 3minutes with zero resistance following this the resistance increased to 2 and the target heart rate maintained as 40% -60% of maximal heart rate. In the second session, the subject listened music and followed the same procedure as he did in the previous session. The music used in this study is fast tempo music of >120beats/min. At the end of each session the duration, distance, is measured. RPE is measured once in every 5minutes.For measuring RPE Modified Brog's scale is used. Both the session, were performed in morning before breakfast. The subjects with previous history of cardiovascular disease, hearing impairment, lower body deformities, metabolic & pulmonary diseases were excluded from the study. Alcoholic and smokers were also excluded. Informed written consent was obtained from the subjects.

Informed written consent was obtained from the subjects.

Study Design: Prospective study.

Study Period: February 2016- August- 2016

Study was done in Thanjavur.

RESULT

Table 1 compares the distance and duration of cycling and also RPE before and after listening music. The mean distance covered by cycling before hearing music is 0.6260 and the mean distance covered after hearing music is0 .7135. The P value (0.003) tells us the music produces significant difference in distance covered by cycling. The mean duration of cycling calculated before hearing music is 9.40 and the mean duration of cycling calculated after hearing music is 10.70. P value (0.001) shows there is significance difference in duration of cycling before and after hearing music. The mean RPE calculated before hearing music is 4.45 and the mean RPE calculated after hearing music is 4.00. The. The P value for RPE at the end of 5 min is 0.001, indicating that the music causes significant reduction in rate of perceived exertion (RPE).

TABLE:1 Comparison of parameters of cycling before and after hearing music

S.no	Parameters	N	MEAN		Difference	P value
			Before	After		
1	Distance	20	.6260	.7135	-.08750	.003
2	Duration	20	9.40	10.70	-1.300	.001
3	RPE	20	4.45	4.00	.450	.001

Thus, from the above table it is clear that the music increases the distance and duration of cycling. The table also shows music reduces the Rate OF perceived exertion during cycling.

DISCUSSION

Recently available evidence shows that music captures attention, raises spirits, triggers a range of emotions, alters or regulates mood, evokes memories, increases work output, heightens arousal, induces states of higher functioning, reduces inhibitions and encourages rhythmic movement [7,8,9,10]– all purposes that have considerable application in the exercise domain. Although the mechanism that underpin the benefits of music is not clearly understood the scientist devoted insufficient attention is responsible for the effects of music on exercise [11,12,13]. The afferent nervous system transmits sensory impulses inwards to the central nervous

system. Since the capacity of the afferent nervous system is limited (an equivalent concept to internet 'bandwidth'), sensory stimuli such as music can impede the physiological feedback signals associated with physical exertion. In 1961 Hernandez Peon explained that pleasurable stimuli promote electrical activity in one sensory pathway while inhibiting electrical activity, and thus the transmission of information, in another sensory pathway[14,15]. In our study music decreases rate of perceived exertion which is similar to the study conducted by Yamashita et al [16] who tested the effects of favored music on RPE during cycle ergometer work at low *and* moderate intensities. But in another study "music on exercise domain" conducted by Costas I.Karageorgis the music reduced RPE at the low but not the moderate exercise intensity. However, Pottiger in his study have reported a strong effect at moderate exercise intensities [17,18]. This study is stressing the fact that fast music can increase the distance and duration of cycling which is accord to the study conducted by J Waterhouse,P Hudson,B Edward in2009 [19] . But in another study conducted by Reynolds and Guston 2010 the faster tempo music has been found by researchers to motivate exercisers to work harder when performing at a moderate pace, but peak performance has been found to be unaffected by listening to music.

CONCLUSSION

Thus, the present study concludes that fast music enhances the distance and duration of cycling along with the reduction in rate of perceived exertion. Hence listening to music while exercising has been found in multiple studies to increase the work rate either by causing distraction from fatigue or by motivation. Further studies are required to capture the actual cause for these beneficial effects of music.

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REFERENCES

1) William D.Mc Ardle, FrankI.katch, Victor R. Katch-Text Book of Exercise Physiology 7th Edition - Section 4, chapter 21, page-476 .

2) Tenenbaum, G., Lidor, R., Lavyan, N., Morrow, K., Thönell, S., Gershgoren, A., et al. (2004). The effect of music type on running perseverance and coping with effort sensations. Psychology of Sport and Exercise, 5,89-109.

3) Wales 1985.Gfeller 1988.

4) Costas I, Karageorghis and david lee preist 2012 Music in the exercise domain: a review and synthesis (Part I)Int Rev Sport Exerc Psychol. 2012 Mar; 5(1): 44–66. Published online 2011 Dec 7.

5) Karageorghis C.I. The scientific application of music in sport and exercise. In: Lane A.M., editor. Sport and exercise psychology. London: Hodder Education; 2008. pp. 109–137.

6) Karageorghis C.I., Drew K.M., Terry P.C. Effects of pretest stimulative and sedative music on grip strength. Perceptual and Motor Skills. 1996;83: 1347–1352. [PubMed]

7) Karageorghis C.I., Jones L., Stuart D.P. Psychological effects of music tempi during exercise. International Journal of Sports Medicine. 2008;29:613–619. [PubMed]

8) Karageorghis C.I., Mouzourides D., Priest D.L., Sasso T., Morrish D., Whalley C. Psychophysical and ergogenic effects of synchronous music during treadmill walking. Journal of Sport & Exercise Psychology. 2009;31:18–36. [PubMed]

9) Karageorghis C.I., Priest D.L., Terry P.C., Chatzisarantis N.L., Lane A.M. Redesign and initial validation of an instrument to assess the motivational qualities of music in exercise: The Brunel Music Rating Inventory-2. Journal of Sports Sciences. 2006;24:899–909. [PubMed]

10) Karageorghis C.I., Terry P.C. The psychophysical effects of music in sport and exercise: A review. Journal of Sport Behavior. 1997;20:54–68.

11) Karageorghis C.I., Terry P.C., Lane A.M. Development and initial validation of an instrument to assess the motivational qualities of music in exercise and sport: The Brunel Music Rating Inventory. Journal of Sports Sciences. 1999;17: 713–724. [PubMed]

12) Lucaccini L.F., Kreit L.H. Music. In: Morgan W.P., editor. Ergogenic aids and muscular performance. New York: Academic Press; 1972. pp. 240–245.

13) Terry P.C., Karageorghis C.I. Music in sport and exercise. In: Morris T., Terry P.C., editors. The

new sport and exercise psychology companion. Morgantown, WV: Fitness Information Technology; 2011. pp. 359–380

14) Hernandez-Peon R. The efferent control of afferent signals entering the central nervous system. Annals of New York Academy of Science. 1961;89:866–882. [PubMed]

15) Rejeski W.J. Perceived exertion: An active or passive process? Journal of Sport Psychology. 1985;75:371–378.

16) Yamashita S., Iwai K., Akimoto T., Sugawara J., Kono I. Effects of music during exercise on RPE, heart rate and the autonomic nervous system. Journal of Sports Medicine and Physical Fitness. 2006;46:425–430. [PubMed]

17) Potteiger J.A., Schroeder J.M., Goff K.L. Influence of music on ratings of perceived exertion during 20 minutes of moderate intensity exercise. Perceptual and Motor Skills. 2000;91:848–854. [PubMed]

18) Szmedra L., Bacharach D.W. Effect of music on perceived exertion, plasma lactate, norepinephrine and cardiovascular hemodynamics during treadmill running. International Journal of Sports Medicine. 1998;19:32–37. [PubMed]

19) Waterhouse J., Hudson P., Edwards B. Effects of music tempo upon submaximal cycling performance. Scandinavian Journal of Medicine and Science in Sports. 2010;20:662–669. [PubMed].

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Surya Namaskar Versus Spot Jogging - Effects on Cardiovascular and HRV Parameters in Young Adults: A Pilot Study

Priyanka Singh[1], Yogesh MK[1] , Nishitha L Mendonca[1], Jamuna BL[2]

[1]Assistant Professor, [2]Associate Professor, Dept. of Physiology, Rajarajeswari Medical College & Hospital, Bengaluru

ABSTRACT

Background: Lifestyle diseases are increasing at a tremendous rate, especially in developing countries. Physical inactivity has been majorly blamed for the rise in these disorders, due to automation and advancement in the technology. Physical activity was a part of our routine lifestyle in the olden days. Physical activity like aerobic exercises & yoga have proved to be highly beneficial. Surya-namaskar, a form of yogic practice has been utilised to very small extent. Hence, we proposed to compare the effect of surya-namaskar with aerobic exercise in the form of spot jogging on the Cardio vascular & Heart rate variability in young healthy subjects.

Aim: To evaluate the individual effect of spot jogging and surya-namaskar of similar duration on cardiac parameters and Heart rate variability of healthy subjects and to compare the effects of spot jogging and surya-namaskar with each other.

Method: The subjects were randomly divided into Group I-surya-namaskar group (n=20) and Group II-spot jogging group (n=20). Group I performed surya-namaskar and Group II performed spot jogging (5 min/day for 6 weeks duration). Cardiovascular and Heart rate variability (HRV) parameters (SBP, DBP, heart rate(HR), VLF, LF, HF and LF/HF ratio) were recorded before and after six weeks of training in each group.

Result: The results showed that SBP, DBP, HR decreased significantly in both surya-namaskar and spot jogging group. LF values decreased significantly in spot jogging group, while a statistically significant increase in HF values was found in surya-namaskar group. LF/HF values decreased significantly in both the groups. On comparing surya-namaskar and spot jogging groups, it was found that difference between the mean values (pre and post) among the two groups was statistically significantly higher for HF component in surya-namaskar group.

Conclusion: Surya-namaskar & spot jogging are found to be equally beneficial in improving the cardiac & autonomic parameters; whereas Surya-namaskar showed better improvement towards parasympathetic dominance.

Keywords : *Surya-namaskar, spot jogging, HRV.*

INTRODUCTION

Modern industrial revolution with rapid advancement of technology has lead to increase in the stress and life style disorders. Physical inactivity is a major concern in the present day scenario. This physical inactivity has to lead to increase in the life style disorders. Whereas the physical activity conveys multiple well established health benefits including decreased incidence of coronary artery disease, hypertension, non insulin dependent diabetes mellitus, osteoporosis[1-3]. Regular physical activity will increase the body fitness and controls the weight greatly, reducing life style disorders. This results from maintaining moderately lower blood pressure (BP), reducing blood cholesterol and low-

Corresponding author:
Priyanka Singh
Assistant Professor, Department of Physiology,
Rajarajeswari medical college, Bengaluru-56
Ph: 8884087272, Email id: drpriyanka681@gmail.com

density lipoproteins along with increase in high-density lipoproteins and perhaps equally important is that physically fit persons have more bodily reserves to call on when he or she becomes stressed.

Aerobic exercise training increases cardiovascular functional capacity and decreases myocardial oxygen demand at any level of physical activity in apparently healthy person as well as in most subjects with cardiovascular diseases[4,5].

Physical activity in ancient India was part of routine life style & it was also complemented with yogic practices which supposedly had definite cardiovascular benefits; which has now been proved scientifically. Reviews have shown that psycho-physiological changes by yoga help in improvement of both musculoskeletal and cardio-pulmonary functions[6-8].

Surya-namaskar is one such yogic practices which has shown to be effective in making the body supple in terms of stretching many muscles and performing movements at many joints of the body. It involves physical and mental exercises which may or may not be compared to aerobic exercise [1,9].

The literal meaning of surya-namaskar is salutation to Sun. Surya-namaskar comprises of a series of 12 postures, teaching to co-ordinate rhythmic breathing with body postures into a flowing routine. The asanas in surya-namaskar is designed in such a way that each asana will be complimentary to the next. During surya-namaskar muscles of entire body experience stretch and pressure alternately and therefore it is said to give more benefits with less expenditure of time[9-11].

This work was undertaken because there is scarcity of research which evaluates the physiological benefits of surya-namaskar and spot jogging in the healthy subjects and weigh against the benefits at the same time. The aim of the study was to evaluate the individual effect of surya-namaskar and spot jogging of similar duration on cardiovascular & HRV parameters of healthy subjects and inturn compare these effects with each other.

METHOD

The study was conducted in department of Physiology, Himalayan Institute of Medical Sciences (HIMS), Swami Ram Nagar, Dehradun. After obtaining ethical clearance from the Institutional ethical committee, the study was conducted on 40 healthy medical students aged 18-30 years. Trained individuals in yoga & sports, smokers, obese and individuals with history of major surgery and illness were excluded from the study. Subjects were explained the study protocol & the right to terminate during the course of study & written informed consent was taken.

The subjects were randomly divided into two groups.

Group I:- 20 participants performed surya-namaskar for 5 min/day for 6 weeks duration under the guidance of investigator.

Group II:- 20 participants performed spot jogging for 5 min/day for 6 weeks duration under the guidance of investigator.

Prior to the study, baseline data were collected from all the participants after taking a detailed medical history on the same time of the day. The following parameters were recorded: age, height, weight, BMI, SBP, DBP, HR and HRV parameters.

The data collection was done using computerized polygraph, which is a window based machine using software physiopac (Medicaid). HR and HRV was measured using it. BP was recorded using automated digital sphygmomanometer.

After recording of baseline parameters, the volunteers were trained in surya-namaskar or spot jogging depending on their respective groups. Once trained, the volunteers were instructed to practice their respective exercises for six weeks at the same time daily. Following six weeks practice, the cardiovascular & HRV parameters were reassessed.

STATISTICAL ANALYSIS

All the values obtained before and after performing surya-namaskar and spot jogging were expressed as Mean±SD. Data was analyzed by statistical package for social science (SPSS version 17). Anthropometric parameters of both the groups were analyzed and compared, using independent t-test. Cardiovascular parameters of pre & post surya-namaskar and spot jogging groups were analyzed and compared, using ANOVA and post hoc test LSD. Difference of mean values pre & post surya-namaskar and pre & post of spot jogging group was calculated and analyzed using independent t-test. $P < 0.05$ was considered as

statistically significant.

RESULTS

Anthropometric parameters, cardiovascular & HRV recordings were compared between surya-namaskar and spot jogging group and there was no significant difference between the groups (p value >0.05) (Table 1, Table-2).

Table-1: Comparison of anthropometric parameters among surya-namaskar (Group I) and spot jogging (Group II)

Variables	Group I (n=20)	Group II (n=20)	p value
Age (years)	18.6±1.2	19.2±1.4	0.803
Height (cm)	166.2±10.5	165.8±10.0	0.920
Weight (kg)	57.9±7.6	59.8±10.2	0.190
BMI (kg/m^2)	21.3± 2.1	21.5±2.3	0.581

p value : <0.05(significant); >0.05(not significant)

Pre and post training cardiovascular & HRV parameters of surya-namaskar and spot jogging group as shown in table-2 indicate that mean SBP, DBP and HR of post surya-namaskar group was significantly lower; while HF was significantly higher than that of pre surya-namaskar group . There was also significant decrease in mean SBP, DBP, HR and LF value in post spot jogging group as compared to pre spot jogging.

Table-2: Comparison of Cardiovascular & HRV parameters among surya-namaskar and spot jogging group

Variables	Group I (n=20)		Group II (n=20)	
	Pre surya-namaskar	Post surya-namaskar €	Pre spot jogging £	Post spot jogging ¥
SBP (mm Hg)	114.6±7.5	108.6±5.9**	111.4±6.4^	106.3±4.5**
DBP (mm Hg)	76.8±5.4	73.2±3.8*	76.2±5.9^	73.2±3.9*
HR (beats/min)	82.6±3.1	79.3±4.5**	82.8±4.0^	80.5±2.8*
VLF (Hz)	0.028±0.009	0.025±0.008^	0.029±0.007^	0.026±0.008 ^
LF (Hz)	0.074±0.037	0.059±0.022^	0.081±0.038^	0.058±0.022*
HF (Hz)	0.19±0.029	0.222±0.034**	0.187±0.030^	0.185±0.033 ^
LF/HF	0.402±0.213	0.276±0.119*	0.445±0.25^	0.324±0.137*

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

€ : comparison between group I post and pre surya-namaskar

£ : comparison between group II pre aerobic exercise and group I pre surya-

namaskar

¥ : comparison between group II post and pre aerobic exercise

On comparing the difference of mean values (pre and post) of cardiovascular & HRV parameters among surya-namaskar and spot jogging group; statistically significant increase in HF was observed in Group I as compared to Group II, whereas the difference in mean values of SBP, DBP, HR, VLF, LF, LF/HF among the two groups was statistically insignificant(Table-3).

Table-3: Comparison of differences in the mean values of Cardiovascular & HRV parameters of (pre & post) surya-namaskar (Group I) and (pre & post) spot jogging (Group II)

Variables	Group I (n=20)	Group II (n=20)	p value
SBP(mm Hg)	6.0 ±4.4	5.1 ±6.6	0.615
DBP (mm Hg)	3.6± 3.1	3.0 ±4.1	0.600
HR(beats/min)	3.3± 3.1	2.3± 2.1	0.253
VLF(Hz)	0.003±0.006	0.003±0.009	0.984
LF(Hz)	0.015 ±0.02	0.075±0.05	0.491
HF(Hz)	0.032±0.026	0.002 ±0.04	0.01
LF/HF	0.126 ±0.133	0.121 ±0294	0.946

p value <0.05 is significant; >0.05 is not significant) by independent t test

DISCUSSION

Our study showed that cardiovascular and HRV parameters changed significantly in surya-namskar group as well as spot jogging group.

