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Effect of Perceived Stress on the Differential Leucocyte Count among Young Adults

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Abstract

Exposure to any form of stress causes an increase in ACTH secretion by the anterior pituitary, followed by increased secretion of Cortisol, which decreases eosinophils, basophils and lymphocytes in blood and increases the number of neutrophils. With the above background, the present study was carried out to determine the changes brought on by perceived stress in the leukocyte profile of young adults. 37 healthy, young adults participated in the study. Perceived stress was measured using the 10-item Perceived Stress Scale (PSS-10) and leukocyte profile was studied by performing a differential leukocyte count. A positive correlation was found between PSS score and percentage of neutrophils, monocytes and N:L ratio. A negative correlation was found between PSS score and percentage of lymphocytes, eosinophils and basophils. Stress identification and management is an important component in the welfare of young adults. Differential count of leukocytes can provide a reliable method to study the response to stress.

Keywords: *perceived stress, DLC, neutrophil, lymphocyte, N:L ratio*

Introduction

The term stress was coined by the endocrinologist Hans Selye⁽¹⁾ and is defined as any change in the environment that changes or threatens to change an optimal existing state.⁽²⁾ Perceived stress refers to an individuals' perception regarding the level or amount of stress that he/she is experiencing at a particular point of time or during a given time period. Therefore, it includes feelings regarding the unpredictable nature of events in one's life, the frequent irritations and various changes occurring in one's life as well as a person's confidence in his/her ability to deal with such stressful situations. Individuals exposed to similar life situations may experience different levels of stress, depending on their personality, coping strategies and support system. Perceived stress is, therefore, a reflection of an individuals' interaction with his/her environment and depends on the individuals' own perception.

The Perceived Stress Scale (PSS)⁽⁴⁾ was developed by Sheldon Cohen and his colleagues in 1983 to measure the

degree to which an individual regards events/situations in his/her life as stressful. Before the development of the PSS, the measurement of stress was primarily based on objective measures, such as the frequency of occurrence of specific stressors e.g. chronic illness, loss of a family member etc. This form of assessment, however, does not take into consideration the fact that the same stressor may be interpreted differently by different persons, resulting in a novel subjective experience for each individual. The PSS was developed by Cohen and his colleagues to add the subjective component to the assessment of stress. The original PSS consists of 14 items that are purported to form a unidimensional scale of global perceived stress. Although scores on the 14-item PSS tend to exhibit good reliability estimates across the literature, four of the items tend to perform poorly when evaluated using exploratory factor analysis.⁽⁵⁾ As a result, the PSS is commonly implemented using the 10-item form.⁽⁶⁾ Cohen et al. (1988) further reduced the PSS to a four item form for quick measurements; however, scores on the 4-item PSS tend to exhibit lower reliability estimates

than researchers would like. ⁽⁵⁾

The leukocytes, also called white blood cells, are the mobile units of the body's protective system. ⁽⁷⁾ Morphologically, there are five types of leucocytes in blood: Neutrophils, Eosinophils, Basophils, Lymphocytes and Monocytes. The first three types of cells, the polymorphonuclear cells, all have a granular appearance and for this reason are called granulocytes or, in clinical terminology, "polys" because of multiple nuclei. ⁽⁷⁾ Normally, human blood contains 4,000-11,000 white blood cells per microlitre. Of these, the granulocytes (Polymorphonuclear leucocytes, PMNs) are the most numerous. Young granulocytes have horse-shoe shaped nuclei that become multilobed as the cells grow older. Most of them contain neutrophilic granules (Neutrophils), but a few contain granules that stain with acidic dyes (Eosinophils) and some have basophilic granules (Basophils). The other two cell types found normally in peripheral blood are Lymphocytes, which have large, round nuclei and scanty cytoplasm, and Monocytes, which have abundant agranular cytoplasm and kidney-shaped nuclei. Of the total white blood cells, the normal percentages of the different types of leucocytes are as follows: Neutrophils (50-70%), Eosinophils (1-4%), Basophils (0.4%), Lymphocytes (20-40%) and Monocytes (2-8%). ⁽²⁾

Leucocyte profiles are altered by stress and can be directly related to stress hormone levels. Specifically, the changes brought on by stress are increase in the number of neutrophils (neutrophilia) and decrease in lymphocyte count (lymphopenia or lymphocytopenia). Moreover, since the number of neutrophils and lymphocytes are affected by stress in opposite directions, researchers have often considered the ratio of one to the other, that is, the relative proportion of neutrophils to lymphocytes (N:L ratio) in mammals as a composite measure of the stress response. This ratio, as read from standard blood smears made before and after a stressful event, is positively related to the magnitude of the stressor and to the circulating glucocorticoids. ⁽⁸⁾

Aims and Objectives

The present study was planned and carried out

with the aim to study the effect of perceived stress on the leucocyte profile of healthy, young adults. The study objectives were:

1. To assess the level of perceived stress of the study subjects
2. To determine the relation between the level of perceived stress and the relative percentages of the different leukocytes (neutrophils, eosinophils, basophils, lymphocytes and monocytes)
3. To determine the relation between the level of perceived stress and the Neutrophil : Lymphocyte (N:L) ratio

Materials and Methods

The study design was approved by the Institutional Ethical Committee, Gauhati Medical College, Guwahati. The study population consisted of the first year D.Pharm students attending classes in the department of Physiology, Gauhati Medical College. The study procedure and objectives of the study were explained to the students. Participation in the study was solely on a voluntary basis. Out of the 60 students, 37 students gave written informed consent to take part in the study giving a response rate of about 62%. The study was a cross-sectional observational study. The study tools were-

1. Perceived stress scale - used to measure perceived stress among students
2. Differential leukocyte count - to study the leukocyte profile of the students

PERCEIVED STRESS SCALE (PSS): The study participants completed the 10-item Perceived Stress Scale (PSS-10; Cohen and Williamson, 1988), which measured the degree to which the individuals perceived their daily life during the past month as stressful. PSS-10 consists of 10 questions, with responses varying from 0 to 4 for each item and ranging from Never, Almost never, Sometimes, Fairly often and Very often respectively, on the basis of occurrence during one month prior to the survey. The possible range of scores varies from 0-40. The score on the positive items (question no. 4,5,7,8) are reversed (e.g. 0=4, 1=3, 2=2, 3=1, 4=0) and then the

scores of all the ten items are added to yield a single score. Higher scores on the PSS-10 represent higher levels of perceived stress.

DIFFERENTIAL LEUCOCYTE COUNT (DLC):
It was performed by staining a peripheral blood smear with Leishman's stain and 100 leucocytes were counted using the oil immersion objective.

Results

The mean PSS score of the study participants was found to be 19.14 ± 6.36 . In response to how frequently they felt nervous or stressed during the last month, 36.84% (14 nos.) responded "Sometimes" and an equal percentage responded "Often/Always". (Table 1)

Table 1: Sample response frequencies for the 10-item PSS survey

Question	Never	Rarely	Sometimes	Often	Always
1. In the last month, how often have you been upset because of something that happened unexpectedly?	8	15	7	2	5
2. In the last month, how often have you felt that you were unable to control the important things in your life?	2	7	12	12	4
3. In the last month, how often have you felt nervous and "stressed"?	3	6	14	9	5
4. In the last month, how often have you felt confident about your ability to handle your personal problems?	0	2	7	11	17
5. In the last month, how often have you felt that things were going your way?	6	8	8	11	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?	3	8	9	13	4
7. In the last month, how often have you been able to control irritations in your life?	6	6	6	13	6
8. In the last month, how often have you felt that you were on top of things?	7	8	15	6	1
9. In the last month, how often have you been angered because of things that were outside of your control?	6	9	12	7	3
10. In the last month, how often have you felt difficulties were piling up so high that you could not overcome them?	9	8	10	6	4

Based on the PSS scores, the students were grouped as “Not stressed” (PSS score 1-10), “Mildly stressed” (PSS score 11-20), “Moderately stressed” (PSS score 21-30) and “Severely stressed” (PSS score 31-40). None of

the study participants had PSS score greater than 30. For each group of study participants, the average N:L ratio was calculated (Table 2). It was seen that the moderately stressed group had higher N:L ratio compared to the mildly stressed and not stressed groups.

Table 2: Mean PSS scores and N:L ratios of study population

PSS score	Classified as	Mean PSS	SD	No.	N:L ratio
1-10	Not stressed	9.67	0.58	3	1.47
11-20	Mild stress	15.63	3.34	19	1.62
21-30	Moderate stress	25.47	3.29	15	1.75

The Pearson correlation coefficient (r) was calculated to study the relation between the PSS score and the relative percentages of the different leukocytes as well as the N:L ratio (Table 3). A positive correlation was found between the PSS score and percentage of neutrophils, monocytes and N:L ratio. A negative correlation was found between PSS score and percentage of lymphocytes, eosinophils and basophils.

Table 3: Correlation between levels of perceived stress and leucocyte counts

Correlation between PSS and	Correlation coefficient (r)
Neutrophil percentage	0.36
Lymphocyte percentage	-0.32
Eosinophil percentage	-0.15
Monocyte percentage	0.21
Basophil percentage	-0.23
N:L ratio	0.38

Discussion

Various types of stressors may have an impact on the functioning of the different systems of the body. In relation to the hematopoietic system, changes that have been reported by previous studies include increase in the numbers of neutrophils and platelets and decrease in the numbers of lymphocytes, eosinophils and monocytes. Earlier studies have used examination as a stressor and

have compared the absolute count of leucocytes in the pre and post examination period. The present study, on the other hand, has measured the perceived stress level and correlated the PSS score with relative percentages of the different leucocytes.

Higher neutrophil count during or post-examination has been reported by Neena et al.⁽⁹⁾, Qureshi et al.⁽¹⁰⁾ as well as Mantur and Murthy.⁽¹¹⁾ Lower counts of

lymphocytes, eosinophils and basophils during or post-examination compared to pre-examination counts have been reported by Neena et al. ⁽⁹⁾ and Qureshi et al. ⁽¹⁰⁾ The findings of the present study are in conformity with those of the previous studies.

In relation to the monocyte count, Neena et al. ⁽⁹⁾ and Qureshi et al. ⁽¹⁰⁾ have reported that counts are lower during or post-examination whereas Mantur and Murthy ⁽¹¹⁾ found higher counts during examination stress. The present study found higher monocyte numbers in participants with higher levels of perceived stress; this finding conforms to that of Mantur and Murthy. ⁽¹¹⁾

Numerous studies have shown that stress and stress hormones induce significant changes in absolute number and relative proportions of leukocytes in blood. Dhabhar et al. ^(12,13) were the first to propose that stress induced changes in blood leukocyte distribution may represent an adaptive response. They suggested that acute stress induced changes in blood leukocyte number represent a redistribution of leukocytes from blood to other organs such as the skin and lining of gastrointestinal tract and the genito-urinary tract and draining sentinel lymph nodes. ⁽¹⁴⁾ They hypothesised that such a reduction may enhance immune function in those compartments to which immune cells travel during stress.

The catecholamines, epinephrine and norepinephrine, and adrenalglucocorticoid hormones have been identified as the major endocrine mediators of stress induced changes in leukocyte distribution. ⁽¹⁵⁻²⁰⁾ In response to glucocorticoids, circulating lymphocytes adhere to the endothelial cells that line the walls of the blood vessels and subsequently, undergo transmigration from the circulation into other tissues e.g. lymph nodes, spleen, bone marrow and skin, where they are sequestered. ⁽²¹⁻²³⁾ This exodus of lymphocytes from the blood causes a significant reduction in their circulating numbers. In contrast, glucocorticoids also stimulate an influx of neutrophils into the blood from the bone marrow and decrease the efflux of neutrophils from the blood to the other compartments. ⁽²⁴⁾ These changes are thought to ensure that the different types of cells are routed to where they are needed during the stress

response^(20,25) and result in an increase in N:L ratio that is proportional to the level of glucocorticoid release. Different types of stressors may affect the hematological parameters e.g. N:L ratio may increase after strenuous exercise in humans. ⁽²⁶⁾

Limitations of leucocyte profiles: The relative percentages of the different leukocytes can give us an idea regarding the amount of stress being experienced by an individual relative to others. However, the DLC only provides information regarding the percentages of WBCs currently in circulation; nothing can be said with much certainty about the number of neutrophils or lymphocytes that are being held in reserve in the other body compartments or how many of these cells would be released in response to a stressor. The results of DLC from a single smear, therefore, does not tell us much regarding an individuals' immune capacity. Performing the differential count on two separate occasions, one before and the second after a stressor event, can give us an idea regarding an individuals' ability to mount an immune response. ⁽⁸⁾

Also, there may be some confusion in differentiating leukocyte responses to stress from those due to inflammation or infection, as in both situations, leukocyte profiles show neutrophilia and lymphocytopenia. However, infections, in addition, cause increases in monocyte percentage, as they also help in phagocytosis of foreign particles ⁽²⁷⁻²⁹⁾ and general increases in total WBC count. ^(27,30-32) Further, according to Jain, ⁽²⁷⁾ reduction in relative eosinophil numbers is more likely to occur in response to stress rather than as a response to disease. Therefore, by taking into account the relative percentages of the different leukocytes and studying the leukocyte profile as a whole, we can differentiate the stress response from the effect of disease.