Surya-namaskar group showed statistically significant decrease in mean values of SBP and DBP. These finding are in accordance with Bhutkar et al and Herur et al, who also reported a statistically significant reduction in SBP and DBP after six months of yogic practice among normal subjects. Sasi et al reported a statistically significant increase in SBP and statistically significant decrease in DBP, following 45 days of daily practice of surya-namaskar by healthy school students[11-13].

In our study a statistically significant decline in mean values of HR was observed in surya-namaskar group. This observation is in accordance with the studies conducted by Bhutkar et al and Sasi et al on healthy subjects who practiced surya-namaskar for 6 months and 45 days respectively[11,13]. Fondran found statistically insignificant decrease in heart rate after training for 6 weeks of surya-namaskar[14].

On evaluating the HRV parameters following surya-namaskar practice, it was observed that the HF component increased and was statistically significant. LF/HF component decreased significantly while there was statistically insignificant decrease in LF values. Sarang et al in their study found a decrease in LF and LF/HF component and increase in HF component after cyclic meditation[15].

In our study both the SBP and DBP showed a statistically significant decrease following spot jogging. Seamus et al, reported a statistically significant reduction in both SBP and DBP on comparing aerobic exercise and control group[16]. White et al reported an increase in SBP and decrease in DBP after 12 weeks of exercise program in young and middle aged non-obese women, but these changes were statistically insignificant[17].

In current study a statistically significant decline in mean values of heart rate was observed after spot jogging. This is in accordance with the work of Sloan et al and Stein et al who found a statistically significant reduction in HR after aerobic conditioning of 12 weeks and 12 months respectively[18,19]. Tulppo et al found statistically significant decrease in HR in sedentary subjects after eight weeks training in both moderate and high-volume aerobic exercise groups[20].

The spot jogging group showed a statistically significant decrease in mean values of LF and LF/HF components, while a statistically insignificant decrease was observed in HF values. Tulppo et al reported that in both moderate and high volume aerobic trained groups; a statistically significant increase in normalized HF spectral component while a decrease in normalized LF component and a marked decline of LF/HF ratio[20]. Sandercook et al in a meta-analysis reported an increase in HF power after exercise training[21].

In the current study a significant reduction in SBP, DBP and HR was found in both surya-namaskar and spot jogging group. On comparing the two groups for the difference between mean values (pre and post); there was a greater decline in the values but was statistically insignificant. Telles et al reported a statistically significant decrease in HR after six weeks of yoga and games[22]. Bowman et al conducted a study on sedentary, healthy normotensive elderly subject and reported a statistically significant decrease in HR following six weeks of yoga but an insignificant decrease in HR after six weeks of aerobic training[23].

In our study a statistically significant decline was seen in LF/HF component in both surya-namaskar and spot jogging group, while LF component showed a statistically significant reduction in spot jogging group and HF component showed a statistically significant increase in surya-namaskar group. On comparing both the groups for the difference between mean values (pre and post) for the above mentioned parameters, the increase in HF component was found to be more, which was statistically significant in surya-namaskar group. This is in accordance with Bowman et al, who reported a statistically significant increase in HF value after six weeks of yoga but statistically insignificant change after six weeks of aerobic training[23]. Sathyaprabha et al, showed significant improvement in parasympathetic parameters in epileptic patients after 10 weeks of yoga as compared with healthy volunteer while the exercise group did not show any significant improvement[24].

In conclusion, a few weeks of disciplined practice of either surya-namaskar or aerobic exercise can lead to improvement in cardiovascular & autonomic functions , however a greater tilt towards parasympathetic dominance was observed following surya-namaskar.

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REFERENCES

1. Hagins M, Moore W, Rundle A. Does Practicing Hath Yoga Satisfy Recommendations for Intensity of Physical Activity which Improves and Maintains Health and Cardiovascular Fitness. BMC Complementary and Alternative Medicine 2007; 7: 40.
2. Hewitt JA, Whyte GP, Moreton M, van Someren KA and Levine TS. The Effect of a Graduated Aerobic Exercise Programme on Cardiovascular Disease Risk Factors in the NHS Workplace: a Randomized Controlled Trial. J of Occ Medicine and Toxicology 2008; 3:7.
3. Murphy MH, Murtagh EM, Boreham CA, Hare LG, Nevill AM. The Effect of a Worksite Based Walking Programme on Cardiovascular Risk in Previously Sedentary Civil Servants. BMC Public Health 2006; 6:136.
4. Fletcher GF, Balady G, Blair SN, Blumenthal J, CasperenC, Chaitman B et al. Statement on Exercise: Benefits and Recommendations for Physical Activity Programs for all Americans. Circulation. 1996; 94: 857-62.
5. Baughman KL. The Risks and Benefits of Exercise: Do we have a Finite Number of Heartbeats? Ital Heart J 2000; 1(3): 101-2.
6. Madanmohan, Udupa K, Bhavanani AB, Vijayalakshmi P, Surendiran A. Effect of Slow and Fast Pranayams on Reaction Time and Cardiorespiratory Variables. Ind J Physiol Pharmacol 2005; 49(3):313-8.
7. Khanam AA, Sachdeva U, Guleria R and Deepak KK. Study of Pulmonary Function of Asthma Patients after Yoga Training. Indian J Physiol Pharmacol. 1996; 40(4):318-24.
8. Ray US, Pathak A, Tomer OS. Hatha Yoga Practices: Energy Expenditure, Respiratory Changes and Intensity of Exercise. Evidence-Based Complementary and Alternative Medicine [Online] 2011. http://www.hindawi.com/journals/ecam/2011/241294/.
9. Sinha B, Ray US, Pathak A, Selvamurthy W.

Energy Cost and Cardiorespiratory Changes During the Practice of Surya Namaskar. Indian J Physiol Pharmacol 2004; 48(2):184-90.

10. Singh A, Sarika, Sandhu JS. The Journal of Research and Education in Indian Medicine [cited 2010 March 12] Available from file:///C:/Users/Currys/Desktop/surya%20namaskar/COMBINED%20EFFECTS%20OF%20SURYANAMASKAR%20AND%20UJJAYI%20printed.htm
11. Bhutkar PM, Bhutkar MV, Taware GB, Doijad V, Doddamani BR. Effect of Surya Namaskar Practice on Cardio-respiratory Fitness Parameters: a Pilot Study. Al Ameen J Medicine Science 2008; 1(2):126-9.
12. Herur A, Kolagi S, Chinagudi S. Effect of Yoga on Cardiovascular and Mental Status in Normal Subjects Above 30 years Of Age. Al Ameen J Med Sci 2010 3 (4): 337-44.
13. Sasi Kumar A, Sivapriya DV, Shyamala Thirumeni. Effect of Suryanamsakar on Cardio Vascular and Respiratory Parameters in School Students. Rec Res in Sci and Tech 2011, 3(10): 19-24.
14. Fondran K M. The Effect of Surya namaskar Yoga Practice on Resting Heart Rate and Blood Pressure, Flexibility, Upper Body Muscle Endurance, and Perceived Well-being in Healthy Adults. Cleveland Ohio Cleveland State University 2008. http://etd.ohiolink.edu/sendpdf.cgi/Fondran%20Kristine%20Marie.pdf?csu1220456637.
15. Sarang, Patil, Telles, Shirley. Effects of Two Yoga Based Relaxation Techniques on Heart Rate Variability . International J of Stress Management 2006; 13(4): 460-475.
16. Whelton SP, Chin A, Xin X, He J. Effect of Aerobic Exercise on Blood Pressure: a Meta-analysis of Randomized, Controlled Trials. Ann Intern Med. 2002; 136(7):493-503.
17. White GM, Young RJ. Effect of a Twelve Week Exercise Programme on Cardio-respiratory and Body Composition Variables in Non-obese Young and Middle-aged Females. Br J Sports Med. 1978; 12(1): 27–32.
18. Sloan RP, Shapiro PA, DeMeersman RE, Bagiella E, Brondolo EN, McKinley PS et al. The Effect of Aerobic Training and Cardiac Autonomic Regulation in Young Adults. Am J Public Health. 2009; 99(5): 921-8.
19. Stein PK, Ehsani AA, Domitrovich PP, Kleiger RE, Rottman JN. Effect of Exercise Training on Heart Rate Variability in Healthy Older Adults. Am Heart J. 1999; 138(3 Pt 1):567-76.
20. Tulppo MP, Hautala AJ, Makikallio TM, Laukkanen RT, Nissila S, Hughson RL et al. Effects of Aerobic Training on Heart Rate Dynamics in Sedentary Subjects. J of App Physiology 2003; 95(1):364-72.
21. Sandercock GRH, Bromley PD, Brodie DA. Effects of Exercise on Heart Rate Variability: Inferences from Meta-Analysis. Exercise 2005; 37(3):433-39.
22. Telles S, Narendran S, Raghuraj P, Nagarathna R, Nagendra HR. Comparison of Changes in Autonomic and Respiratory Parameters of Girls after Yoga and Games at a Community Home. Percept Mot Skills. 1997; 84(1): 251-7.
23. Bowman AJ, Clayton RH, Murray A, Reed JW, Subhan MM, Ford GA. Effects of Aerobic Exercise Training and Yoga on the Baroreflex in Healthy Elderly Persons. Eur J Clin Invest. 1997; 27(5):443-9.
24. Sathyaprabha TN, Satishchandra P, Pradhan C, Sinha S, Kaveri B, Thennarasu K et al. Modulation of Cardiac Autonomic Balance with Adjuvant Yoga Therapy in Patients with Refractory Epilepsy. Epilepsy Behav. 2008; 12(2):245-52.

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Study of Cardiac Autonomic Neuropathy (CAN) in Type II Diabetes Mellitus Patients Attending a Tertiary Health Care Center in Maharashtra

Mohammed Suhail[1], Sayed Badar Azhar Daimi[2], Abhay D Hatekar[3], Ashfak Ahmed Hussain[4]

[1]Assistant Professor, [2]Associate Professor, Physiology, Indian Institute of Medical Science and Research, Warudi, Tq.Badnapur, Dist.Jalna, Maharashtra, [3]Associate Professor, Physiology, Grant Medical College and Sir J. J. Group of Hospitals, Maharashtra, [4]Associate Professor, Physiology, Government Medical College, Aurangabad, Maharashtra

ABSTRACT

Cardiac autonomic neuropathy (CAN) is one of the major complications of diabetes mellitus. Resting heart rate, deep breathing difference and valsalva ratio expresses cardiac autonomic function. Present study was done to estimate prevalence of cardiac autonomic neuropathy in type II diabetes patients and to investigate its association with glycemic control. The study group comprised of 60 type 2 diabetes patients within the age group of 40-60 years coming to a Tertiary health care center in Maharashtra and those hospitalized in medicine wards, They were further classified in to two sub-groups(n = 30 in each group), well controlled Type II diabetes patients (HbA1c < 7) and uncontrolled Type II Diabetes patients (HbA1c > 7). Glycosylated hemoglobin level was detected by calorimetric method (spectronic -2).The control group consisted of 30 age matched healthy subjects (volunteers). After thorough examination of the subjects as per the proforma resting heart rate, deep breathing difference and valsalva ratio were estimated using Physiopac I.n present study total 36 (60%) type II diabetes patients had cardiac autonomic neuropathy. Out of 60 type II diabetes patients 16 (26.66%) individuals were found to have severe cardiac autonomic neuropathy. While 20 (33.33%) had borderline Cardiac autonomic neuropathy (CAN) poor glycemic control is associated with abnormal valsalva ratio. The value of valsalva ratio was significantly lower in type II diabetes patients with poor glycemic control as compared to well controlled diabetics and healthy subjects. There was no statistically significant difference among value of deep breathing difference and resting heart rate in type II diabetes patients with poor glycemic control and type II diabetes with good glycemic control. Poor glycemic control is associated with impairment of cardiac autonomic function.

Keywords: *Uncontrolled diabetes, resting heart rate, Deep Breathing Difference, Valsalva Ratio, cardiac autonomic neuropathy.*

INTRODUCTION

Diabetes mellitus is characterized by chronic hyperglycemia associated with altered carbohydrate fat and protein metabolism due to defective insulin secretion, insulin action or both [1]. The worldwide prevalence of DM has risen dramatically in past two decades, from an estimated 30 million cases in 1985 to 422 million cases in 2014 [2]. Prevalence of type II diabetes is increasing very rapidly because of sedentary lifestyle and obesity. 6 of the top 10 countries with the highest prevalence of diabetes are in Asia [3].

Corresponding author:
Sayed Badar Azhar Daimi,
Email ID- albadar085@gmail.com

Studies in India indicate that more than 50% of people with diabetes have poor Glycaemic control (HbA1c > 7%), uncontrolled hypertension and dyslipidaemia, and a large percentage have diabetic vascular complication [4].

Vascular complication includes macrovascular and microvascular complications, Microvascular complications comprise Neuropathy, Retinopathy and nephropathy. Neuropathy includes both peripheral and autonomic neuropathy. Diabetic autonomic neuropathy may manifest as disturbances in cardiovascular, gastrointestinal or genitourinary system[5] and these complications are missed because they are usually asymptomatic for negligent patients. Cardiac autonomic

neuropathy (CAN) is one of the major complications of diabetes mellitus. It is also the most under diagnosed and least understood diabetic complications [6]. Poor glycemic control plays an important role in the development and progression of diabetic cardiac autonomic neuropathy, and studies have shown that reduced cardiovascular Autonomic Function is associated with increased morbidity and mortality. Research in this regard has suggested a strong association between hyperglycemia and the progression of microvascular complications in diabetic patients.

Glycosylated hemoglobin reflects long-term glycemic control and has proven to be a more accurate and stable measure than fasting blood glucose levels. Quantitative cardiovascular Autonomic Function tests which include estimating resting heart rate, deep breathing test, valsalva maneuver, calculating valsalva ratio are widely used to detect, verify and quantify the cardiovascular autonomic dysfunction. They have been tested for their validity and reliability. These tests are performed because the procedures are easy to perform bedside, these are reproducible and non invasive.

Earlier studies have suggested that patients with poor glycemic control have higher prevalence of cardiovascular autonomic neuropathy than in patients with good glycemic control in type I diabetes. Similar studies in type II Diabetes mellitus are relatively few in this region.

Present study is designed to evaluate and compare cardiac Autonomic Function tests in Type II Diabetics with poor control and compare it with Type II diabetics with good glycemic control and with age matched control group. Glycosylated hemoglobin levels are used as a measure of glycemic control.

METHOD

The study comprised of 90 subjects, 60 type II diabetes patients and 30 age matched normal individuals. Type II diabetes patients were selected randomly from diabetic O.P.D. and those referred from medicine wards. Age and sex matched controls were volunteers. Type II diabetes patients were further classified in to two sub-groups – Type II diabetes patients with good glycemic control (HbA1c < 7, n=30) and Type II diabetes patients with poor glycemic control (HbA1c > 7, n=30).

The study was approved by the ethical committee. The present study was carried out in accordance with the Helsinki Declaration all subjects participated voluntarily after being given a detailed explanation of the purpose of the study. Written and Informed consent were obtained from each subject. All subjects of the study underwent a full clinical examination and history.

Groups were selected by considering following inclusion and exclusion criteria.

Inclusion and exclusion criteria for different groups

Type 2 Diabetes patients with poor glycemic control (n=30).

All the subject having type II diabetes with Hba1c > 7 between the age group of 40-60 years were included in this group

Type2 Diabetes patients with good glycemic control (n=30).

All the subject having type II diabetes with Hba1c < 7 between the age group of 40-60 years were included in this group

Healthy Controls (n=30).

All non-Diabetic subject with Hba1c < 6 between the age group of 40-60 years were included in this group

All smokers, alcohol consuming patients, patients suffering from cardiovascular disease and patients who were on drugs altering autonomic function test were excluded from study

The laboratory tests were done between 7-9 a.m. in the lab with stable room temperature

(22-24^{o}C).

The subjects were instructed not to smoke, eat or drink coffee prior to examination. In the case of the diabetics, antidiabetic medication was given at the end of the examination.

Criteria for the diagnosis of diabetes:-

HbA1c ≥ 6.5%. The test should be performed in a laboratory using a method that is NGSP certified and standardized to the Diabetes Control And Complication Trial (DCCT) assay.* Or
Fasting Plasma Glucose(FPG) ≥ 126 mg/dl (7.0 mmol/l). Fasting is defined as no caloric intake for at least8 h.* Or
2-h plasma glucose ≥ 200 mg/dl (11.1 mmol/l) during an oral glucose tolerance test (OGTT). The test should be performed as described by the World Health Organization, using a glucose load containing the equivalent of 75 g anhydrous glucose dissolved in water.* Or
In a patient with classic symptoms of hyperglycemia or hyperglycemic crisis, a random plasma glucose ≥ 200 mg/dl (11.1 mmol/l)

*In the absence of unequivocal hyperglycemia, result should be confirmed by repeat testing[7].

Glycosylated hemoglobin was estimated by modified method of Fluckiger and Winterhalter

Following three tests were used to evaluate autonomic function test of all subjects

1. Resting heart rate

2. Heat rate response to deep breathing (deep breathing difference)

3. Heart rate response to Valsava maneuver (valsalva ratio)

Presence of any two abnormal values of above mentioned 3 tests is considered as diagnostic criteria for presence of cardiac autonomic neuropathy.

Autonomic Function Test: The subjects were asked to relax in supine position for 30 minutes. Resting heart rate and respiratory activity were recorded by Physiopac-8: Computerized 8- channel biopotential acquisition system (Medicaid, Chandigarh) BP was measured with Omron Intellisense M3 Blood Pressure Monitor. The cardiovascular tests performed are detailed below in the order of execution. These tests were demonstrated to the subjects.