Limitations of study: The present study is a cross-sectional type of observational study. Only a single DLC smear was prepared and examined in a small number of subjects. Also serum Cortisol level was not estimated.

Conclusion

Several researchers have put forward the concept

of use of DLC parameters such as neutrophilia, lymphocytopenia or N:L ratio as an adjunct to the measurement of adrenal glucocorticoids, especially Cortisol, for studying the stress response. There is ample evidence which suggests that there is a close relationship between the responses of the leukocytes and the adrenal hormones to stress. Advantages of studying the leukocyte response by doing a DLC include low cost and ease of performing the test in a small laboratory with minimal infrastructure. Thus, studying the leukocyte profile by performing a differential leukocyte count can provide a reliable method to assess the stress response. ⁽⁸⁾In view of the limitations of the present study, a longitudinal study with more subjects and examination of DLC smears before and after a stressful event, followed by correlation with PSS scores, along with measurement of serum cortisol levels shall be more informative and helpful.

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A Comparative Study of Maximum Voluntary Ventilation in Overweight & Obese Adult Males

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Abstract

Introduction: Obesity is a global epidemic. It is characterized by excessive fat accumulation in the body, which affects multiple organs including the respiratory system by various mechanisms. The Prevalence and severity of obesity in young adults is increasing worldwide. The lung functions can be measured by spirometry. The Maximum Voluntary Ventilation test evaluates the respiratory endurance and is influenced by the lung and chest compliance, control of breathing and airway resistance.

Aim: The purpose of this study was to compare the Maximum Voluntary Ventilation parameter in obese, overweight and non-obese adult males and to evaluate the impact of obesity on MVV.

Methodology: A cross-sectional study was conducted among seventy-six adult males of Western Rajasthan in the age group ranging 18-25 years were performed on a spirometer, who were further divided into three groups based on Body Mass Index (criteria for Asian Indians) two groups based on WHR (waist-hip ratio). The observed data were statistically analyzed using ANOVA, Post-Hoc test and Linear Regression test.

Results: In our study, we found a significant reduction in MVV values in overweight and obese. The obese males had MVV (L/Min) of 68 ± 10.80 ; overweight males of 78.77 ± 17.93 whereas corresponding values in non-obese were 112.61 ± 19.42 . According to ANOVA, a highly-significant (HS) difference among the three groups ($p < 0.01$). The multiple regression method reveals a negative correlation with MVV which is highly-significant ($p < 0.01$).

Conclusion: Our study concluded that the impairment of Pulmonary Function is strongly associated with adult overweight and obese males. The reduction in BMI by reducing weight can reduce morbidity.

Keywords: MVV–Body Mass Index, Maximum Voluntary Ventilation, Pulmonary Function Tests, Spirometry.

Introduction

An increase in the prevalence of overweight and obese has been seen around the world. Obesity is a chronic disease characterized by excessive body fat that causes damage to the individual's health and is associated with comorbidities such as diabetes, hypertension and vascular dysfunction. Obesity may affect respiratory functions in a number of ways. In obese people, the presence of adipose tissue around the rib cage and abdomen and in the visceral cavity loads the chest wall and reduces pulmonary functions. Carbon-

dioxide production increases as a result of increased body weight. Obese subjects consume approximately 25% more oxygen than non-obese subjects at rest.¹

According to ICMR-INDIAB study 2015, prevalence rate of obesity and central obesity varies from 11.8% to 31.3% respectively. Obesity can cause deleterious effects on respiratory function such as alterations in respiratory mechanics, decrease in respiratory muscle strength and endurance, decrease in pulmonary gas exchange, lower control of breathing, limitations in pulmonary function tests and exercise capacity and impair health and quality

of life. Obesity may affect several body functions and therefore, lead to higher morbidity and mortality rates in the population. The MVV test evaluates the respiratory endurance and is influenced by the respiratory muscle strength, the lung and chest compliance, and the control of breathing and airway resistance. In the case of obese individuals this variable is reduced mainly by mechanical injury to the respiratory muscles, caused by the excessive weight on the thorax.²

Materials and Methods

The present study is an observational cross-sectional study that is conducted to compare pulmonary function tests of non-obese with the overweight and obese. The study was carried out in the Department of Physiology, Dr. S. N. Medical College, Jodhpur with a sample size of seventy-six male subjects (adult males 18-45 years). Institutional ethical clearance was obtained before the commencement of the study. An informed consent was taken from each subject during the study. The subjects were first given an explanation about the purpose and procedure of the experiment.

Inclusion Criteria

- **Males aged 18 to 45 years.**
- **Normal-weight with BMI 18.0-22.9 Kg/m².**
- **Overweight with BMI 23.0-24.9 Kg/m².**
- **Obese as a BMI ≥ 25 Kg/m².**

Exclusion Criteria

- **Smokers and tobacco chewers.**
- **Age below 18 years and above 45 years.**
- **The subjects with acute or chronic respiratory diseases, cardiovascular diseases and other major systemic illness.**
- **People working in mining industry.**

Detailed history including name, age, Anthropometric parameters, resting cardiovascular parameters were taken.

THE ANTHROPOMETRIC PARAMETERS

The following Anthropometric Parameters were measured in all 76 subjects: -

- **Weight** was measured the nearest to 0.1 Kg by weighing balance (Krup's Weighing Scale) after removal of shoes with light clothing only.
- **Height** was measured to the nearest 0.5cm against the wall without shoes using Stadiometer.
- **Body Mass Index** was calculated using Quetelet's equation.³

$$\text{BMI} = \text{Weight (Kg)} / \text{Height (m)}^2$$

Table-1: BMI Criteria for Asian Indians⁴

BMI (Kg/m ²)	STATUS
<18.0	Under weight
18.0 to 22.9	Normal weight
23 to 24.9	Over weight
≥ 25 and above	Obese

- **Waist Hip Ratio (WHR)** waist circumference was measured at the midpoint between the lower margin of the last palpable ribs and the top of the iliac crest, using a measuring tape (cm). Hip circumference was measured around the widest portion of the buttocks with the measuring tape and the individual stands with closed feet, arms at the side and body weight evenly distributed, and should wear light clothes. And this measurement was taken at the end of normal respiration.

$$\text{WHR} = \frac{\text{WC(cm)}}{\text{HC(cm)}}$$

Waist hip ratio for the males (Asian Indians) = >0.90 ⁵

For Pulmonary Function tests electronic spirometer (Spiro Excel PC/Laptop based spirometer, Medicaid Systems). This instrument is capable of giving highly accurate and reliable test results. It consists of an ergonomic handset with a digital turbine transducer which was connected directly to a PC/Laptop's USB

port. The test was carried out in a place convenient and comfortable for the subjects. Demonstration of tests were shown to subjects. The maximum voluntary ventilation (MVV) performed at least three times each, according to the standards of the American Thoracic Society with the subjects in the sitting position. Results were expressed as absolute values and as a percentage of the reference predicted values. The MVV was expressed in L/min. and as a percentage of the reference predicted values.

Statistical Analysis

Mean and standard deviation of maximum voluntary ventilation (MVV) of all the subjects were calculated by

Microsoft excel. The data was compared by One-way analysis of variance (ANOVA) in "Open Epi" software and Post Hoc test. The multiple regression analysis was performed by SSP software. The $p < 0.05$ was considered statistically significant.

Results

The average age, weight, height, BMI (body mass index) and WHR (waist hip ratio) of the subjects were as in Table -1. A total of seventy-six adult males were recruited and then classified on the basis of body mass index.

Table No.1: Mean Anthropometric Parameters

Parameters	Mean \pm SD		
	Control (N=33)	Overweight(N=11)	Obese (N=32)
Age (Years)	22.84 \pm 4.36	23.36 \pm 2.90	23.90 \pm 5.63
Weight (Kg)	65.03 \pm 3.84	69.45 \pm 5.69	91.21 \pm 18.92
Height (cm)	176.16 \pm 4.51	165.09 \pm 12.6	169.98 \pm 15.27
BMI (Kg/m ²)	20.96 \pm 1.08	23.8 \pm 0.51	29.80 \pm 3.54
Waist Hip Ratio	0.88 \pm 0.03	0.92 \pm 0.01	1.01 \pm 0.07

Table 2: Comparison of Maximum Voluntary Ventilation(L/min) between different BMI groups (ANOVA)

BMI	Maximum Voluntary Ventilation(L/min) (Mean \pm SD)	p-Value
Normal	112.61 \pm 19.42	<0.01(HS)
Overweight	78.77 \pm 17.93	
Obese	68.85 \pm 10.80	

Note: -HS = highly significant

Chart No.1: Comparison of Maximum Voluntary Ventilation(L/min) between different BMI groups (ANOVA)

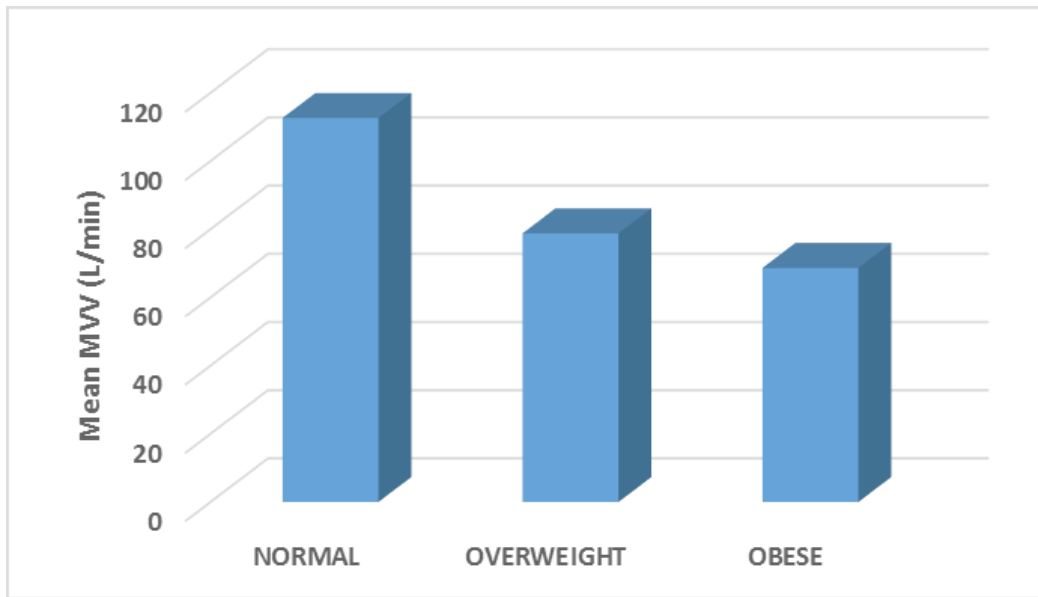


Table 2B: Comparison of Maximum Voluntary Ventilation(L/min) between different BMI groups (POST-HOC TEST)

BMI	p-Value
Normal v/s Overweight	<0.01(HS)
Normal v/s Obese	<0.01(HS)
Overweight v/s Obese	>0.05(NS)

Note: -HS = highly significant, NS = non-significant

Table 2, 2B & Chart 1 shows MVV values among different BMI groups. The one-way ANOVA demonstrated a statistically highly significant difference ($P < 0.01$).

Table No. 3: Correlation of Obesity and Waist-To-Hip Ratio with MVV-

PFT Parameters	BMI	WHR
MVV	-0.645**	-0.532**
%MVV	-0.549**	-0.425**

Note: -** = $p < 0.01$ (Highly Significant), * = $p < 0.05$ (Significant)

Table no. 3 is showing a correlation between MVV and obesity indices (BMI & WHR). Therefore, MVV is strongly correlated with obesity.