Deep breathing test: In the sitting position subjects were asked to breathe quietly and deeply at the rate of 6 breaths per minute. A continuous ECG was recorded for six cycles. The maximum and minimum R-R intervals were measured during each breathing cycles and converted to beats per minute. The result was then expressed as mean of the difference between maximum and minimum heart rate for six measured cycles in beats per minute.

Deep breathing difference (DBD) = mean of heart rate differences in 6 breath cycles.

Heart Rate response test	Normal	Borderline	Abnormal
Heart rate response to deep breathing.(DBD)	15 beats/min OrMore	11-14 beats/min	10beats/minim less.

Heart-Rate response to Valsalva Maneuver (valsalva ratio): The subjects were seated comfortably and asked to blow into a mouthpiece connected to a mercury sphygmomanometer and holding it at a pressure of 40 mm of mercury for 15 seconds. The ECG was continued to be recorded after release of pressure at the end of 15 seconds for 30 seconds.valsalva ratio was obtained by dividing maximum RR interval with minimum RR interval.

Valsalva Ratio(VR)= maximal tachycardia/maximum bradycardia

= maximum R-R interval/minimum R-R interval

Heart Rate response test	Normal	Borderline	Abnormal
response to Valsalva Maneuver.(VR)	1.21 or more	1.11-1.20	1.10 or less.

RESULT

The data collected has been statistically analyzed using SPSS version 19.

First basic characteristic age was compared in all three groups with ANOVA test tables and graphs are given below.

Table- 1: BASELINE STATISTICS FOR 3 GROUPS:

		Mean	Std. Deviation	Df	f	P value
RHR	Uncontrolled diabetes	90.17	9.454	2	39.93	< 0.001
	Controlled diabetes	87.03	12.40			
	healthy controls	68.67	7.792			
HbA1c	Uncontrolled diabetes	9.53	1.899	2	90.011	< 0.001
	Controlled diabetes	6.22	.710			
	healthy controls	5.71	.428			
DBD	Uncontrolled diabetes	11.10	4.054	2	13.006	< 0.001
	Controlled diabetes	11.40	5.769			
	healthy controls	17.53	6.442			
VR	Uncontrolled diabetes	1.07	.198	2	10.352	< 0.001
	Controlled diabetes	1.22	.148			
	healthy controls	1.25	.128			

COMPARISON OF TWO GROUPS

Table- 2: Uncontrolled diabetes patient group with Controlled diabetes patient group basic statistics

	Coding	Mean	Std. Deviation	P Value
RHR	Uncontrolled diabetes	90.17	9.454	0.276
	Controlled diabetes	87.03	12.40	
HbA1c	Uncontrolled diabetes	9.53	1.899	< 0.001
	Controlled diabetes	6.22	.710	
DBD	Uncontrolled diabetes	11.10	4.054	.817
	Controlled diabetes	11.40	5.769	
VR	Uncontrolled diabetes	1.07	.198	0.002
	Controlled diabetes	1.22	.148	

Table- 3: basic statistics for uncontrolled diabetic patient group and healthy control group

	Coding	Mean	Std. Deviation	P Value
RHR	uncontrolled diabetic	90.17	9.454	< 0.001
	healthy control group	68.67	7.792	
HbA1c	uncontrolled diabetic	9.53	1.899	< 0.001
	healthy control group	5.71	.428	
DBD	uncontrolled diabetic	11.10	4.054	< 0.001
	healthy control group	17.53	6.442	
VR	uncontrolled diabetic	1.07	.198	< 0.001
	healthy control group	1.25	.128	

Table- 4: Basic statistic of controlled diabetes patient group and healthy controls

	Coding	Mean	Std. Deviation	P Value
RHR	controlled diabetes	87.03	12.40	< 0.001
	healthy controls	68.67	7.792	
HbA1c	controlled diabetes	6.22	0.710	0.001
	healthy controls	5.71	0.428	
DBD	controlled diabetes	11.40	5.769	< 0.001
	healthy controls	17.53	6.442	
VR	Controlled diabetes	1.22	0.148	0.365
	healthy controls	1.25	0.128	

DISCUSSION

In present study total 36 (60%) type II diabetes patients had cardiac autonomic neuropathy. Out of 60 type II diabetes patients 16 (26.66%) patients were found to have severe cardiac autonomic neuropathy. While 20 (33.33%) had borderline CAN. out of 30 uncontrolled diabetes patients 8 had severe cardiac autonomic neuropathy while in controlled diabetes patient group also 8 patients had severe cardiac autonomic neuropathy on the contrary none of the patient in healthy control group had cardiac autonomic neuropathy

Though there is no statistically significant difference between prevalence of CAN among uncontrolled and controlled diabetes patient group ($p > 0.05$) but differences in the means of valsalva ratio is statistically significant. Valsalva ratio is deranged in uncontrolled diabetic patient group. 13 out of 30 uncontrolled diabetes patients had abnormal valsalva ratio as compared to 4 out of 30 patients in controlled diabetes patient group and only 1 out of 30 subject from healthy controls had abnormal valsalva ratio.

Mean and standard deviation of valsalva ratio (VR) (table: 1) in uncontrolled diabetes patient group, controlled diabetes patient group and healthy controls are 1.07 ± 0.198, 1.22 ± 0.148 and 1.25 ± 0.128 respectively. There is gradual decrease in mean from healthy control group to uncontrolled diabetes patient group. that means there is less variability in heart rate .with Analysis of variance (ANOVA) test among difference in valsalva ratio was statically significant ($p < 0.001$) when unpaired t test is applied to compare Uncontrolled diabetes patient group with Controlled diabetes patient group the difference in means of valsalva ratio value is found to be statistically significant (table: 2) and valsalva ratio is significantly decreased in uncontrolled diabetics. When unpaired t test between uncontrolled diabetes patient group and healthy controls was applied difference in mean was statistically significant and valsalva ratio was significantly decreased in uncontrolled diabetics compared to healthy controls ($p < 0.001$).When controlled diabetes patient group is compared with healthy controls(table: 4) there is statistically insignificant difference in the means of valsalva ratio in two groups ($P= 0.365$). The heart rate response to Valsalva maneuver depends on the integrity of sympathetic as well as parasympathetic pathways. Parasympathetic fibers being the longest fibers are affected first due to atherosclerotic changes of vasa nervosum.

Mean and standard deviation of deep breathing difference among three study groups i.e. uncontrolled diabetes, controlled diabetes and healthy controls are 11.10 ± 4.054, 11.40 ± 5.769 and 17.53 ± 6.442 respectively. ANOVA test was applied to see significance between three groups, difference between three group is statistically significant ($p < 0.001$) unpaired T test was applied to know in which two groups there is statistical significance, when uncontrolled diabetic patient group was compared with healthy controls the difference in heart rate response was statistically significant ($p< 0.001$). When deep breathing difference was compared between controlled diabetic patient group and healthy control group difference was statistically significant ($p< 0.001$). Between uncontrolled diabetic patient group and controlled diabetic patient group value of deep breathing difference is statistically insignificant though value is comparatively less in uncontrolled diabetic patient group. After comparing these results, there is gradual loss of deep breathing difference as apparent in mean

and standard deviation mentioned above this shows that there is progressive parasympathetic dysfunction in diabetics but it is more in poorly controlled diabetics. HR response to breathing is a normal phenomenon and is due to fluctuations in parasympathetic output to heart. In diabetes, loss of vagal tone (vagal denervation) is responsible for reduced heart rate response to deep breathing. Parasympathetic fibers being the longest fibers are affected first due to atherosclerotic changes of vasa nervosum. Similar results were found in studies done previously.

Abbasher Hussein et al studied presence of cardiac autonomic neuropathy in a group of adult diabetic Sudanese patients. 45% type II diabetes patients had abnormal heart rate response to Valsalva maneuver. Deep breathing difference was found to be abnormal in 90% of study population [8]. Compared to Abbasher Hussein et al present study has lower number of patients having abnormal valsalva ratio (28.33%) and deep breathing difference (40%).

V. Nagalakshmi et al did a study in 2016 on diabetes and cardiac autonomic neuropathy they found prevalence of CAN in diabetics was 16%. As compared to V. Nagalakshmi et al present study has higher prevalence of CAN (60%) [9].

Various mechanisms are responsible for development of diabetic autonomic neuropathy such as hyperactivity of polyol pathway, activation of protein kinase C formation of advanced Glycation end products and oxidative stress Both sympathetic and parasympathetic fibers are affected with parasympathetic dysfunction preceding sympathetic dysfunction.

Chronic hyperglycemia causes hyperactivity in polyol pathway leading to activation of sorbitol and accumulation of fructose. This pathway ultimately cause neuronal damage and decrease neuronal blood flow Uncontrolled diabetes leads to stimulation of Diacylglycerol (DAG) and protienkinase C these together leads to impaired gene expression and neuronal cell death via activation of mitogen activated protein kinases (MAPKs)

Advantage of using resting tachycardia, deep breathing difference and valsalva ratio for assessment of cardiac autonomic neuropathy is that these tests are extremely easy to perform bedside and are reproducible. These tests can be applied to assess cardiac autonomic function of diabetic patients in outpatient as well as inpatient department. Limitation of present study is limited sample size and cross sectional study design. Studies with larger sample size are immediately needed in this region to detect cardiac autonomic neuropathy and prevent associated morbidity and mortality in type II diabetes patients.

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REFERENCES

1. Elliott Proctor Joslin, C. Ronald Kahn Joslin's diabetes mellitus, fourteenth edition 2005 p. 331.
2. Sicree R, Shaw J, Zimmet P. Diabetes and impaired 3. glucose tolerance. In: Gan D, editor. Diabetes atlas, 4th ed. International Diabetes Federation. Belgium: International Diabetes Federation; 2009. p. 1-105.
3. Wild S et al: Diabetes Care 27:1047, 2004.
4. Raheja BS, Kapur A, Bhoraskar A, et al. DiabCare Asia—India Study: Diabetes care in India—Current status. J Assoc Physicians India 2001;49:717–22..
5. Vinik AI, Maser RE, Mitchell BD, Freeman R.Diabetic autonomic neuropathy. Diabetes Care 2003; 26(5): 1553–1579.
6. Rolim LC, Sá JR, Chacra AR, Dib SA. Diabetic cardiovascular autonomic neuropathy: risk factors, clinical impact and early diagnosis. Arq Bras Cardiol 2008; 90(4): 24–31
7. Standards of Medical Care in Diabetes American Diabetes Association, 2011.
8. Abbasher Hussein et al International Journal of the Physical Sciences Vol. 6(2), January 2011 pp. 308-312, 18.
9. Nagalakshmi V, Smruthi V, Shama GR, Nallulwar SC. Cardiac Autonomic Neuropathy in Type II Diabetes Mellitus Patients and its Association with the Age of the Patient, Duration of Disease and Glycemic Control. Indian J Physiol Pharmacol. 2016;60(3):222-9.

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Correlation of FEV1, FVC, & FEV1/FVC % with Body Fat Percentage in College Students of Dharwad City

Khaleel Ahmed Manik[1], Imran Jagadal[2], Leena S Hiremat[3], Mohd Haroon Khan[4]

[1] Assistant Professor, Department of Physiology MES Medical College, Perinthalmanna, Kerala, [2]Assistant Professor, Department of Physiology Jawaharlal Nehru Medical College, Belgaum, Karnataka, [3]Assistant Professor, Department of Physiology K. S. Hegde Medical Academy (KSHEMA), Deralakatte, Mangalore, Karnataka, [4]Assistant Professor, Department of Community Medicine, SHKM Govt Medical College, Nalhar Nuh, Haryana

ABSTRACT

Background- Obesity is a growing problem even in developing regions like India. Obese people are also at risk for social discrimination and possibly adverse psychological consequences. **Objective**: to study dynamic lung functions and flow rates Forced Expiratory Volume (FEV), Forced Ventilatory Capacity (FVC), FEV1/FVC ratio on subjects and controls. **Methods**- The study was conducted in the Department of Physiology, SDM College of medical sciences and hospital, Dharwad. 150 male students in the age group 15-24 years of the college formed the subjects of the study. **Results**- The mean (±SD) body mass index in overweight group was 23.94 ± 0.55kg/m^2, in obese group was 26.81 ± 1.45kg/m^2 and in controls was 21.04 1.26 kg/m^2. The mean (±SD) age in overweight group was 20.44 ± 1.83 years, in obese group was 20.60 ± 1.78 years and in controls was 19.90 ± 1.31years. The mean (± SD) forced vital capacity at rest in overweight group was 3.54 ± 0.37 litres, in obese group was 3.53 ± 0.76 litres and in controls was 3.82 ± 0.46 litres. The mean (± SD) FEV_1 at rest in overweight group was 3.11 ± 0.40 litres, in obese group was 3.10 ± 0.73 litres and in controls was 3.43 ± 0.5 litres. The mean (± SD) FEV_1/FVC at rest in overweight group was 0.87 ± 0.37 %, in obese group was 0.87 ± 0.03% and in controls was 0.89 ± 0.06%.

Conclusion- FEV_1 and FVC were significantly lower in overweight and obese groups compared to controls. FEV_1 was reduced more significantly than FVC. But there is no significant change in FEV_1/FVC ratio in overweight and obese groups.

Keywords*: Forced Vital capacity (FVC), Forced Expiratory Volume in first second (FEV_1), FEV_1/FVC, BMI*

INTRODUCTION

Physiologic system, orchestrated through endocrine and neural pathways, permits humans to survive starvation for as long as several months[1]. However in the presence of nutritional abundance and a sedentary life style, & influenced importantly by genetic endowment, this system increases adipose energy stores resulting in obesity that produces adverse health consequences[2]. Adipose tissue accounts for about 20% of the total body weight of a normal young adult, about 15kg in the average person.

The WHO consultation on obesity, Geneva interim report on "obesity-preventing and managing the global epidemic1997: has recognized that overweight and obesity represent a rapidly growing threat to the health of population worldwide. It recognized obesity as a disease, which is prevalent in both developing and developed countries and affects children and adults alike. Indeed obesity and overweight are so common that they are replacing the more traditional public health concern such as under nutrition and infectious diseases as some of most significant contributes to ill health.

There are different measures to assess obesity. One of the most commonly used is Body Mass Index (BMI)

Corresponding author:
Dr. Khaleel Ahmed Manik
Assistant Professor, Department of Physiology, MES Medical College, Perinthalmanna, Via kolathur, PO Palachode, Dist – Malappuram - 679338, Kerala, India.
Mob.: 09605927374, khals2000@yahoo.co.in

which is a measure of general obesity[3]. Indices used to measure regional and central obesity are subscapular skin fold thickness, waist circumference and abdominal sagittal diameter and ratios like Waist-Hip ratio (WHR). These have been considered as better and more sensitive than BMI[4].

On the other end of the spectrum purely mechanical consequences of obesity like various forms of hypoventilation syndrome and dramatic reduction in various lung volumes have also been established[5]. Hence the present study is taken up to study dynamic lung functions and flow rates Forced Expiratory Volume (FEV), Forced Ventilatory Capacity(FVC), FEV1/FVC ratio on subjects and controls

MATERIALS AND METHOD

The study was conducted under the auspices of the laboratory set up of the Department of Physiology, SDM college of medical sciences and hospital, Dharwad. 150 male students in the age group 15-24 years of the college formed the subjects of the study with applying exclusion criteria i.e Those with history of smoking or atopy, asthama, BMI <18.5 or >29.9, History or family history of asthama, Congenital cardiopulmonary disease and age <15 or >25 years

These subjects were divided into three groups based on BMI as follows.

GpI (Controls) : 50 controls BMI 18.5-22.9(age and sex matched)

Gp-II (Overweight) : 50 students with BMI 23-24.9

Gp-III (Obese) : 50 students with BMI 25-29.9[3]

Method of data collection: Identification data name, age, sex and address were recorded. Age was calculated in years to the nearest birthday. Height and weight of each subject was recorded. BMI (Body Mass Index) was calculated using the formula BMI = Weight in Kg. / [Height in m]^2

- A detailed clinical examination of Respiratory, Cardio-Vascular and Central Nervous Systems was done.

- Skinfold thickness was measured at chest, abdomen, thigh regions using skin fold callipers, body fat percentage is calculated using Jackson and pollock's formula.

  o Three skinfold sites (chest, abdoman and thigh sites from above, SUM3 is the sum of these sites in mm)

  o Bone Density = 1.1093800 - (0.0008267 * SUM3) + (0.0000016 SUM3^2) - (0.0002574 Age)

  o Body Fat Percentage = [(4.95/Bone Density) - 4.5] 100

- Lung Function Tests were recorded using Spirovit SP-1.

Spirovit SP-1:

The instrument used in this study was Spirovit SP1 manufactured by Schiller. Its a type of flow sensing Spirometer. This is a low cost high performance instrument capable of giving highly accurate and repeatable test results and represents the major advancement in computerized pulmonary function testing. It is best instrument for routine screening of large number of subject.

a. Forced Vital Capacity (FVC)

b. Forced Expiratory Volume in First Second (FEV_1)

c. Forced Expiratory Volume in first second to FVC ratio (FEV1/FVC)

Procedure: All maneuvers were performed in sitting position and at rest with the nose clip in place. The subject was asked to loosen tight clothing, if any. Each student was taught about the various maneuvers to be performed for about 5 minutes. Demonstration was also given. Every subject was given ample time to understand carefully and then was allowed to do some practice blows. Sufficient rest was provided between the procedures. Given below are the ways in which the subject was instructed to perform the three maneuvers.

o **FVC maneuver** – A disposable card board mouth piece was placed in the pneumotachograph. The 'FVC' button on the menu pad was pressed (with the sensor still on the stand). After sufficient rest was given the subject was asked to place the mouth piece properly. The start/stop button was pressed and the subject was asked to inhale completely and then exhale it forcefully

and completely, this was followed by another complete inhalation, then the start/stop key was pressed again to stop the test. This test has three memories. The LCD screen displays both the PFT parameter results, as well as the flow volume loop.