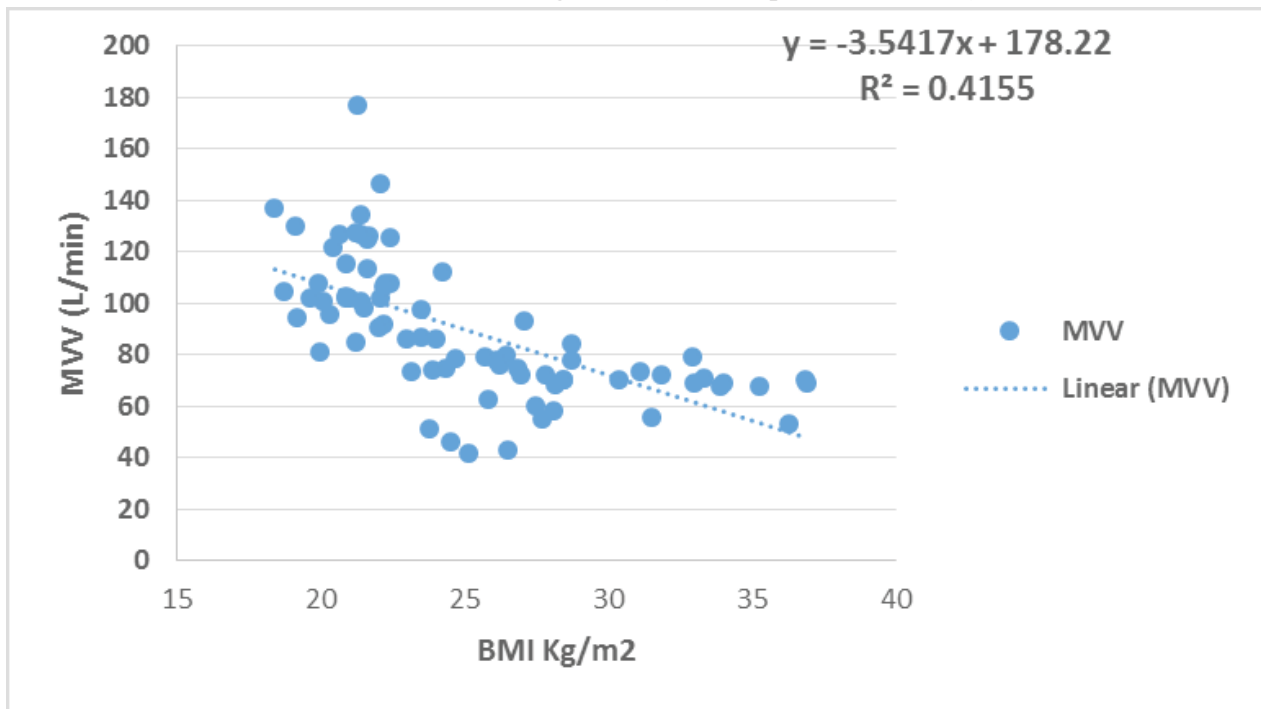
Table No. 4: Multiple Regression Analysis of Obesity and Waist-To-Hip Ratio with MVV-

PFT Parameter	BMI		WHR	
	Coefficient	p-value	Coefficient	p-value
MVV	-0.05	0.00**	-0.00	0.02**

Note: ** = p<0.01(Highly Significant)

In the table no. 4, the multiple regression method was applied to find the effect of BMI and WHR on maximum voluntary ventilation. It shows that BMI is negatively correlated with MVV and this relation is found to be highly significant (p<0.01).

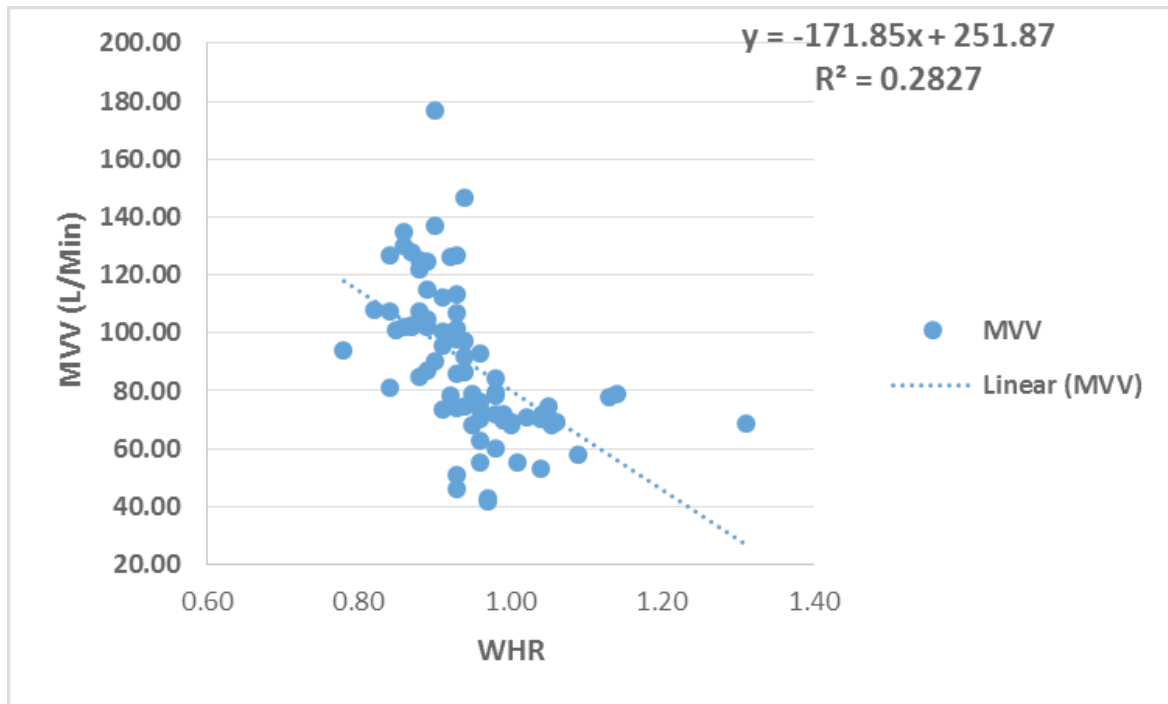
Chart No.2: Linear Regression (MVV dependent variable)-



Coefficient of determination (R squared) = 0.4155

The standard error of estimate = 178.22

Graph implies that the BMI is negatively correlated with maximum voluntary ventilation and this relation is found to be significant.

Chart No.3: Linear Regression (MVV dependent variable)-

Coefficient of determination (R squared) = 0.2827

The standard error of estimate = 251.87

Graph implies that the WHR is negatively correlated with maximum voluntary ventilation and this relation was found to be significant. Reduction in MVV in obesity is due to a direct mechanical effect on the distribution of body fat.⁸

Discussion

The prevalence and severity of obesity in adult males are dramatically increasing worldwide.⁶ Among the harmful effects of obesity to health, the respiratory changes represent an additional factor with functional

limitation and detriment to the quality of life of obese individuals. A significant finding of the study is decrease in the MVV in the overweight and obese group. The MVV test evaluates the respiratory endurance and is influenced by the respiratory muscle strength, the lung and chest compliance, and the control of breathing and airway resistance.⁹ It provides an overall assessment of the effort, coordination, and flow-resistive properties of the respiratory system. Similar results were obtained in the studies done by various authors as shown in table no. 5-

Table No.5: Comparison of present study with other studies

Studies ↓	Maximum Voluntary Ventilation (L/min)			p-value
	BMI (Mean ± SD)			
	Normal	Overweight	Obese	
Present study (2019)	112.61 ± 19.42	78.77 ± 17.93	68.85 ± 10.80	<0.01
Oona Mandal et al (2018)	114.29 ± 16.75	98.44 ± 14.77	98.97 ± 12.73	<0.01
Shah Bijal (2017)	80.89 ± 10.52	-	86.90 ± 9.84	<0.05
Ashwin Sorani et al	121 ± 32.16	117.8 ± 8.6	-	>0.05
Paralikar et al (2012)	148.96 ± 29.04	-	108.45 ± 22.6	<0.01
Costa et al (2008)	122.60 ± 19.80	-	108.50 ± 3.30	<0.01
Joshi et al (2008)	126.23 ± 24.08	115.30 ± 19.11	-	<0.05

The MVV values for Normal weight, Overweight and Obese are 112.61 ± 19.42, 78.77 ± 17.93, 68.85 ± 10.80 respectively.

On comparing the Normal, Overweight and Obese group, we found that there was a significant reduction in MVV with increasing BMI and statistically it comes out to be highly-significant (**p<0.01**).

In the present study, MVV was highest in normal weight and lowest in obese which is a result of air trapping that is inspiratory muscles are placed at a mechanical disadvantage which leads to lower inspiratory pressure and flows, and reduced respiratory muscle strength, causing a low MVV. Alternatively, in some obese patients, diaphragmatic muscle weakness

is due to excessive weight on the thorax which causes a decreased MVV. Also, this may reflect extrinsic mechanical compression on the lung and the thorax.⁷

MVV was found to be an important contributor to obesity indices (BMI & WHR) and was statistically significant (**p<0.01**). Similar results were observed by Oona Mandal et al (2018), Shah Bijal (2017)¹³, Ashwin Sorani et al¹¹, Paralikar et al (2012)¹⁰, Costa et al (2008), and Joshi et al (2008)¹².

Percentage of predicted Maximum Voluntary Ventilation

Table No.6: Comparison of present study with other studies

Studies ↓	% MVV			p-value
	BMI (Mean ± SD)			
	Normal	Overweight	Obese	
Present study (2019)	73.54 ± 12.74	53.56 ± 12.13	49.75 ± 8.39	<0.01
Shah Bijal et al (2017)	100.16 ± 12.83	-	112.40 ± 112.40	<0.05
Paralika et al (2012)	131.53 ± 0.00	-	95.07 ± 0.00	<0.01
Costa D et al (2008)	102.95 ± 13.32	-	97.70 ± 9.80	<0.01

On comparing the Normal, Overweight and Obese groups, we found a significant reduction in % MVV with increasing BMI which was statistically highly-significant (**p<0.01**).

In case of obese individuals, this variable is reduced mainly by mechanical injury to the respiratory muscles, caused by the excessive weight on the thorax.⁷

Conclusion

An observational study in young overweight and obese adult males showed that MVV values were significantly reduced. Hence, in this study, PFT parameter MVV showed statistically significant inverse relation with obesity. This indicates that obesity alters pulmonary functions which may give rise to long-term complications but these hazardous effects of obesity might be reversible and weight loss could improve lung functions.

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A cross-sectional Study of Metamemory in Obese South Indian Females

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Abstract

Introduction: Metamemory is the introspective knowledge of one's brain memory capability and process involved in memory self-monitoring. This self-awareness of memory has important implications for how people learn and use memories for everyday activities. **Aim:** The aim is to assess metamemory in female obese individuals. **Materials and Method:** A study was conducted among 165 female overweight and obese category at random south Indian population. The participants were asked to complete a self-reported questionnaire on metamemory. The Multifactorial Memory Questionnaire (MMQ) was developed to assess separate dimensions of memory ratings that are applicable to clinical assessment and intervention, includes scales of Contentment (i.e., affect regarding one's memory), Ability (i.e., self-appraisal of one's memory capabilities), and Strategy (i.e., reported frequency of memory strategy used). **Result:** Association between corresponding subscale scores and blood glucose which indicates a weak correlation between blood glucose, satisfaction ($r = -.008$) and strategy ($r = -.07$). In addition, the MMQ subscales and the total score showed good internal consistency ($\alpha = 0.82-0.85$). **Conclusion:** Obese and overweight female individuals had poor metamemory scores. The study would help the obese individuals to identify any early stage of cognitive impairment and create an awareness to delay or prevent any further metacognitive dysfunction.

Keywords: Metamemory, obese, dementia, Hippocampus

Introduction

Metamemory is defined individual's knowledge about functioning of memory in general than individual knowledge of their own memory. In this context metamemory is the introspective knowledge of one's brain memory capability and process involved in memory self-monitoring ^[1]. This self-awareness of memory has important implications for how people learn and use memories. For example, when a person asserts that he or she is good at remembering faces, but poor at remembering names, that person is making a statement concerning metamemory knowledge. Metamemory awareness refers to our feelings or experiences of our own memory. For example, if a person feels certain that he or she will remember later something just learned

now, that person is having a metamemory experience ^[2-5]. Metamemory is a subarea of Meta cognitions. Accordingly refers to people's self-monitoring and self-control of their own memory process and strategies that can aid memory. Due to a sedentary lifestyle, more and more people are becoming obese nowadays. In addition to health-related problems, obesity can also impair cognition and motor performance⁽⁶⁾.

Overweight and obesity are usually related to poorer cognition across lifespan ⁽⁷⁻⁹⁾. It is increasingly evident that obesity negatively impacts human health and the prevalence of obesity is increasing world-wide ^[10]. Both overall obesity (body mass index (BMI) >30 kg/m²) and fat distribution (waist-hip-ratio (WHR) >1.0 in men and >0.85 in women indicative of abdominal

fat accumulation) have been linked to cardiometabolic diseases and death in observational studies ⁽¹¹⁻¹⁴⁾. Compared to BMI, central adiposity has a stronger association with the risk of developing cognitive impairment and dementia in women ⁽¹⁵⁾. Therefore it is important to evaluate the state of metamemory in obese female individuals. This will not allow them to bring back their memory to full extent but it will at least be useful for them to look for alternatives to make sure they don't forget events happening every day. So, the state of metamemory in overweight or obese person will surely result in better understanding of the cognitive condition by the physicians. Therefore, the purpose of this study is to investigate and understand the relation between the decrease or increase in metamemory in obese female individuals.