Table no.1: Interpretation of Spirometry values[6]

Parameters	Restrictive	Obstructive
FVC	< 80% of predicted	Normal or < 80% of predicted
FEV_1	Normal or < 80% of predicted	< 80% of predicted
FEV_1/FVC	≥ predicted	< predicted

o According to recommendations of global initiative for COPD, FEV_1/FVC of 70% or less is defined as obstructive lung diseases**.**

o These values (FVC, FEV_1, FEV_1/FVC) were compared with average predicted for a subject on the basis of age, sex, built and race[7]

o In both the groups (test and control) subjects were highly motivated and cooperative. They performed the tests with care and maximum efforts.

Statistical analysis: Following statistical methods were employed in the present study using SPSS-20. Anova - Compares mean values of more than two groups. Correlation analysis

Findings**:** The Anthropometric data in overweight, obese and controls are shown in table 2.

Table 2. Anthropometric data of controls, oveweight and obese groups

Parameter	Control Mean ± SD (n=50)	Overweight Mean ± SD (n=50)	Obese Mean ± SD (n=50)	'p' value	Significance
Age(yrs)	19.90 ± 1.31	20.44 ± 1.83	20.60 ± 1.78	0.090	NS
Height(cm)	170 ± 7.2	170 ± 6.1	168 ± 6.1	0.121	NS
Weight(kg)	60.80 ± 4.84	69.44 ± 4.35	75.72 ± 8.11	0.000	S
BMI(kg/m^2)	21.04 ± 1.26	23.94 ± 0.55	26.81 ± 1.45	0.000	S
WHR	0.83 ± 0.03	0.86 ± 0.028	0.85 ± 0.04	0.000	S
BFP	19.11 ± 3.77	24.13 ± 1.95	26.35 ± 3.74	0.000	S

The mean (±SD) age in overweight group was 20.44 ± 1.83 years, in obese group was 20.60 ± 1.78 years and in controls was 19.90 ± 1.31years. The mean (±SD) height in overweight group was 170 ± 6.1cms, in obese group was 168 ± 6.1cms and in controls was 170 ± 7.2cms. There was no statistically significant difference of age and height between the three groups.

Weight: The mean (± SD) weight in overweight group was 69.44 ± 4.35 kgs, in obese group was 75.72 ± 8.11 kgs and in controls was 60.80 ± 4.84kgs. As BMI is the basis of division all three groups, they have significantly increasing weight with increasing BMI.

Body Mass Index (BMI): The mean (±SD) body mass index in overweight group was 23.94 ± 0.55kg/m^2, in obese group was 26.81 ± 1.45kg/m^2 and in controls was 21.04 ± 1.26 kg/m^2. As BMI is the basis of division so all three groups have significantly different BMI.

Waist Hip Ratio (WHR): The mean (±SD) waist hip ratio in overweight group was 0.86 ± 0.028, in obese group was 0.85 ± 0.04 and in controls was 0.83 ± 0.03. WHR is significantly more in obese and overweight groups compared to controls.

Body Fat Percent (BFP): The mean (±SD) body fat percent in overweight group was 24.13 ± 1.95 %,

in obese group was 26.35 ± 3.74 % and in controls was 19.11 ± 3.77%. BFP is significantly more in obese and overweight groups compared to controls and also in obese group compared to overweight group.

Dynamic Lung Function: FVC parameters of Controls, overweight and obese groups are shown in Table 3.

Table 3. Dynamic lung function of controls, overweight and obese groups

Parameters	Control Mean ± SD (n=50)	Overweight Mean ± SD (n=50)	Obese Mean ± SD (n=50)	'p' value	Significance
FVC (L)	3.82 ± 0.46	3.54 ± 0.37	3.53 ± 0.76	0.017	S
FEV1 (L)	3.43 ± 0.54	3.11 ± 0.40	3.10 ± 0.73	0.007	S
FEV1/FVC (%)	0.89 ± 0.06	0.87 ± 0.37	0.87 ± 0.03	0.081	NS

Forced Vital capacity (FVC): The mean (± SD) forced vital capacity at rest in overweight group was 3.54 ± 0.37 litres, in obese group was 3.53 ± 0.76 litres and in controls was 3.82 ± 0.46 litres. FVC was significantly less in overweight and obese groups compared to controls.

Forced Expiratory Volume in first second (FEV_1): The mean (± SD) FEV_1 at rest in overweight group was 3.11 ± 0.40 litres, in obese group was 3.10 ± 0.73 litres and in controls was 3.43 ± 0.5 litres. FEV_1 was significantly less in overweight and obese groups compared to controls table 4.

Table 4. Correlation of WHR with PFT

Parameters	"r" value	"P"value
FVC (L)	- 0.228	0.005*
FEV1 (L/min)	- 0.262	0.001*
FEV1/FVC (%)	- 0.225	0.006*

FEV_1/FVC: The mean (± SD) FEV_1/FVC at rest in overweight group was 0.87 ± 0.37 %, in obese group was 0.87 ± 0.03% and in controls was 0.89 ± 0.06 %. There was no statistically significant difference among three groups.

DISCUSSION

Forced Vital capacity (FVC): The mean (± SD) forced vital capacity at rest in overweight group was 3.54 ± 0.37 litres/sec, in obese group was 3.53 ± 0.76 litres/sec and in controls was 3.82 ± 0.46 litres/sec. FVC was significantly less in overweight and obese groups compared to controls. FVC tend to decrease with increasing BMI[8,9]. However, the effect is small, and both FEV1 and FVC are usually within the normal range in healthy, obese adults[10].

Forced Expiratory Volume in first second (FEV_1): The mean (± SD) FEV_1 at rest in overweight group was 3.11 ± 0.40 litres/sec, in obese group was 3.10 ± 0.73 litres/sec and in controls was 3.43 ± 0.5 litres/sec. FEV_1 was significantly less in overweight and obese groups compared to controls. FEV1 tend to decrease with increasing BMI[8, 9]. However, the effect is small and both FEV1 and FVC are usually within the normal range in healthy, obese adults[8] and children[10].

FEV_1/FVC: The mean (± SD) FEV_1/FVC at rest in overweight group was 0.87 ± 0.37, in obese group was 0.87 ± 0.03 and in controls was 0.89 ± 0.06. There was no statistically significant difference among three groups. Both FEV_1 and FVC were similarly reduced (in terms of percentage predicted), the FEV_1 to FVC ratio was normal and static lung volumes were reduced, suggesting the reduction may be due to restriction as opposed to air flow obstruction[11]. The FEV1 to FVC ratio is usually well preserved or increased[12,9,] even in morbid obesity [13] , indicating that both FEV1 and FVC are affected to the same extent[10]. The normal FEV1/FVC ratio in our study may also indicate that the inspiratory and expiratory muscle strength is normal[13].

FVC and FEV1 results are consistent with previous studies done by Helena Santana et.al[14], senmann[15], both FEV1 and FVC are the lung functions most closely related to body composition and fat distribution. It has been also stated that increase in adult body mass is a predictor of FEV1 decline[8]. The normal FEV1/FVC ratio in our study indicates that the inspiratory and expiratory

muscle strength is normal[13]. Both FEV_1 and FVC were similarly reduced (in terms of percentage predicted), the FEV_1 to FVC ratio was normal and static lung volumes were reduced, suggesting the reduction may be due to restriction as opposed to air flow obstruction[11].

FEV1 and FVC, tend to decrease with increasing BMI[8,9] . However, the effect is small, and both FEV1 and FVC are usually within the normal range in healthy, obese adults [8] and children. The FEV1-to-FVC ratio is usually well preserved or increased[8] even in morbid obesity1[9], indicating that both FEV1and FVC are affected to the same extent. This finding implies that the major effect of obesity is on lung volumes, with no direct effect on airway obstruction.

Lazarus et al[20] found that the FEV_1 to FVC ratio decreases with increasing BMI in overweight and obese individuals. In morbidly obese subjects (defined as individuals with a body weight (in kilograms) to height (in centimetres) ratio greater than 0.9 (in kg/sqcm), Biring et al[19] found a reduction in midexpiratory flows and the FEV_1 to FVC ratio. Therefore, it appears that spirometric abnormalities in patients with mild to moderate obesity represent a restrictive defect placed on the system whereas with severe and morbid obesity, it represents true air flow obstruction. The mechanism may be related to small airway collapse due to decreased lung volumes with increasing obesity or it may be independent[11].

CONCLUSION

Dynamic lung volumes (FEV_1 and FVC) were significantly lower in overweight and obese groups compared to controls. FEV_1 was reduced more significantly than FVC. But there is no significant change in FEV_1/FVC ratio in overweight and obese groups.

Conflict of Interest*:* None to declare

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REFERENCES

1. Flier JS, Flier EM. Biology of obesity. Harrisons's Principles of Internal Medicine. 17th edition. McGraw Hill Publishers; 2005.622-637.
2. Farooqi IS. Obesity. Warrel DA(ed). Oxford text book of medicine. 5th edition. Oxford university press; 2010.1525-1535.
3. James P, Oxford text book of public health. 5th edition. Oxford university press; 2009.1046-58.
4. Guyton AC, Hall JE. Guyton and Hall; Text Book of Medical Physiology. 11th edition. Saunders Publications; 2006. 475-477.
5. Cotes JE. Lung Function Tests. 4th edition. Blackwell Publications;1979.122-23.
6. American Thoracic Society. "Lung function testing: selection of reference values and interpretative stratergies". Am Rev Respir Dis 1991;144:1202-18.
7. Townsend MC; ACOEM position statement spirometry in the occupational setting. J of Occup Envir Lung Dis Commit 2000;3(42):228-45.
8. Schachter LM, Salome CM, Peat JK, Woolcock AJ. Obesity is a risk for asthma and wheeze but not airway hyperresponsiveness. Thorax 2001;56: 4–8.
9. Hubert H B, Feinleib M, Mcnamara P M, Castelli W P. Obesity as an independent risk factor for cardiovascular disease: a 26-year follow-up of participants in the framingham heart study. Circulation 1983; 67:968-77.
10. Salome CM, King GG, Berend N. Physiology of obesity and effects on lung function. J Appl Physiol 2010;108:206-11.
11. Parameswaran K, Todd DC, Soth M. Altered respiratory physiology in obesity. Can Respir J 2006;13(4): 203–10.
12. Jackson H, Hubbard R. Detecting chronic obstructive pulmonary disease using peak flow rate: cross sectional survey. BMJ 2003;327: 653–4.
13. Sahebjami H, Gartside PS. Pulmonary function in obese subjects with a normal FEV1/FVC ratio. Chest 1996; 110(6): 1425–28.
14. Garrow JS, Webster J. Quetelet's index (W/H2) as a measure of fatness. Int J Obes 1985; 9(2):147-53.
15. Segal KR, Vanlon M, Fitzggerald PI. Lean body mass estimation by bioelectric impedance

analysis-A four site cross validation study, Am J Clin Nutr 1988; 47:7-14.

16. Heggenhougen H K(ed). International Encyclopedia of public health, Vol-4. Elsevier publications; 2008.589-09.
17. Carey IM, Cook DG and Strachan DP. The effects of adiposity and weight change on forced expiratory volume decline in a longitudinal study of adults. Int J Obesity 1999; 23: 979-85.
18. Schachter LM2, Peat JK, Salome CM. Asthma and atopy in overweight children. Thorax 2003;58: 1031–35.
19. Biring M, Lewis M, Liu JT, Mohsenifar Z. Pulmonary physiologic changes of morbid obesity. Am J Med Sci 1999;318: 293–97.
20. Lazarus R, Gore CJ, Booth M. Effects of body composition and fat distribution on ventilatory function in adults. Am J Clin Nutr 1998;68:35-41.

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Study to Assess Iodine Status in Pregnant Women

Massarat Begum[1], Ch. N Rajumari[2]

[1]Assistant Professor, Department of Physiology, Bhaskar Medical College, Yenkapally, Moinabad, Ranga Reddy, Telangana, India, [2]Professor and Head, Upgraded Department of Physiology, Osmania Medical College, Koti, Hyderabad, Telangana, India

ABSTRACT

Background: Pregnancy is associated with substantial changes in thyroid physiology and represents a major stress on maternal iodine homeostasis leading to an increased requirement of iodine. The fetus is particularly vulnerable and maternal iodine deficiency can cause irreversible cognitive and motor deficits.

Objectives: The main objective of the present study was to assess the iodine status of pregnant women and to know the prevalence of iodine deficiency in them.

Materials and Method: A Cross-sectional, observational, hospital based study was done in normal, healthy pregnant women. Pregnant women, who were in their first (n=60) and third (n=60) trimesters were selected. Age matched healthy non pregnant women served as control group (n=60). Urine Iodine Concentration (UIC) and Serum Thyroid Stimulating Hormone (TSH) levels were determined. The cut off values for iodine nutrition sufficiency as defined by WHO/UNICEF/ICCIDD guidelines were used.

Results and Discussion: The results obtained showed that the values of Urine Iodine Concentration in third trimester pregnant women were significantly less ($P<0.05$) compared to first trimester women. Increased hormonal and metabolic demands may lead to depletion of total body iodine stores which if not compensated by adequate dietary iodine intake is reflected by decreasing levels of UIC with increase in gestational period. The serum TSH values in third trimester pregnant women were significantly high ($P<0.05$) compared to first trimester and non pregnant women reflecting increased thyroidal stimulation. The study also documented the negative correlation between maternal TSH and UIC.

Conclusions: The findings of the present study indicates that Pregnant women tend to become more iodine deficient as pregnancy advances. So, monitoring of iodine nutrition status during pregnancy is essential, to plan and evaluate adequate interventions either in the form of specific dietary care or therapeutic iodine supplementation.

Keywords : *Pregnant women, Iodine status, UIC, TSH*

INTRODUCTION

Iodine deficiency is the easiest of the nutritional deficiencies to correct and the most preventable cause of mental retardation. Iodine requirement varies with physiological states and the nutritional needs for iodine are increased, as any other nutrient during pregnancy, as it is associated with substantial changes in thyroid physiology. During pregnancy circulating TBG levels increase[1] 1.5 fold, increasing the levels of circulating total T3 and T4 and requiring an increase in thyroid hormone production to maintain normal unbound thyroid hormone levels. Additionally, in early gestation, the thyroid gland is stimulated not only by TSH but by the alpha subunit of human chorionic gonadotropin (hCG), which also binds to and stimulates the TSH receptor[2].

Also there is significant increase in renal clearance of iodide because of increased maternal glomerular filtration rate[3] during pregnancy and Urine iodine excretion being a passive process is dependent on glomerular filtration rate (GFR)[4]. Fetal thyroid is capable of organifying iodine by approximately the 20th week of gestation. Before this the maternal T4 traverse the placenta in small amounts to meet the metabolic

needs of the fetus and even after the fetal thyroid gland function is established, the fetal iodine requirement depends exclusively on maternal intake.

These hormonal changes and metabolic demands require an increase in thyroid hormone production that depends directly upon the availability of iodine and consequently requirements of iodine are increased to maintain normal metabolism. When dietary iodine is lacking it results in impaired thyroid hormone synthesis and an adequate physiological adaptation is difficult to achieve and is progressively replaced by pathological alterations that occur in parallel with the degree and duration of iodine deficiency.

Thyroid hormones are also a key regulator in the process of early growth and development of most organs, especially of the brain, which occurs in humans during fetal and early postnatal life. They affect brain maturation through specific effects on cell differentiation and play an essential role in neuronal migration, myelination, synaptic transmission and plasticity[5,6]. Therefore severe iodine deficiency during this critical period, may result in adverse effects on the fetus including congenital anomalies, decreased intelligence, and neurological cretinism[7]. Even mild to moderate iodine deficiency during pregnancy can result in mild intellectual blunting that may go unrecognised or may present with attention deficit hyperactivity disorders in offspring.

Severe maternal iodine deficiency in pregnancy is associated with poor obstetric outcomes including spontaneous abortion, prematurity, and stillbirth[7]. So, maternal Iodine status remains critical for optimal development of the fetus and to prevent adverse maternal and neonatal outcomes which are generally irreversible but preventable. Monitoring of adequacy of iodine nutrition of school-age children or non pregnant women may not indicate adequate iodine nutrition among pregnant women and they should be directly monitored.

The World Health Organization[8] recently increased their recommended iodine intake during pregnancy from 200 to 250 µg/d. The American Thyroid Association[9] (ATA) recommends a supplement of 150µg iodine/ day during pregnancy and lactation in addition to the use of iodised salt. Though there are limited studies specific to the iodine status of pregnant women in India but the weighted results from those available suggest inadequate intake.

MATERIALS AND METHOD

An Observational, Cross sectional study was done in 180 subjects. Normal healthy pregnant women attending antenatal outpatient department of Government Maternity Hospital in their first and third trimesters and without any disease or pregnancy related complications were included. Those with any chronic disease or any thyroid disorder or on iodine supplementation or any pregnancy related complication were excluded. Age matched non pregnant women were taken as controls. The study subjects were divided into three groups of 60 each.