Materials And Method

Ethical Consideration:

The study proposal was approved by the board of the Saveetha medical college and hospitals (IRB No. SMC/IEC/2020/03/028). The purpose and objective of the study was clearly explained to the participants through an information sheet. It was emphasized that their participation was optional and the confidentiality of data was assured. The participants were requested to sign a consent form attached with the questionnaire, to ensure their willingness to participate in the study.

Study setting and design:

This was a cross-sectional, descriptive correlational study. This standard questionnaire was done by 165 female obese individuals who volunteered to participate in this study. A convenience sample of participants from 19 to 55 years old female individuals was recruited from Medicine OP, Saveetha Hospitals. The questionnaire was administered through face-to-face contact by the investigator with potential participants. Potential participants who expressed interest in the study were screened for eligibility based on the inclusion/exclusion criteria. Inclusion criteria were as follows: ages from 19 to 55; BMI ranges between 30 to 40; ability to read, speak, and understand english. Participants with comorbidities

like diabetes mellitus, hypertension and hyperlipidemia were excluded. Individuals with cognitive impairment (Alzheimer's disease) were also excluded. After the inclusion/exclusion criteria were applied, 120 participants have received paper copies of the study's survey instrument. The questionnaire included about age, height and weight, hence BMI calculated $BMI = \text{Weight/Height in meter}^2$. The participant's BMI ranges are between 30 and 40. Individuals falling under obese I & II category were included.

Procedure:

Perceived memory:

The multifactorial memory questionnaire is a standard metamemory questionnaire (MMQ) which helps to assess a Metamemory of a person. It consists of three scales measuring separate aspects of metamemory. Items are rated on a 5-point Likert scale (0 = strongly agree, 1 = agree, 2= undecided, 3 = disagree, 4 = strongly disagree) based on the test's takers experiences. The three MMQ scales and their respective metamemory domains include: MMQ-Satisfaction (formerly called MMQ-Contentment). This scale measures satisfaction, concern, and overall appraisal of one's own memory. Each of 18 statements is rated based on degree of agreement. The score range is 0 to 72, with higher scores indicating a higher degree of satisfaction. MMQ-Ability. This scale measures self- perception of everyday memory ability. Respondents rate how often they experienced each of 20 common memory mistakes over the previous two weeks. The score range is 0 to 80, with higher scores indicating better self-reported memory ability. MMQ-Strategy. This scale measures the use of practical memory strategies and aids in day-to-day life. Respondents rate how often they used each of 19 memory strategies over the previous two weeks. The score range is 0 to 76, with higher scores indicating greater use of memory strategies. Based on questionnaire data total score ranges are measured. Using a method formula; $\text{Prorated Score} = \text{Number of possible items} \times (\text{Obtained score} / \text{Number of completed items})$.

Data Analysis

Statistical analysis was done using SPSS Version 25.0. Descriptive variables were reported (Mean with standard deviation, Percentage) for all demographic variables. Pearson's correlation analysis was used to assess correlations between BMI and the survey scores (Satisfaction, ability and strategy) and Cronbach's alpha was calculated to measure internal consistency among the individual scores ⁽¹⁶⁾. The significance level was set at 0.05.

Results

Among the 165 participants, the mean and SD for age, height & weight were calculated (Table 1). Mean and SD for blood glucose levels and MMQ Subscale scores (Satisfaction, ability and strategy) are given in Table 2. Age and BMI were correlated with MMQ subcomponents (Table 3). The internal consistency of

subscale scores are measured by cronbach's alpha to check the reliability. There was a weak negative relationship between age and MMQ subscales (Satisfaction, ability and strategy). This relationship suggests that in obese female individuals, increasing age is associated with decreased satisfaction, metamemory. Based on the MMQ subcomponent scores the study participants were found to have more worries about their memory (MMQ-contentment), report significantly more instances of forgetfulness (MMQ-ability), and use less memory aid strategies in their day-to-day activities (MMQ-strategy) (Table 2 & 3). BMI had a weak negative correlation with MMQ-contentment ($r = - .008$) or MMQ-ability ($r = - .03$) or MMQ-strategy ($r = .07$). In our evaluation with a sample of 165 middle-aged and older obese female individuals analyses using Cronbach's alpha indicated good internal consistency for the Satisfaction ($\alpha = .85$), Ability ($\alpha = .84$), and Strategy ($\alpha = .82$) scales (Table 3).

Table 1: Demographic characteristics of the participants

	Mean	SD	Range
Age (Yrs)	44.62	14.6	19 - 70
Height (Cms)	155.88	4.1	142 – 165
Weight (Kgs)	83.12	9.7	55 - 109

Table 2: Summary statistics for blood glucose levels and MMQ raw scores:

Scale	Mean	SD	SEM
BMI	34.51	3.6	0.47
Satisfaction	49.87	10.2	1.3
Ability	48.98	10.7	1.3
Strategy	49.44	10.3	1.4

Table 3: Correlations between demographic characteristics and cognitive variables & internal consistency of MMQ subscales

Scale	Age	BMI	Cronbach's α
Satisfaction	$r = - .14$	$r = - .008$.85
Ability	$r = - .17$	$r = - .03$.84
Strategy	$r = - .13$	$r = - .07$.82

Discussion

In the present study, Obesity in female obese individual adults showed a negative correlation on all the metacognitive components. When the BMI values were correlated with metamemory components it showed a weak negative correlation. Simply, the study has indicated that female with overweight and obese report more worries about their memory, more forgetfulness, and more use of strategies to ameliorate memory difficulties. Based on BMI data, individuals who are overweight or obese, fall in the lowest quartile of global cognition, verbal fluency, delayed recall, immediate logical memory, and intelligence⁽¹⁷⁾. Other than BMI, other adiposity measures are also related to cognitive performance and brain changes. Visceral adiposity is inversely correlated with verbal memory and attention. High visceral adiposity is associated with smaller hippocampus and larger ventricular volume⁽¹⁸⁾. There is also a negative correlation between waist-to-hip ratio and hippocampal volume and a positive correlation between waist-to-hip ratio and white matter hyperintensities⁽¹⁹⁾. Statistical parametric mapping has revealed a significant negative correlation between BMI and metabolic activity in prefrontal cortex (Brodmann areas 8, 9, 10, 11, 44) and cingulate gyrus (Brodmann area 32) but not in other regions⁽²⁰⁻²²⁾. These results further indicate the urgency of creating awareness on obesity in the society. A host of previous literature has suggested that exercise can improve both obesity-related cognitive and motor declines. As more and more people develop obesity in young age, introducing exercise

intervention early would result in the greatest benefits towards good health⁽⁶⁾.