Institutional Ethics committee approval was obtained prior to study. Informed written consent was taken from the subjects. The study included a questionnaire by which their personal information, obstetric history, history of any chronic illness or thyroid disorders, use of supplements and dietary habits were documented. For assessment of iodine nutrition status they were evaluated clinically for the presence of goitre and urine samples were collected for the determination of UIC and blood samples were collected by venipuncture to determine Serum TSH levels.

Measurement of urinary iodine is the most common and universally accepted measure to monitor dietary iodine intake. The World Health Organization (WHO)/International Council for the Control of Iodine Deficiency Disorders/United Nations Children's Fund (UNICEF) recommend median UIC as the primary tool for assessment of iodine status in pregnant populations[7]. Because serum TSH is determined mainly by the level of circulating thyroid hormone, which in turn reflects iodine intake, TSH can be used as an indicator of iodine nutrition.

The iodine in the urine was measured by a modification of the traditional colorimetric method using ammonium persulphate of Sandell and Kolthoff[10]. The cut off values for iodine nutrition sufficiency for the studied indicators as defined by WHO/UNICEF/ ICCIDD guidelines were used[11]. Estimation of serum TSH levels was done in the hospital laboratory using ELISA method by a commercially available kit. The limits of detection were first trimester- 0.3 to 4.5 µlU/ml, second trimester - 0.5 to 4.6 µlU/ml and third trimester - 0.8 to 5.2 µlU/m.

Statistical Analysis - Quantitative variables were described as Mean ± SD and qualitative variables as frequency percentages (Tables 1 - 2). Statistical analysis was performed using Statistical Package for Social Sciences (SPSS Inc., Chicago, USA) software version 18.0. for windows. The data was analysed by One Way Analysis of Variance (ANOVA) /Welch/ Brown-Forsythe test after testing for the significance of Levene's test of Homogeneity of variances. Multiple comparisons were done by Tukey's HSD and Tamhane's Post Hoc tests. P values less than 0.05 were considered statistically significant. Pearsons Correlation coefficient was computed to assess correlation between UIC and serum TSH levels. P values less than 0.01 were considered statistically significant.

RESULTS

On clinical examination none of the subjects were found to have goitre.

Table-1 - Shows the Mean ± SD and Median values of demographic characteristics [Age and Weight] and biochemical parameters [UIC and Serum TSH] of all the three study groups.

GROUPS	Number of Subjects	Age (years) Mean ± SD (Median)	Weight (kg) Mean ± SD (Median)	Urinary Iodine Concentration (µg/L) Mean ± SD (Median)	Serum TSH (µIU/ml) Mean ± SD) (Median)
Pregnant women (first trimester)	60	22.88 ± 2.75 (22)	55.57 ± 3.08 (56)	159.17 ± 23.37 (164)	0.75 ± 0.42 (0.65)
Pregnant women (third trimester)	60	23.28 ± 2.62 (23)	65.87 ± 3.63 (66)	132.08 ± 39.90 (152)	2.80 ± 1.53 (2.45)
Control	60	23.17 ± 2.57 (23)	55.67 ± 2.97 (56)	145.02 ± 16.92 (145)	0.63 ± 0.21 (0.60)

Table - 2 - Depicts the distribution of urinary iodine concentration among the three groups based on median UIC[11].

GROUPS	Number of Subjects	Mild *(50 – 99 µg/l) (50 – 149 µg/l) Number of subjects (%)	Moderate (20 – 49 µg/l) Number of subjects (%)	Severe (< 20µg/l) Number of subjects (%)	Sufficient *(100 – 199 µg/l) (150 – 249 µg/l) Number of subjects (%)
Pregnant women (first trimester)	60	5 (8.33)	1 (1.66)	-	54 (90)
Pregnant women (third trimester)	60	19 (31.66)	2 (3.33)	2 (3.33)	37 (61.66)
*Control	60	1 (1.66)	-	-	59 (98.33)

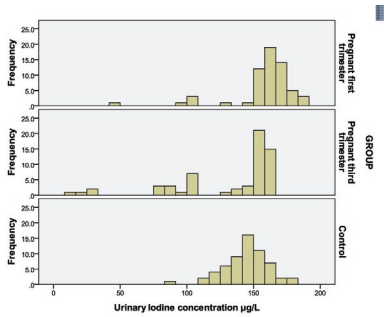

Figure-1 -

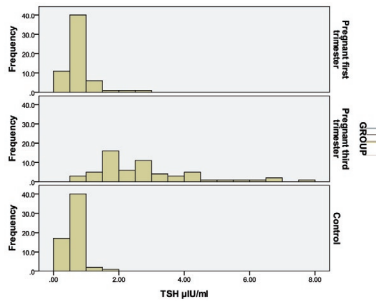

Figure-2 -

Frequency distribution of UIC in all the three groups. Frequency distribution of TSH levels in all the three groups.

The results obtained showed that the Mean ± SD and Median values of Urine Iodine Concentration in third trimester pregnant women were less compared to first trimester pregnant women and the values in first trimester pregnant women were raised compared to controls. ANOVA showed these differences to be highly significant (0.000).

The results have also shown that the Mean ± SD and Median values of serum TSH in third trimester pregnant women were high compared to those of first trimester pregnant women and non pregnant women. ANOVA showed these differences to be highly significant (0.000). Correlation between UIC and serum TSH was done by Pearson's correlation. They were found to be negatively correlated and the correlation was highly significant (0.000).

DISCUSSION

Pregnancy is associated with changes in thyroid physiology due to a complex combination of factors specific to the pregnant state and represents a major stress on maternal iodine homeostasis leading to an increased requirement of iodine. Adequate dietary iodine intake during pregnancy is essential to prevent adverse maternal and neonatal outcomes. The aim of the present study was to assess iodine nutrition status of pregnant women and to compare it with healthy non pregnant women. Urinary Iodine Concentration (UIC) and serum TSH levels were determined in all the subjects.

The study documented the impact of different stages of gestation on UIC. The lower Mean ± SD and Median values of UIC in third trimester pregnant women compared to first trimester pregnant women suggest decreasing levels of UIC with advancing gestation. The results are consistent with the earlier studies done by others[12,13]. The GFR related increased renal iodide loss, increased thyroidal iodine uptake as well as the iodine shift from the maternal circulation to the growing fetus may lead to depletion of total body iodine stores, which if not compensated by adequate dietary iodine is represented by continuous decrease of UIC over the course of pregnancy.

The raised Mean ± SD and Median values of Urine Iodine excretion in first trimester pregnant women compared to controls could be due to increased glomerular filtration rate, causing increased renal iodine clearance during early gestation. The findings are consistent with other studies done in other parts of the world[14,15].

The significantly high Mean ± SD and Median values of serum TSH in third trimester pregnant women compared to those of first trimester pregnant women and non pregnant women suggest thyroidal stimulation. The study brings to notice that thyroid function testing early in gestation as advised routinely is only partly effective in identifying thyroid dysfunction in pregnant women, because maternal thyroid function may be effected even later in gestation and inadequate iodine intake may go unnoticed.

The study elucidated the pregnancy related changes in the iodine metabolism and thyroid function in pregnant women and also documented the correlation between maternal thyroid function in relation to maternal iodine status during the course of pregnancy and found it to be negatively correlated and the correlation was found to be significant. These changes reflect the possible iodine deficiency and the consequent low thyroidal activity during normal pregnancy indicated by relative hypothyroidism.

The study was done to know the prevalence of iodine deficiency in pregnant women and to compare their iodine status with non pregnant women living in the same area. The data suggest that the control population has no iodine deficiency as 98.33% of them were found to have optimal iodine nutrition. As the study group is also taken from the same area, the control group could be a representative of the prepregnant state of the pregnant women retrospectively as on clinical examination also none of the subjects were found to have goitre, an indicator of long term iodine deficiency, thus ruling out the possibility of any geographical influence or use of non iodized salt as the cause of iodine deficiency.

In this study the percentage of pregnant women falling below the recommended criteria of iodine sufficiency of >150 µg/L, increased from 10% in first trimester to 38.33 % in third trimester reflecting iodine intake to be inadequate to meet the increasing demands. This study is complementary to the similar studies done on iodine status done in other parts of the world and in India[16].

CONCLUSION

Stratification by gestation, revealed a dynamic relationship between ioduria and gestation. Median UIC was elevated in early pregnancy due to increased glomerular filtration rate and subsequently declined as the gestation period increased reflecting physiological alterations in normal pregnancy leading to depletion of total body iodine stores not been compensated by adequate dietary iodine ingestion.

The use of the same standard reference criteria for assessment of iodine nutrition based on the median UIC for all the three trimesters is inappropriate and gestation specific UIC reference intervals are required to classify iodine nutrition during pregnancy.

The findings of the present study emphasize the importance of monitoring and recommend routine evaluation of the iodine status of pregnant women to be made mandatory as a part of antenatal care to plan and evaluate adequate timely interventions either in the form of specific dietary care or therapeutic iodine supplementation to meet the increased demand of iodine as a result of the pregnancy. Trimester-specific changes in maternal thyroid hormone and TSH during gestation suggest that their measurement to be done in each trimester.

Considering the fact that salt fortification of iodine alone may not be sufficient to meet the increased iodine requirement during pregnancy, there is a need to explore alternate methods. This study points out the potential role of iodine supplementation to ensure adequate thyroid hormone levels in all pregnant women. The study can be done on a larger sample size and complemented by measuring T3, T4 and Thyroglobulin levels for improving objectivity of tests.

Conflicts of Interest – The Authors Declare No Conflict Of Interest.

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REFERENCES

1. Ain KB, Mori Y, Refetoff S 1987 Reduced clearance rate of thyroxine-binding globulin (TBG) with increased sialylation: a mechanism for estrogen-induced elevation of serum TBG concentration. J Clin Endocrinol Metab 65: 689–696.
2. Hershman JM. Physiological and pathological aspects of the effect of human chorionic gonadotropin on the thyroid. Best Practice & Research: Clinical Endocrinology & Metabolism. 2004;18(2):249–265.
3. Dafnis E, Sabatini S. The effect of pregnancy on renal function: physiology and pathophysiology. American Journal of the Medical Sciences. 1992;303(3):184–205.
4. Soldin OP 2002 Controversies in urinary iodine determinations. Clin Biochem 35:575–579
5. De Escobar GM, Obregón MJ, Del Rey FE. Iodine deficiency and brain development in the first half of pregnancy. Public Health Nutrition. 2007;10(12A):1554–1570.
6. Younes-Rapozo V, Berendonk J, Savignon T, Manhães AC, Barradas PC. Thyroid hormone deficiency changes the distribution of oligodendrocyte/myelin markers during oligodendroglial differentiation in vitro. International Journal of Developmental Neuroscience. 2006;24(7):445–453.]
7. World Health Organization. Assessment of Iodine Deficiency Disorders and Monitoring their Elimination. 3rd edition. Geneva, Switzerland: WHO; 2007.
8. Michael B Zimmermann. Iodine deficiency in pregnancy and the effects of maternal iodine supplementation on the offspring: a review. Am J Clin Nutr 2009;89(suppl):668S–72S.
9. Pere Berbel , María Jesús Obregón, Juan Bernal, Francisco Escobar del Rey and Gabriella Morreale de Escobar.Iodine supplementation during pregnancy:a public health challenge.Trends in Endocrinology and Metabolism. November 2007;18(9) :338-343.
10. ICCIDD, UNICEF, WHO. Dunn JT et al. Methods for measuring iodine in urine. The Netherlands, ICCIDD, 1993.
11. World Health Organization 2001 Assessment of iodine deficiency disorders and monitoring their elimination. A guide for program managers. 2nd ed. Chapter 2.1. Geneva: World Health Organization/Department of Nutrition for Health and Development/01.1

12. Alvarez-Pedrerol M, Guxens M, Mendez M, Canet Y, Martorell R, Espada M, Plana E, Rebagliato M, Sunyer J. Iodine levels and thyroid hormones in healthy pregnant women and birth weight of their offspring. Eur J Endocrinol. March 2009;160(3): 423-9.

13. Cosmas O. Ujowundu*, Agwu I. Ukoha, Comfort N. Agha, Ngwu Nwachukwu and Kalu O. Igwe. Assessment of current iodine status of pregnant women in a suburban area of Imo State Nigeria, twelve years after universal salt iodization. African Journal of Biochemistry Research January 2010; 4 (1) :06-012

14. Caldwell KL, Jones R, Hollowell JG 2005 Urinary iodine concentration: United States National Health and Nutrition Examination Survey 2001–2002. Thyroid 15:692–699

15. Smyth PP 1999 Variation in iodine handling during normal pregnancy. Thyroid 9:637–642

16. Kapil Yadav, Rahul Srivastava, Badhal S, Palanivel C, Chandrakant S Pandav, Madhu G Karmarkar. Iodine nutrition of pregnant women in India:evidence of significant iodine deficiency.Indian journal of medical specialities .2010; Review article.

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Study of the Sleep Quality among the Undergraduate Medical Students

Jyoti Priya[1], Seema Kumari[2], Sarbil Kumari[3], Jairam Singh[1], Ashok Kumar[4]

[1]Assistant Professor, Department of Physiology, Vardhman Institute of Medical Sciences, Pawapuri, [2]Resident, Maharaja Agrasen Hospital, Delhi [3]Associate Professor & H.O.D, Department of Physiology, Vardhman Institute of Medical Sciences, Pawapuri, [4]Tutor, Department of Physiology, Vardhman Institute of Medical Sciences, Pawapuri

ABSTRACT

Aims and Objectives: This study was conducted to assesss the quality of sleep among undergraduate medical students.

Materials and Method: This work is a cross-sectional questionnaire-based study conducted at VIMS , Pawapuri during the month of Januaury in 2017 .The participants in this study were 307 undergraduate M.B.B.S students of the 1st,2nd ,3rd and 4th academic year of this college . A self-administered questionnaires were distributed to the students which collected information regarding participants'age, gender,habitat ,physical activity ,body mass index, addictions, year of study, residence and background , Pittsburg sleep quality index (PSQI) score and Epworth sleepiness scale .

Result A total of 307 responses with a rate of 80% were obtained . According to the PSQI score, 67.42% of participants were considered to have abnormal sleep quality , with a statistically significant increase in female students ($P < 0.05$) and those having daytime sleepiness (ESS >10) ($P<.0001$).

Conclusions: A very high prevalence of poor sleep quality was found among the medical students specifically among female students. There was a significant relationship of abnormal PSQI scores with female students ($P < 0.05$) and those having daytime sleepiness ($P<.0001$).

Keywords:, *Medical Students, Pittsburgh Sleep Quality Index(PSQI), Sleep Quality, Epworth Sleepiness Scale (ESS)*

INTRODUCTION

Sleep is serves a restorative homeostatic function and appears to be crucial for normal thermoregulation and energy conservation [(1).] Sleep deprivation and symptoms related to sleep disorders have not only been ignored but also inadequately understood. The prevalence of sleep disorders in the general population has been estimated to be 15% -- 35% [2,3.]. Medical students are especially vulnerable to poor sleep, perhaps due to the long duration and high intensity of study, clinical duties that include overnight on-call duties, work that can be emotionally challenging, and lifestyle choices[(.4)]

Research on sleep disturbances in undergraduate medical students is of particular interest because of the known relationship between sleep and mental health[(5)] and the concern that the academic demands of medical training can cause significant stress[(6,7)]. A large body of evidence supports the notion that good quality sleep is important for optimal neurocognitive and psychomotor performance as well as physical and mental health[(8)]

Many factors determine sleep quality, and some of the important ones are age,gender, habitat, body mass index (BMI), physical activity or sports, smoking[(9)]. Recent studies have demonstrated that the sleep–wake cycle of medical students is characterized by insufficient sleep duration, delayed sleep onset, and occurrence of napping episodes during the day[(10, 11)] which has been found to affect cognitive function in medical students[(12).]

Corresponding author :
Dr. Jyoti Priya
Jagjyoti Complex, Prithvipur,chiraiyatand Main Road, Patna -800001, Email I.D : jyoti.priya@gmail.com
Mobile no: +919431361060

Moreover, multiple studies have indicated a high correlation between sleep duration and performance in some activities and in subjective alertness [13, 14]..

Despite inherent importance of sleep, there is limited information about sleep behavior and sleep disturbances in medical college students[15].This study was designed to assess the quality of sleep among the undergraduate medical students.

METHODOLOGY

STUDY DESIGN

This cross-sectional study was conducted at VIMS in Pawapuri during the month of Januaury in 2017 .The participants in this study were 307 undergraduate M.B.B.S students of the 1st,2nd ,3rd and 4th academic year of this college . Among them, 72 were female and 235 were male. Students who were willing to participate were given a brief description about the study and its aims & objectives. Verbal consent of each student was taken and were assured about the confidentiality . Students with chronic diseases or sleep disorders were excluded . The ethics committee of the institute approved the study. Recruitment and collection of data continued for four weeks in the month of January A self-administered questionnaires were distributed to the students which collected information regarding participants'age, gender,habitat ,physical activity ,body mass index, addictions, year of study, residence and background , Pittsburg quality of sleep index (PQSI) score and Epworth daytime sleepiness scale (ESS).The recruitment and collection process was carried out under the supervision of the authors and the help of 10 previously trained senior medical students . After completion, the questionnaires were collected from the students and the incomplete ones were removed from the study.

The analysis was performed using Graphpad instat prism 6. T-test was then used for processing quantitative information and chisquare test for the qualitative information. Statistical significance was accepted at $P<0.05$. .

Instrumental tools used in the study

Pittsburg Sleep quality Index (PSQI)[16] It is a self report instrument to assess the quality of sleep. The Pittsburgh sleep quality index (PSQI), a self-rated questionnaire that assesses sleep quality over a time interval was adopted in the survey. Seven properties of sleep were evaluated by this questionnaire:

1. Sleep quality of the individual
2. Time it takes for an individual to sleep
3. Duration of sleep
4. Sleep efficiency
5. Bedtime problems
6. Use of sleeping medication
7. Impairment in daily functioning

The scores for each question range from 0 to 3, with 0 indicating the highest sleep quality and 3 indicating the lowest one. The seven component scores are then added to yield a global PSQI score in the range of 0 to 21; the higher the score is, the worse the sleep quality. A global score equal or greater than 5 indicates poor sleep quality in the past month.

Epworth Sleepiness Scale (ESS)[17]: It is a scale intended to measure daytime sleepiness that is measured by use of a very short questionnaire. This can be helpful in diagnosing sleep disorders. It was introduced in 1991 by Dr. Murray Johns of Epworth Hospital in Melbourne, Australia. The questionnaire asks the subject to rate his or her probability of falling asleep on a scale of increasing probability from 0 to 3 for eight different situations. The scores for the eight questions are added together to obtain a single number. A number in the 0-9 range is considered to be normal while the numbers 10 and 11 are border line and 12-24 range indicates that expert medical advice should be sought.

RESULT

A total of 307 responses were obtained of which 67.42 % were considered poor sleepers. The mean age of the participants, which ranged from 17 to 24 years, was 20.54 . Among this population, 235 (76.54%) were male and 72 (23.45%) were female. The students were distributed among the four academic years. Daily sleeping hours of 4 - 6 hours were reported by 213 (69.38 %) of the participants and 7 - 10 hours by 66 (21.49%). A small numbers of students 28(9.12%) slept less than 4 hours or more than 10 hours . Among the students, 100 (32.54%) had normal PSQI scores and 207 (67.42%)

had PSQI > 5 scores.indicating poor quality.

Daytime sleepiness was assessed using the ESS. The ESS is a standardized validated subjective way to assess daytime sleepiness. 193 students had ESS <10 while 114 (37%) students had ESS >10 indicating increased daytime sleepiness among them.

Table 1 presents the complete demographic characteristics and other study variables.Table 2 presents the analysis of the study variables with PSQI scores. A multivariate analysis of sleep disturbance and other study variables revealed that girls had poorer sleep quality than boys. sleep quality also had a significant relationship with , habitat, sleeping hours and daytime sleepiness . The prevalence of sleep disorders was higher among day scholars (90.1%) as compared to those who lived in the hostel .Sleep quality was significantly poor among students having ESS>10. 114 students had daytime sleepiness of which 91.2% had poor quality which was very significant (p<.0001).However sleep quality was not significantly associated with the academic year and the body mass index of the students .

Table 1: Demographic Characteristics and Other Variables of the Study Population

Variables		NO(%)
GENDER	MALE	235 (76.5)
	FEMALE	72 (23.4)
Academic year		
	FIRST	90(29.3)
	SECOND	72(23.4)
	THIRD	61 (19.9)
	FOURTH	84 (27.4)
HABITAT		
	HOSTEL	274 (89.3)
	HOME	33 (10.7)
BMI		
	<18.5	61(19.9)
	18.5-24.9	135 (44)
	25- 29.9	73 (23.8)
	>30	38 (12.4)
SLEEP HOURS		
	4-6	213 (69.4)
	7-10	66 (21.5)
	OTHERS	28 (9.1)
PSQI		
	<5 (NORMAL)	100 (32.6)
	≥ 5 (ABNORMAL)	207(67.4)
ESS		
	<10(NORMAL)	193 (62.9)
	≥10 (ABNORMAL)	114 (37.1)

Table 2. Analysis of PSQI Scores With Other Study Variables

VARIABLES		PQSI < 5	PQSI ≥ 5	TOTAL	P VALUE
SEX					<.05
	MALE	84 (35.74)	151(64.26)	235	
	FEMALE	16 (22.22)	56(77.77)	72	
ACADEMIC YEAR					>.05
	FIRST	24 (26.66)	66 (73.33)	90	
	SECOND	29 (40.28)	43(59.72)	72	
	THIRD	28(45.90)	33 (54.1)	61	
	FOURTH	19(22.62)	65(77.38)	84	
HABITAT					<.05
	HOSTEL	97 (35.4)	177 (64.5)	274	
	HOME	3 (9.1)	30 (90.1)	33	
BMI					>.05

Cont... **Table 2. Analysis of PSQI Scores With Other Study Variables**

	< 18.5	21(34.4)	40 (65.6)	61	
	18.5 – 24.9	36(26.7)	99 (73.3)	135	
	25 – 29.9	27 (37)	46 (63)	73	
	>30	19 (50)	19 (50)	38	
SLEEP HOURS(in hrs)					<.05
	4-6	55 (25.8)	158 (74.2)	213	
	7 -10	28 (42.4)	38 (57.6)	66	
	OTHERS	17(60.7)	11 (39.3)	28	
ESS					<.0001
	<10 (NORMAL)	90 (46.6)	103 (53.4)	193	
	>10 (ABNORMAL)	10 (8.8)	104 (91.2)	114	

DISCUSSION

In the present study , decreased sleep quality was found to be very common among medical students as 235(67.42%) students reported poor sleep quality. These findings agree with those of a study conducted on medical students demonstrating that 38.9% of students had poor sleep quality according to the PSQI [18]. A high percentage of respondents i.e > 213 (72%) got less than 7 hrs of sleep per night. .Similar findings were shown wali et al [19] and another studies in Iran[20]

Sleep deprivation is associated with a variety of adverse consequences and can result in significant changes in cognitive functioning, short-term memory and concentration. [21]. Medical students suffer high level of stress due to academic demands. Stress associated with insufficient sleep and excessive daytime sleepiness can result in lower academic performance [22] compromised learning, impaired mood, and increased risk of motor vehicle accidents. It may also lead to difficulties in interpersonal relationship, depression, anxiety, and alcohol and drug abuse.[23,24]

Daytime sleepiness was assessed using the ESS. Our analysis showed that 114 (37%) respondents had ESS score >10 indicating daytime sleepiness of which 91.2% had poor sleep quality and it was very significant which concurs with the findings published previously by Wali et al (19) and BaHammam (15) . People with daytime sleepiness because of insomnia have lower self-esteem and are three times as likely to be involved in road accidents as their well-rested counterparts (*Garbarino et al., 2002*).[25]

In the current study, several factors such as gender, habitat, sleep hours, and daytime sleepiness were associated with sleeping disorder among medical students. Our results were consistent with the findings of Nojomi et al. [26]. These risk factors, aside from socioeconomic status, life habits, and psychological factors, were also demonstrated for sleep disorders in other studies [6,].

The results of the present study revealed that female medical students have a higher prevalence of sleep disorder than males,which is in contrast to the findings of PA Giri et al [8]. Ghanizadeh et al.[27] revealed that the mean duration of night sleep in high school students in Iran is not different between genders. However it is consistent with the study of Keshavarz Akhlaghi and Ghalebandi conducted among pre-university students in Karaj, Iran [20]

It was interesting to note that day scholars had more sleep problems than the hostellites. This has been attributed primarily to the commuting between college and their residences. A feeling of inadequacy in fulfilling family commitments can also be attributed to the higher stress levels in day scholars.

As medical colleges strive to provide the optimal

learning environment to students, more attention needs to be directed towards improvement of students' quality of life. Medical schools should build reforms in medical education and provide recreation centers in order to minimize the stress among students.This can be achieved by establishing counselling facilities that can serve those with physical and psychological difficulties.Medical students, on the other hand, would also have to identify their problems and seek for an advice from the faculty in order to find solutions for it.

The main limitations of the study is that it is based only on subjective assessment by the respondent. False information may be provided by students answering the questionnaires, and students may also be unable to understand or may misinterpret the questions. Moreover, the respondents may not have considered a few nights of sleep difficulty due to stress to be equivalent to insomnia or to a persistent sleep disturbance.

CONCLUSIONS

This study reveals a high prevalence of poor sleep quality among medical students.Therefore, undergraduate medical students should be educated about the importance of adequate sleep to their academic performance. The need for further local research on students' sleep is clear. Research in particular should examine factors that may affect the quality and quantity of students' sleep and its effects on academic achievements and solutions that will help students combat sleep difficulties and avert the deleterious effects of sleep deprivation. .

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REFRENCE

1. Kaplan HI, Sadock BJ. Synopsis of Psychiatry. 8th ed. Baltimore (MD): Williams and Wilkins 1998. p. 737-741
2. OhayonMM,Guilleminault C. Epidemiology of sleep disorders. Sleep: A Comprehensive Handbook. Hoboken, New Jersey: Wiley-Liss; 2006.
3. Foley DJ, Monjan AA, Brown SL, Simonsick EM,Wallace RB, Blazer DG. Sleep complaints among elderly persons: an epidemiologic study of three communities. Sleep. 1995;18(6):425–32. [PubMed: 7481413]
4. Wong JGWS, Patil NG, Beh SL, et al. Cultivating psychological well-being in Hong Kong's future doctors. Med Teach. 2005;27:715–9. [PubMed]
5. Kim EJ, Dimsdale JE. The effect of psychosocial stress on sleep: a review of polysomnographic evidence. Behav Sleep Med. 2007;5:256–78. [PMC free article][PubMed]
6. Abdulghani HM, Alrowais NA, Bin-Saad NS, Al-Subaie NM, Haji AM, Alhaqwi AI. Sleep disorder among medical students: relationship to their academic performance. Med Teach. 2012;34(Suppl 1):S37–41. [PubMed]
7. Palatty PL, Fernandes E, Suresh S, Baliga MS. Comparison of sleep pattern between medical and law students. Sleep Hypn. 2011;13:1–2.
8. Giri P, Baviskar M, Phalke D. Study of sleep habits and sleep problems among medical students of Pravara Institute of Medical Sciences Loni, Western Maharashtra, India. Ann Med Health Sci Res. 2013;3:51–4. [PMC free article] [PubMed]
9. Haseli-Mashhadi N, Dadd T, Pan A, Yu Z, Lin X, Franco OH. Sleep quality in middle-aged and elderly Chinese: distribution, associated factors and associations with cardio-metabolic risk factors. BMC Public Health. 2009;9:130. doi: 10.1186/1471-2458-9-130. [PubMed: 19426521].
10. Ng EP, Ng DK, Chan CH. Sleep duration, wake/sleep symptoms, and academic performance in Hong Kong Secondary School Children. Sleep Breath. 2009;13(4):357–67. doi: 10.1007/s11325-009-0255-5. [PubMed: 19377905].
11. Sweileh WM, Ali IA, Sawalha AF, Abu-Taha AS, Zyoud SH, Al-Jabi SW. Sleep habits and sleep problems among Palestinian students. Child Adolesc Psychiatry Ment Health. 2011;5(1): 25. doi: 10.1186/1753-2000-5-25. [PubMed: 21762479].
12. Roth T, Zammit G, Kushida C, Doghramji K, Mathias SD, Wong JM, et al. A new questionnaire to detect sleep disorders. Sleep Med. 2002;3(2): 99–108. [PubMed:14592227].
13. Cronin AJ, Keifer JC, Davies MF, King TS, Bixler EO. Postoperative sleep disturbance: influences of

opioids and pain in humans. Sleep. 2001;24(1): 39–44. [PubMed: 11204052].

14. Bazil CW. Epilepsy and sleep disturbance. Epilepsy Behav. 2003;4:39–45.
15. BaHammam A. Sleep pattern, daytime sleepiness and eating habits during the month of Ramadan. Sleep and Hypnosis 2003; 5: 165-172.
16. Buysse DJ, Reynolds CF, Monk TH, Berman SR, Kupfer DJ. The Pittsburg sleep quality index: A new instrument for psychiatric practice and researc h. PsychiastryRes. 1989;28:193–213. [PubMed]
17. Johns MW. A new method for measuring daytime sleepiness: The Epworth sleepiness scale. Sleep. 1991;14:540–5. [PubMed]
18. Medeiros ALD, Mendes DBF, Lima PF, Araujo JF. The Relationships between Sleep-Wake Cycle and Academic Performance in Medical Students. Biol Rhythm Res. 2003;32(2):263–70. doi: 10.1076/brhm.32.2.263.1359
19. Wali SO, Krayem AB, Sammam YS, Mirdad S, Alshimemeri AA, Almobaireek A. Sleep disorders in Saudi health care workers. Ann Saudi Med 1999; 19: 406-409.
20. Keshavarz Akhlaghi AA, Ghalebandi MF. Sleep quality and its correlation with general health in pre-university students of Karaj, Iran. Iran J Psychiatr Behav Sci. 2009;3(1):44–9.
21. Johnson LC. Sleep deprivation and performance. In: Biological Rhythms, Sleep and Performance. Webb WB editor. New York (NY): John Wiley and Sons; 1982. p. 111-142
22. Lack LC. Delayed sleep and sleep loss in university students. J Am Coll Health 1986; 35: 105-110.
23. Jean-Louis G, Von Gizycky H, Zizi F, Nunes J. Mood states and sleepiness in college students: Influences of age, sex, habitual sleep and substance use. Percept Mot Skills. 1998;87:507–12.[PubMed]
24. Santibanez I. Estudo de habitos normais e patologicos de sono e vigilia de estudantes de medicina: Estudo de prevalencia. J Bras Psiq. 1994;43:33–7.
25. Garbarino S, De Carli F, Nobili L,Mascialino B, Squarcia S, Penco MA, Beelke M, Ferrilla F. 2002. Sleepiness and sleep disorders in shift workers: a study on a group of Italian police officers. Sleep 25(6):648–653.
26. Nojomi M, Ghalhe Bandi MF, Kaffashi S. Sleep pattern in medical students and residents. Arch Iran Med. 2009;12(6):542–9. [PubMed: 19877745]
27. Ghanizadeh A, Kianpoor M, Rezaei M, Rezaei H, Moini R, Aghakhani K, et al. Sleep patterns and habits in high school students in Iran. Ann Gen Psychiatry. 2008;7:5. doi: 10.1186/1744-859X-7-5. [PubMed:18339201]

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Effect of Smoking on Breath Holding Time

Sukanya Badami[1], Baragundi Mahesh C[2]

[1]Assistant Professor, Dept. of Physiology, [2]Professor and HOD, Dept. of Microbiology, Gadag Institute of Medical Sciences, Gadag, Karnataka

ABSTRACT

Introduction- Breath holding time (BHT) may be considered as one of the indicators of efficiency of breathing function. Tobacco smoking is highly prevalent throughout the world Smoking tobacco causes impairment of lung functions. Hence the present study was done to know the effect of smoking on BHT among healthy males.

Methodology- Study was conducted on 47 apparently healthy male smokers and 47 healthy non smokers between the age group of 20-50yrs. The subject was instructed to hold his breath by pinching the nose with thumb and index finger as long as possible at the end of deep inspiration. The breaking point time was noted in seconds using a stop watch.

Results - The mean breath holding time among smokers was 34.85 seconds, whereas the mean breath holding time was 46.61 seconds among non smokers.

Conclusion - The present study showed that BHT was lower among smokers than non-smokers and the difference was statistically highly significant.

Keywords – *Breath holding time, Smoker, Tobacco.*

INTRODUCTION

There are several pulmonary function tests available to assess the respiratory functions of an individual. Breath holding time (BHT) is one of them and can be applied easily, even in field settings to assess the pulmonary function. BHT is defined as the time taken by the subject to hold his breath as long as he can. Normal voluntary BHT is 45 – 55 seconds. [1]

The point at which breathing can no longer be voluntarily inhibited is called the breaking point. It is due to increased arterial pCO_2 and decreased arterial pO_2. [2]

Breath-holding induces the dyspneic sensation, and BHT gives information about overall efficiency of respiratory system to sustain dyspnea. In normal individuals, breath holding at functional residual capacity, initially there is no sensation for about 15 – 20 sec where oxygen in the residual volume is used to maintain pO_2 level of arterial blood. When all oxygen is used the pO_2 in arterial blood falls gradually inducing dyspneic sensation. Dyspneic sensation increases until the person can no longer hold his breath voluntarily. This point is defined as breaking point of breath holding. The measurement of the period of no respiratory sensation provides us with information about the threshold of dyspneic sensation whereas the measurement of the total breath-holding time is a behavioral measure of the tolerable limit of dyspneic sensation.[3] The breath holding time varies from person to person and with different environmental conditions.[4]

Prevalence of smoking is very high throughout the world and India is no exception. Smoking tobacco causes irritation of the respiratory tract which in turn causes hypertrophy of mucosal cells resulting in increased secretion of mucus and formation of mucosal plugs, which leads to impairment of lung functions.[5]

Literature search revealed that there are very few studies on effect of smoking on BHT. Hence the present

Corresponding author:
Dr. Sukanya Badami, MD
Assistant Professor, Dept. of Physiology,
Gadag Institute of Medical Sciences, Gadag, Karnataka.
Ph:9741033699, Mail-sukanya_ahesh@rediffmail.com

study was done to know the effect of smoking on BHT among healthy males.

MATERIALS AND METHOD

Study was conducted on 47 apparently healthy male smokers and 47 healthy non smokers between the age group of 20-50yrs. Ethical clearance was obtained by Institutional ethical committee. Informed consent was taken from subjects after explaining the purpose and procedure size of the study.

Inclusion criteria:

Cases – Healthy male subjects with a history of smoking for more than one year and those who smoke five or more than five cigarettes per day.

Controls- healthy male subjects with no past, present or passive history of smoking.

Exclusion criteria:

1. Female subjects to avoid sex bias.

2. Subjects with any illness and those who are exposed to dust or fumes occupationally.

3. Subjects having allergic, endocrine, neuromuscular, musculoskeletal disorders etc. which are likely to affect respiratory function.

Breath holding time was recorded after a period of rest for 10 minutes in morning hours between 11 – 12 pm to avoid any diurnal variation. The subject was instructed to hold his breath by pinching the nose with thumb and index finger as long as possible at the end of deep inspiration. The breaking point time was noted in seconds using a stop watch. The procedure was repeated three times at 5 minutes interval. The highest of the three readings was taken.

Statistical analysis was done by calculating mean breath holding time and standard deviation. Statistical significance was calculated by unpaired t test using SPSS software.

RESULTS

Table-1 shows, the comparison of anthropometric parameters between smokers and non-smokers. The mean ± 2SD age of smokers was 36.77 ± 11.02, while that of non-smokers was 38.61 ± 12.10. The P value was more than 0.05 indicating that the difference in mean age between smokers and non-smokers was statistically not significant.

Similarly the mean ± 2SD for height was 165.04 ±12.16 among smokers and 164.29±10.64 among non-smokers. Again the difference in mean height between smokers and non-smokers was statistically not significant.

The mean ± 2SD for weight was 61.04 ± 16.34 among smokers and 68.31±15.20. The difference was statistically significant. Non-smokers had more weight than smokers.

Table-1: Anthropometric parameters of smokers and non-smokers.

Parameters	Smokers Mean±2SD	Non-smokers Mean±2SD	t- statistic	P value
Age (yrs)	36.77 ±10.02	38.61±12.10	-1.5499	0.1246, >0.05
Height (cms)	165.04±12.16	164.29±10.64	0.6314	0.5294, >0.05
Weight (Kgs)	61.04±16.34	68.31±15.26	-4.4688	0.000, <0.001

Table-2 shows, that the mean breath holding time among smokers was 34.85 seconds, whereas the mean breath holding time was 46.61 seconds among non smokers. Smokers had a shorter BHT when compared to non smokers. When the difference was analyzed using t test, the difference was found to be statistically highly significant ($P<0.001$).

Table-2: Mean ±SD of breath holding time among Smokers and Non- smokers

Group	No.	Breath holding time. Mean ± 1SD	t- statistic	P value
Smokers	47	34.85 ± 11.22	-8.1311	0.000, <0.001
Non – Smokers	47	46.61 ± 16.36		

DISCUSSION

Breath holding test is used as a rough Index of Cardiopulmonary Reserve.[6] BHT is dependent on the volume of oxygen at the beginning of the test i.e., on functional residual capacity and also on diffusing capacity of lungs in a particular individual. Respiratory centers control respiration by sensing pCO_2 and pO_2 levels in the blood. An increase in pCO_2 or decrease in pO2 stimulates respiration.[7] The Breaking point is generally reached when alveolar pO_2 drops to 56mmHg and alveolar pCO_2 rises above 49 mmHg.[1] The time taken to reach breaking point decides the BHT. Maximal BHT is used in Respiratory physiology as a measure of ventilator response. [7,8,9]

The present study showed that BHT was lower among smokers than non-smokers and the difference was statistically highly significant.

Similar to the present study low BHT values were observed in smokers when compared to non-smokers in a study by Sudha et.al in 2012.[10] Similarly lower values of BHT were recorded in smokers exposed to dust and fumes when compared to non-smokers in a study by Mhase VT et.al in 2002.[11] Study by Zvolensky MJ has revealed that breath holding time was longer in sustained smoking quitters. [12]

Tobacco smoking is highly prevalent throughout the world and India is no exception. Smoking causes loss of cilia of respiratory tract, mucus gland hyperplasia, converts pseudostratstified ciliated epithelium to squamous metaplasia, carcinoma, smooth muscle hypertrophy, inflammation, peribronchiolar fibrosis, alteration in alveoli etc.[13] Numerous studies have shown that smokers have about 6 – 20 % lower diffusing capacity when compared to age matched non smokers.[14] The exact mechanisms of smoking affecting BHT is not clear. Smokers show a reduction in all lung functions and their capacity to tolerate physical discomfort is also less compared to non-smokers. It is a known fact that smoking raises the CO2 levels in blood. The CO present in cigarette smoke is more than 600 times the concentration of CO in automobile exhaust. The high levels of CO2 in the blood of smokers bind with hemoglobin and form carboxyhemoglobin. Carboxyhemoglobin affects the oxygen carrying capacity of the blood. Hence, a smoker has high susceptibility for hypoxia and hypercapnia compared to a non-smoker causing the rapid attainment of the break point, and in turn reducing the BHT.[1]

Limitations of the present study were small size of the study population and not considering possible effects of physical activities, duration of smoking, number of cigarettes per day, type of smoking (beedi, cigarette, or any other form), and other confounding factors like psychological factors and motivation. Hence a large scale study considering above points needs to be carried out.

REFERENCES

1. Bijlani RL. Understanding Medical Physiology. 3rd ed. New Delhi-India: Jaypee Brothers Medical Publishers (P); 2004. p. 307-8.
2. Jain AK. Textbook of physiology. 4th edition. Avichal publishing company 2010;465.
3. Nishino T (2009) Pathophysiology of dyspnea evaluated by breath-holding test: studies of furosemide treatment. Respir Physiol Neurobiol 167: 20-25.
4. Viecili RB, Silva DR, Sanches RS, Muller AF, Pereira da Silva D and Menna Barreto SS. Real-Time Measurement of Maximal Voluntary Breath-Holding Time in Patients with Obstuctive Ventilatory Defects and Normal Controls. J Pulmon Resp Med 2012;2(5):1-3.
5. Gold D, Wang XB, Wypij D, Speizer FE, Ware JH, Docey DW, Effects of cigarette smoking on lung function of adolescent boys and Girls. N Engl J Med 1996;335:931-937.
6. Bagavad Geeta M, Roopa S, Subhashini AS and Syed Sultan K. Effect of Physical training on Breath holding time in Indian subjects. Ind J of

Physiol and Pharnac 2014;58:

7. Nunn JF. Chapter 2: Control of breathing: breath holding. In: Applied respiratory physiology. 2nd ed. London, England: Butterworth; 1977. p. 95-9.
8. Godfrey S, Campbell EJ. Mechanical and chemical control ofbreath holding. Q J Exp Physiol Cogn Med Sci 1969;54:117-28.
9. Godfrey S, Campbell EJ. The control of breath holding. Respir Physiol 1968;5:385-400.
10. Sudha BS, Sunitha MS, Nataraj SM, Murali Dhar. A study of reduction in breath-holding time in smokers and recovery among ex-smokers in bus depot workers. Int J of Health & Allied Sciences 2012;1(3): 166-171.
11. Mhase VT, Reddy PS. Effect of smoking on lung functions of workers exposed to dust and fumes. Indian J Community Med 2002-03;27:26-9.
12. Zvolensky MJ, Feldner MT, Eifert GH, Brown RA. Affective style among smokers - Understanding anxiety, sensitivity, emotional reactivity, and distress tolerance using biological challenge. Addict Behav 2001;26:901-15.
13. Shereman CB. The health consequences of smoking pulmonary diseases: Cigarettesmoking. Med CL North Am 1992;76:355-375.
14. Hyatt RE Dynamic Lung Volumes in: Fenn WO and Rahn H. Handbook of Physiology in : Sec. 3, Respiration Vol. II Ist Edi., Washington DC 1965: 1381-95.

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The Comparative Study of Aerobic Capacity between Physically Trained and Untrained Subjects Using Astrand Ryhming Step Test

Sukanya Badami[1], Baragundi Mahesh C[2]

[1]Assistant Professor, Dept. of Physiology, [2]Professor and HOD, Dept. of Microbiology, Gadag Institute of Medical Sciences, Gadag, Karnataka,

ABSTRACT

Introduction : Research findings in the last three decades have shown that physical inactivity and a negative lifestyle has seriously threatened health and hastened the deterioration rate of the human body. Maximum oxygen uptake (VO_{2max}) is considered the best indicator of aerobic fitness. Hence the present study was done to compare the maximum aerobic capacity between students of medical education leading a sedentary life and students of physical education leading a sedentary life.

Methodology : 50 healthy male medical students and 50 healthy age matched male physical education students of College of Physical education after completion of 9 months of course in the college, were the subjects of the study. VO_{2max} of each subject was recorded by using Astrand-Ryhming step test (ARST).

Results : The comparison of mean±1SD duration of exercise and VO_{2max} between students of ME and PE shows that the scores were more in PE students when compared to ME and all the differences were statistically highly significant.

Conclusion : Physical activities, regular exercise and sports should be encouraged for better cardio respiratory fitness.

Keywords : *VO_{2max}, medical, Physical education, Training, aerobic capacity.*

INTRODUCTION

Research findings in the last three decades have shown that physical inactivity and a negative lifestyle has seriously threatened health and hastened the deterioration rate of the human body. A sedentary lifestyle is the most prevalent modifiable risk factor for cardiovascular diseases, and this is particularly important in view of the mounting evidence that physical activity and regular exercise may reduce the risk for the chronic diseases and death especially from coronary heart disease.[1]

Corresponding author:
Dr. Sukanya Badami. MD
Assistant Professor, Dept. of Physiology,
Gadag Institute of Medical sciences,
Gadag, Karnataka. Ph:9741033699
Mail-sukanya_mahesh@rediffmail.com

Maximum oxygen uptake (VO_{2max}) is considered the best indicator of aerobic fitness. Aerobic capacity or VO_{2max} (maximal oxygen consumption) is the maximum capacity of an individuals body to transport and utilize oxygen during incremental exercise, which reflects the physical fitness of the individual.[2]

Those who are fit have higher VO_{2max} values and can exercise more intensely than those who are not as well conditioned. Numerous studies show that you can increase your VO_{2max} by working out at an intensity that raises your heart rate to between 65 – 85% of its maximum for atleast 20 minutes three to five times a week. [3]

The direct determination of VO_{2max} needs well established laboratory set up, skilled personnel, expensive equipments and medical supervision in order to avoid risk factors involved in exhaustive work (maximal test).

Hence in the present study Astrand-Ryhming nomogram was used to calculate VO_{2max} indirectly using heart rate response to sub maximal Astrand-Ryhming step test. Astrand – Ryhming nomogram is suitable for using as an indirect method of estimation of VO_{2max} in Indian subjects. [4]

Due to heavy academic curriculum, medical students do not get time for physical activities and lead a sedentary life. Physical education students undergo regular physical training as a part of their curriculum, Hence the present study was done to compare the maximum aerobic capacity between students of medical education leading a sedentary life and students of physical education leading a sedentary life.

METHODOLOGY

50 healthy male medical students and 50 healthy age matched male physical education students of College of Physical education after completion of 9 months of course in the college, were the subjects of the study. Ethical clearance was obtained from the institutional ethical committee. Test procedure and purpose were explained and a written consent was taken from subjects.

Recording of VO_{2max} by using Astrand-Ryhming step test: [5,6,7,8]

VO_{2max} of each subject was recorded by using Astrand-Ryhming step test (ARST). Each subject completed step 'up' and 'down' task at the rate of 90 steps per minute (22.5 cycles/min) on 40 cm bench (16 inch) for 5 minutes or until exhaustion (when the subject can not maintain the stepping rate for 15 seconds), which ever was early. The subject placed one foot on the platform and later the other, and immediately stepped down, bringing down first the same foot which he placed up first. The rate of stepping at 90 steps per min was maintained with the help of a metronome.

Pulse counts immediately after step test from 15 – 30 seconds were recorded.

Maximum aerobic capacity (VO_{2max}) was indirectly assessed by the **Astrand Ryhming nomogram method (1960)** from submaximal exercise data obtained using ARST. [5,9]

Pulse rate immediately after step test from 15 seconds to 30 seconds was connected with body weight in kg in the Astrand –Ryhming nomogram and VO_{2max} in liters per min was obtained on the middle VO_2 line. VO_{2max} was converted to ml per kg per min by multiplying with 1000 and dividing by body weight. Age correction factor, was not used, as the subjects in the present study were more than 17 years and less than 25 years.

STATISTICAL ANALYSIS

Data was analyzed by following statistical methods.

1. Unpaired 't' test.
2. Chi-square test.

RESULTS

Table-1, shows the comparison of mean±1SD duration of exercise and VO_{2max} between students of ME and PE. All the scores were more in PE students when compared to ME and all the differences were statistically highly significant.

Table-1: Comparison of Duration of exercise and VO_{2max} between students medical and physical education.

Parameter	Medical Education Mean ± SD	Physical Education Mean ± SD	t value	p value	Remark
Duration of exercise(sec)	269.4±43.6	296.1±11.8	4.18	<0.001	HS
VO_{2max} (ml/kg/min)	47.7±6.2	57.5±4.4	9.12	<0.001	HS

HS-Highly significant

Table - 2 shows the comparison of VO_{2max} scores between students of ME and PE. Most of PE students had superior and excellent VO_{2max} scores where as most of ME students had excellent, good and fair VO_{2max} scores. The differences in VO_{2max} scores between both groups were statistically highly significant.

Table-2: Comparison of VO_{2max} scores of medical and physical education students.

Score	Medical Education. Number of students (%)	Physical Education. Number of students (%)	Chi – square Value	p value	Remarks
Superior	12 (24)	41 (82)	36.21	<0.001	HS
Excellent	16 (32)	7 (14)	36.21	<0.001	HS
Good	6 (12)	1 (2)	36.21	<0.001	HS
Fair	15 (30)	1 (2)	36.21	<0.001	HS
Poor	1 (2)	0(0)	36.21	<0.001	HS
Very Poor	0(0)	0(0)	36.21	<0.001	HS

HS-Highly significant

DISCUSSION

Aerobic power is the maximum capacity of an individual's body to transport and utilize oxygen during incremental exercise, which reflects the physical fitness of the individual.[10] Aerobic capacity or maximum oxygen uptake capacity (VO_{2max}) is widely considered to be the best measure of cardio respiratory fitness.[11]

The present study revealed a statistically highly significant higher mean±1SD, VO_{2max} value in PE students(57.5±4.4ml/kg/min) than ME students(47.7±6.24ml/kg/min). The comparison of VO_{2max} scores showed that most of PE students had superior (82%) and excellent (14%) scores while most of ME students has excellent (32%) and fair (30%) scores of VO_{2max}.

The positive relationship between aerobic endurance training and VO_{2max} obtained in the present study is in agreement with a large number of previous studies.

Kavin R et al have reported a significantly high VO_{2max} in trained men(56.7±6.4 ml/kg/min) than VO_{2max} in untrained men(39.8±1.7 ml/kg/min).[12]

In a study on 8 trained and 9 untrained male subjects aged 18-25 yrs from a university by Christie CJA et al, trained subjects showed a significantly higher VO_{2max} (70±7.2 ml/kg/min) than untrained subjects (54.5±3.6 ml/kg/min).[13]

VO_{2max} was compared between high, moderate and low physical activity groups in a study by Shaikh WA et al. Highest VO_{2max} was seen in high physical activity group and least VO_{2max} was seen in low physical activity group.[14]

Two groups of male medical students from Belgium and France respectively had aerobic powers that compared well with those of PE students. It was concluded that this could be because of sampling of the fittest medical students.[15]

Numerous other studies also have shown that trained subjects have higher VO_{2max} than untrained subjects.[16,17,18]

A VO_{2max} of 54.24±6.17 ml/kg/min in national Indian sportsman is reported by Varma SK et al.[19] Prajapati R et al have reported 54.32±0.70 ml/kg/min VO_{2max} in Nepalese medical students.[20] VO_{2max} score of most of medical students was found to be in poor to average range in a study by Tong prasert S et al.[21]

In previously sedentary people, training at 75% of aerobic power, for 30min, 3 times a week over 6 months increases VO_{2max} on an average of 15-20%. [18]

The possible underlying mechanisms for improvement in VO_{2max} by aerobic training are 1.Increase in cardiac output, 2. Increase in arteriovenous O_2 difference because of better utilization of oxygen by exercising muscles and 3.Increase in pulmonary capillary density. [22]

Hence physical activities, regular exercise and sports should be encouraged for better cardio respiratory fitness.

REFERENCES

1. Choudhary S, Rajnee, Binawara BK. Effect of exercise on serum iron, blood hemoglobin and cardiac efficiency. J postgrad Med Inst 2012; 26(1):13-16.
2. Lars Hermansen, Lange Anderson K. Aerobic work capacity in young Norwegian men and women. J Appl Physiol 1965; 20(3): 425-431.
3. Hussain Baig MN. A Comparative study on cardiopulmonary efficiency and BMI in trained cyclists & sedentary young adults (thesis).Bijapur, India;RGUHS:2008.
4. Joseph NT, Srinivasulu N, Sampath KJ, Gupta S. Indirect estimation of Aerobic capacity in Indians. Inidan J Med Res 1973; 61(2): 252-259.
5. Marley WP, Linnerud AC. Astrand-Ryhming step test norms for college students. Br J sports Med 1976; 10(2):76-79.
6. Das B, Ghosh T, Gangopadhyay S. A Comparative study of Physical Fitness Index (PFI) and Predicted Maximum Aerobic Capacity (VO_2 max) among the Different Groups of Female Students in West Bengal, India. International J of App sports sci 2010; 22(1):13-23.
7. Taddamino DA, Karpvich PV. Endurance as measured by the Harvard Test. Research Quarterly 1951; 22:381-384.
8. Harvard Step test - Athletics Wiki-Athlepedia. Available at:mhtmsl:file://D:\ Print 3-2011\ Harvard step test – Athletics Wiki-Athlepedia mht. Accessed March 3,2011.
9. Cheevers A, Pettersen C. Harvard step test. Hoge school van Amsterdam, Amsterdam Institute of Allied and Health Education, European school of Physiotherapy. 2007. Available at: Kennisbank.hva.nl/document/218826. Accessed may 20, 2011.
10. Thomason H. Collected papers on exercise physiology from the Human Performance Laboratory, University of Salford. Human performance Laboratory, University of Salford 1974; 111-119.
11. Foss ML, Keteyian SJ. Fox's physiological basis for exercise and sport. 6th ed., Boston, MA: McGraw-Hill; 1998.
12. Short KR, Sedlock DA. Excess post exercise oxygen consumption and recovery rate in trained and untrained subjects. J Appl Physiol 1997; 83: 153-159.
13. Christie CJ, Lock BI. Impact of training status on maximal oxygen uptake criteria attainment during running. SAJSM 2001; 21(1): 19-92.
14. Shaikh WA, Patel MC, Singh SK. Association of Physical activity and Physical Fitness with blood pressure profile in Gujarati Indian Adolescents. Indian J Physiol pharmacol 2011; 55(4): 322-328.
15. Shephard RJ, Pimm P. Physical Fitness of Canadian Physical Education Students with a note on International Differences. Available at:mhtml:file: //C:\Documents%20 and 20 settings \-\ Deskdtop\ topi. Accessed December 11, 2010.
16. Cornelissen VA, Fagard RH. Effects of Endurance Training on Blood pressure, Blood-Pressure Regulating Mechanisms, and Cardiovascular Risk Factors. Hypertension 2005; 46:667-675.
17. Khodnapur JP, Bagali SC, Muller LM, Dhanakshirur GB, Aithala M. Role of Regular Exercise on VO_2 max and Physiological parameters among Residential and non-residential school children of Bijapur. International J of Biomed and Adv Res 2012; 3(5):397-400.
18. Malipatil BS. Pre and post exercise changes in cardiopulmonary functions in healthy school children of Gulbarga district. Int J of Biomed and Adv Res 2012; 3(5).
19. Verma SK, Sidhu LS, Kansal DK. A study of maximum oxygen uptake and Heart rate during work and recovery as measured on cycle ergometer on National Indian sportsmen. Brit J Sports, Med 1979;13:24-28.
20. Prajapati R, Dhungel KU, Pramanik T, Gosh A, Roychowdhury P. Assessment of some pulmonary parameters and cardiorespiratory fitness status in Nepalese medical students. Nepal Med Coll J 2008 ;10(1):28-29.
21. Tongprasert S, Wattanapan P. Aerobic capacity of Fifth-Year Medical Students at Chiang Mai University. J. Med Assoc Thai 2007; 90(7):1411-1415.
22. Indukurana. Textbook of medical physiology.1st ed. Elsivier, a division of Reed Elsevier India Private Limited 2010;1221-1232.

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Comparison of Pulmonary Function Test in Athletes and Individuals with Sedentary Lifestyle

R Girija[1], Rvinodha[2]

[1]Assistant Professor, Department of Physiology, Government Medical College, Omandurar Government Estate, Chennai,
[2]Professor & HOD, Department of Physiology, Thanjavur Medical College, Thanjavur

ABSTRACT

Background: Pulmonary function test is one of the basic tools for evaluating a person's respiratory status. Physical fitness is essential for athletes and non-athletes for maintenance of physical and mental health. Sedentary lifestyle could be associated with less efficient pulmonary function. So the present study has been put forward to study the better pulmonary function in athletes than in people with sedentary life style. **Aim:** To compare pulmonary function test in Athletes and individuals with sedentary life style. **Materials and method:** Study group consists of 80 subjects, 40 were athletes and remaining 40 were individuals with sedentary life style. The pulmonary function test parameters were compared between the two groups. **Statistical analysis:** Statistical analysis was done using SPSS software version 10. Independent sample t test was used to compare between the two groups. P value <0.05 was statistically significant.

Result: Mean value of FEV1, FVC, MMEF, MVV was significant. PEF, FEV1/FVC % Mean value was found to be insignificant.

Conclusion: The result of the present study showed that physical training and exercise improved the lung function parameters in athletes. A continued high physical activity is associated with lower mortality, and delays decline in the pulmonary function and therefore should be encouraged.

Keywords: *athletes, sedentary lifestyle, pulmonary function test.*

INTRODUCTION

Pulmonary function test is one of the basic tools for evaluating a person's respiratory status. A very useful and simple test of pulmonary function is the measurement of a single forced expiratory volume[1]. Buffalo Health study concluded that pulmonary function is the long term predictor for overall survival rates, in both the genders and could be used as a tool in general health assessment[2]. Results from several studies have described a significant relationship between pulmonary function and both all cause mortality as well as cause – specific mortality[3,4].

Address for correspondence:
Dr. R Girija M.D Physiology,
Assistant Professor, Department of Physiology,
Government Medical College, Omandurar Government Estate, Chennai- 600002. Mobile: 9486408626
E-mail:drgirija76@gmail.com

Persson et al pointed out that there is an urgency to reach a better understanding of the relationship of impaired pulmonary function to disease in order to undertake preventive measure[5]. Sedentary lifestyle could be associated with less efficient pulmonary function. People who take regular physical exercise report less anxiety and depression and also lower level of stress than do sedentary people [6].

Involvement in certain physical activities or sports could help in respiratory muscle strengthening and improvement in pulmonary function. Physical fitness is required not only by athletes for better performance but also by non – athletes for maintenance of physical and mental health. Hence it is essential to be involved in physical activity or sports. The federation of International Respiratory societies have declared October 14th, 2010 as First ever world spirometry day to celebrate lung health during the YEAR OF THE LUNG.

In this study I have compared pulmonary function of people with sedentary life styles with athletes to see if athletes have better pulmonary function than people with sedentary lifestyle; and if so, how they differ amongst themselves with respect to various spirometric parameters.

MATERIALS AND METHOD

This is a Cross – Sectional Study done to assess the better lung function among athletes compared to individuals with sedentary life style. The subjects for the study were taken by convenient non probability sampling. 40 athletes who form the study group and 40 persons with sedentary life style who form the control group were selected from Thanjavur town. The study was carried out from July 2009 to May 2010. Pulmonary Function Testing Equipment 'SUPERSPIRO' developed by **MIDMEDS Limited** which is computerised, was used for the study.

SUBJECTS:-

Definitions:

Athletes were defined as marathon runners running at least 2 km daily for at least 6 months.

Sedentary lifestyle was defined as per center for disease control and prevention, as no leisure – time physical activity, or activities done for less than 20 minutes or fewer than three times per week

"Smokers" was defined as per center for disease control and prevention as those who have smoked more than 100 cigarettes in their lifetime and currently smoke.

INCLUSION CRITERIA:-

i) Males aged between 20 -40 years. This is to remove the confounding factor of impact of aging on lung function [7].

EXCLUSION CRITERIA:-

i) smokers[8].

ii) persons with past History of pulmonary disease and treatment.

iii) Persons with pulmonary disease now.

A detailed history and physical examination of each subject was carried out. Subjects with any history of smoking, chronic cough, past H/O Asthma, chronic obstructive lung disease, obesity were excluded from the study. The age, body weight and height without shoes were recorded, which gives the BMI of the subject. The test was carried out in the morning during the post absorptive phase. Testing procedure was quite simple, non- invasive and harmless to the subject.

Technique:-

The data of the subject was entered. The subjects were familiarized with the instrument and the technique used. The forced vital capacity (FVC) maneuver was done in sitting position.

The subject is asked to take a maximal inspiration to total lung capacity, and then to breathe out as fast as rapidly as he can, until he can exhale no further which is maximal exhalation to residual volume; he then takes a rapid and maximal inspiration.

Statistical analysis was done for all the parameters using SPSS (Statistical Package for Social Sciences) version 10. One way analysis of Variance (ANOVA) was used to see if groups differ in any of the parameters. Independent sample t test was used for comparison between groups. P value was derived and $p<0.05$ was considered as significant.

RESULTS

Out of 80 male subjects, 40 were athletes performing study group and remaining 40 were individuals with sedentary life style forming control group. The two groups differ significantly in various lung function parameters

In this study, Athletes who form the study group were in age group of 20-35 years, mean 27.62 years. Their mean height was 172.43 ± 3.59cm, mean weight 68.25 ± 7.61 Kg, mean BMI was 22.9 ± 1.9 Kg/m^2.

The control group of individuasl with sedentary lifestyle were in the age group of 20 – 40 years, mean 30.7 years. Mean height was 169.8 ± 4.87 cm, mean weight was 68.5 ± 6.64Kg, mean BMI was 23.7 ± 1.6 Kg/m^2(TABLE-1)

FEV_1 in the athletes show mean value 3.8 ± 0.29 and in control group it is 3.1 ± 0.31 L /S with P value 0.005. MMEF in athletes gives the mean value of 4.7

± 0.75 L/S and in control group 4.13 ± 0.67 L/S with P value 0.005.PEF shows mean value in athletes of about 9.1 ± 1.02 L/S and in control group 8.6 ± 1.4 L/S with P value 0.110.MVV shows mean value in athletes of about 144.75 ± 11.1 L/S and in control group 118.15 ± 11.8 L/S with P value 0.005.FEV_1 / FVC% in athletes is about 93.8 ± 6.4% and in control group 94.1 ± 6.1% with P value 0.832. FVC in the athletes shows mean value about 4.1 ± 0.43 L/S and in control group 3.3 ± 0.41 L/S with P value 0.005(TABLE-2)

Table-1: Descriptive variables for two groups

Descriptive	Study group Mean & S.D	Control group Mean & S.D	'P' value
Age(yrs)	27.62 ± 5.04	30.7 ± 5.28	0.009
Height(cm)	172.43 ± 3.59	169.80 ± 4.87	0.008
Weight(kg)	68.25 ± 7.61	68.5 ± 6.64	0.876
BMI(kg/m^2)	22.9 ± 1.9	23.7 ± 1.6	0.035

Table-2: Lung function parameters for two groups

BY INDEPENDENT SAMPLE t TEST

Parameters	Study group Mean & S.D	Control group Mean & S.D	'P' value
FEV_1	3.8 ± 0.29	3.1 ± 0.31	0.005
FVC	4.1 ± 0.43	3.3 ± 0.41	0.005
FEV_1/FVC %	93.8 ± 6.4	94.1 ± 6.1	0.832
MMEF	4.7 ± 0.75	4.1 ± 0.67	0.005
MVV	144.75 ± 11.1	118.15 ± 11.8	0.005
PEF	9.1 ± 1.02	8.6±1.4	0.110

DISCUSSION

The results of lung function parameters were compared between the two groups, the athletes who were marathon runners running atleast 2 Km daily for atleast 6 months and individuals with sedentary lifestyle. The lung function parameters were also compared with studies carried out previously.

The values of FEV_1,(Forced expiratory volume in one second) and FVC (Forced vital capacity) were found to be statistically significant in Athletes, when compared to control group with sedentary life style. The higher values in athletes could be explained due to better strengthening of respiratory muscles as a result of physical training. Skeletal muscle controls many crucial elements of aerobic conditioning including lung ventilation[9].

In the Amsterdam Growth and Heart study, physical activity was observed to be positively correlated to changes in FVC between ages 13-27 years over a period of 15years[10]. A recent study by Fuster et al also observed increment in FVC as an effect of increased physical activity[11.] FEV_1 and FVC were higher in different sportsmen in India when compared to individuals with sedentary lifestyle[12] Men who remained active had higher FEV_1 and FVC than persons who remained sedentary[13]. In this study, both the lung function parameters are increased in Athletes. The ability to work and function in daily life is related to FEV_1 and FVC.

The difference in the mean values of PEFR in both the groups shows a better lung function due to increased Ventilatory capacity. PEFR value is higher in athletes when compared to sedentary workers in a previous study[14]. The Border Security force Trainees of India in whom PEFR is higher when compared to healthy medical students of the same age group and sex who did not perform regular exercise and were sedentary.

In this study, though the mean value of PEFR shows increase in athletes, statistical significance was not observed. This may be due to varying sample population, Age group difference and small sample size.

FEF_{25-75} or MMEF values were significantly higher in athletes as compared to the control group. Studies done previously observed higher FEF_{25-75}, in athletes who are involved in physical training. But insignificant difference in FEF_{25-75} were observed in Border Security force trainees and sedentary individuals due to high co-efficient of variation.

The present study showed the values of maximum voluntary ventilation MVV to be much higher in athletes as compared to individuals with sedentary lifestyle. The difference was found to be statistically significant in the comparative groups. In the previous study, MVV values were high among Border Security forces as compared to

sedentary persons. The Value of MVV was found to be increased in different groups of sportsmen than those of sedentary group[12].

The mean value of FEV_1 as a percentage of FVC (FEV_1 / FVC) was found to be almost similar in both the groups. It was probably that there was equal rise in FEV_1 and FVC in the various groups. The difference whatsoever was statistically insignificant. In the previous study, FEV % among athletes and sedentary workers were found to be the same. In this study, the same results were recorded as that of previous studies.

The results discussed above clearly indicate that there is significant different in the flow rates between the comparative groups. This confirms that regular exercise has a facilitatory effect on the lungs. The possible explanation for this could be that regular forceful inflation and deflation of the lungs for prolonged periods lead to strengthening of respiratory muscles.

Physical activity is associated with a delayed decline in pulmonary function and thus middle aged and older people should be encouraged to enjoy exercise[15]. Physical activity appears to be beneficial in both smoker and nonsmoker to reduce the decline in pulmonary function .This is important from a public health and clinical point of view. Sedentary lifestyle is associated with high incidence of obesity and development of restrictive lung function and cardiovascular morbidity.

CONCLUSION

The result of the present study showed that physical training and exercise improved the lung function parameters in athletes.The person who had sedentary life styles had lower pulmonary function parameters. A continued high physical activity is associated with lower mortality, and delays decline in the pulmonary function and therefore should be encouraged.

ABBREVIATIONS USED IN THIS STUDY:

PFT- pulmonary function test

FVC - forced vital capacity

FEV1- forced expiratory volume in 1st second

FEV1/FVC – FEV1 as percentage of FVC.

PEFR- peak expiratory flow rate.

MVV- Maximum voluntary ventilation

MMEF - Maximum mid-expiratory flow rate.

Conflict of Interest: None declared.

Source of Support: Nil

Ethical Clearance: Permission got from ethical committee, Thanjavur Medical College.

REFERENCES

1. West JB; Respiratory physiology: - The essentials, 8th Ed Baltimore; Lippincott, Williams & Wilkins
2. Schunemann HJ, Joan Dorn, Brydon J.B.Grant, warren winkelstein, Jr and Maurizio Trevisan. Pulmonary function is a long – term predictor of mortality in the General population. 29 – year follow – up of the Buffalo Health Study. Chest 2000; 118(3); 656-664.
3. Beaty TH, Cohen B.H, Newill CA, Menkers HA, Diamond EL, chen CJ. Impaired pulmonary function as a risk factor for mortality. Am J Epidemiol 1982; 116 ; 102 -113.
4. Bang KM, Gergen PJ, Kramer R etal. The effect of pulmonary impairment on all cause mortality in a national cohort. Chest 1993; 103;536-540.
5. Persson C, Bengtsson C, Lapidus L etal. Peak expiratory flow and risk of cardio vascular disease and death. Am J Epidemiology 1986;124;942 - 948
6. Bray GA, Bouchard C, James WPT. Handbook of obesity clinical application 2nd Ed. 1998. Marcel Dekker.
7. Knudson RJ, Lebowitz MD, Holberg CJ, Burrows B. changes in the normal maximal expiratory flow-volume with growth and aging. Am Rev Respir Dis 1983 127 (6); 725 -734.
8. Tockman M, Menkas H, Cohen B, Permutt S, Benjamin J, Ball Jr Wc, Tonascia J. Comparison of pulmonary function in male smokers and Non smokers. Am Rev Respir Dis 1976; 114; 711-722.
9. Thaman RG, Arora A, Bachhel R. Effect of physical training on pulmonary tests in Border security force Trainees of India. J Life Sci.2010; 2(1); 11-15.
10. Twisk JW, staal BJ, Brinkman MN, kemper HCG,

van Mecheler W1998. Tracking of Lung function parameters and the Longitudinal relationship with lifestyles. Eur Respir J, 12:627-634.

11. Fuster V, Rebato E, Rosique J, Fernandez, Lopex JR 2008. Physical activity related to forced vital capacity and strength performance in a sample of young males and females.coll Antropol, 32(1): 53-60.
12. Ghosh AK, Ahuja A, Khanna GL. Pulmonary Capacities of different groups of sportsmen in India. British Journal.
13. Cheng YJ, Macera Ca, Addy CL, Sy FS, wieland D, Blair SN, Effects of physical Activity on exercise tests and respiratory function.
14. Shivesh P, Meshram S, Ramtekkar U. Athletes, yogis and individuals with sedentary lifestyles; Do their lung functions differ? Indian J physiolpharamacol 2007; 51 (1); 76-80.
15. Pelkonen M, Notkola IL, Lakka T, Tukiaine HO, Kivinen P, Nissinen A. Delaying decline in pulmonary function with physical activity. A 25 yr follow up. Amer Jour respire critical care med 2003. 168; 494-499.

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