Conclusion

Obesity has become a worrying health and social issue. The current study also has shown that obese and overweight individuals had poor metamemory scores. Obesity affects cognition mainly through altering the brain structures and functions and motor performance. The study would help the obese individuals to identify any early stage of cognitive impairment and create an awareness to delay or prevent any further metacognitive dysfunction. Regular physical activity and exercise benefits both cognition and motor behaviours.

Limitations:

The small sample size from a single area of the country also limits generalizability. The current study had taken individuals who were obese for past 2 years. BMI measurements were independent of the quantity of total body fat and a number of potential confounders, including age, puberty stage and household income. The study did not differentiate metamemory values between overweight and obesity. Physical activity was not measured. Future research is needed to investigate relationships between these metacognition variables, objective neuropsychological tests, and functional MRI imaging.

Conflict of Interest: No conflict of interest

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A Simple Model to Demonstrate the Critical Flicker Fusion Frequency Using Microsoft Office Powerpoint

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Abstract

Background: The critical flicker fusion frequency (CFF) is the frequency at which a flickering light is perceived as a continuous light. It is an index of visual temporal processing. It is affected in several disease conditions like hepatic encephalopathy, multiple sclerosis, age related macular degeneration and cataract. We wanted to demonstrate the phenomenon to undergraduate medical and health science students to help them understand the concept using a personal computer with Microsoft office power point suite.

Aim: The aim of the study was to demonstrate this concept of CFF using a personal computer with Microsoft office power point suite in small groups to undergraduate medical and health science students and to take a survey from the students regarding the demonstration and its outcome in understanding the concept of CFF.

Material and Methods: It is a cross sectional survey obtained from the medical, dental and allied health science students following the demonstration of CFF using the personal computer with Microsoft office power point suite in small groups.

Results: Our results have shown that the demonstration have helped 94% of the students in understanding the concept of the CFF. 91% of the students felt that the demonstration has helped them in reviewing the topic. 98% of the students felt that they would recommend the demonstration to future batches of the students. 86% of the students said that the demonstrations made the learning fun and exciting.

Conclusions: The demonstration of CFF using the Microsoft office power point suite have helped the students to understand the concept evoking interest and enthusiasm as they were able to relate the concept by demonstration and seeing it for themselves.

Keywords: Critical flicker fusion frequency (CFF), demonstration, power point

Introduction

Critical fusion frequency or critical flicker fusion frequency (CFF) is the frequency at which a flickering light is perceived as a continuous light. The CFF is used as an index for visual temporal processing. It depends

on the light source intensity, color of the light, mono or binocular vision, light-dark ratio of the stimulus, locus of stimuli on retina, degree of central fatigue of the subject and with age¹. The concept of CFF is taught to UG medical students while teaching visual processing. There are several models that are available to demonstrate the CFF². Most models available are expensive and may not be suitable for resource limited setting. Hence, we used a computer with Microsoft office power point suite to demonstrate CFF. It is well established that the concepts are learnt better when demonstrated, than with a lecture³.

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Materials and Methods

The demonstration was performed after clearance from the institutional ethical committee. To demonstrate the CFF we used a personal computer with 2016 Microsoft office power point suite. The animation window in the power point suite was used to demonstrate the CFF. The background of the slide was set to black color. A small circle was inserted in the middle of the slide. The size of the circle is formatted with height and width to be equal. For demonstration it was set at 0.51". It was formatted with white color fill and outline and is aligned at the middle and center. The animation with blink or pulse emphasis effect was enabled. In the animation pane the timing option was chosen with the following setting, the animation was set to start on click, with zero second delay, and the duration from 1s (1Hz) to 0.01s (100Hz). The animation was set to play until next click. The slideshow was then played to the students.

The animation was played at different frequencies ranging from 1Hz, 11Hz, 20Hz, 33Hz, 50Hz, and 100Hz. The blinking was appreciated by the students until the frequency of 33Hz, above which the image appeared

as a constant at higher blink frequency. The above demonstration can be done with different background color and for various color blink.

Results

To assess the usefulness of the demonstration students were asked to give an anonymous written feedback.

The feedback was completed by one hundred and forty students. The data collected is expressed as percentage of the total students who responded (see Table 1). 94 % of student opined that this demo helped them in understanding critical flicker-fusion frequency. 91 % percent of students felt that the demo helped them review the topic. 98% of the students responded that they would recommend this demonstration to future batches of students and 86 % of the students felt that this demonstration made their learning fun and exciting. They used words like “innovative” and “helpful” to describe the demonstration and no comments were negative.

Table 1 Consolidated survey of Feedback from the students

Question	Yes (%)	No (%)	Not sure (%)
My understanding of the CFF improved with this demo	94.3	0.7	5.0
The demonstration helped me review the topic	91.4	2.9	5.7
I would recommend such demonstration for future batches of students	98.6	0.0	1.4
Was learning exciting and fun with demonstration	86.4	4.3	9.3

Discussion

The brain processes the visual inputs in two domains, spatial and temporal. Spatial resolution is defined as the ability to discriminate two adjacent objects in space. Temporal resolution is defined as the ability to discriminate luminance change over time⁴. The temporal resolution is limited by the time required to collect and

process the visual input and it is finite. Intermittent stimuli presented to the eye will be perceived as distinct only when they are presented below a rate called as critical flicker-fusion frequency above which the stimuli will be perceived as a continuous stimulus. The CFF is affected by several physical factors such as intensity, color and size of the stimulus^{1,4}. It is also influenced by

the contrast, light condition and the age of the subject. The CFF is reduced in several medical conditions such as hepatic encephalopathy, multiple sclerosis, age related macular degeneration and cataract.

The CFF is very important concept which a medical graduate should understand. The demonstration has shown that the concept can easily be conveyed during the lecture using the simple animation available with the Microsoft office suite. The demonstration doesn't require a mat lab software which is commonly used for demonstration and research. The demonstration is suitable for a small group. It allows the students to interact with their peers and the demonstrator and have their concepts clear^{5,6}.

The demonstration can be completed in less than 15 minutes and is suitable for undergraduate medical, dental and health science students.

Conclusions

The model using the Microsoft office power point suite is suitable for demonstration of CFF. The demonstration is suitable for small group discussion and is most apt for resource limited setting. Our demonstration favors the students by enhancing their understanding of CFF by increasing the enthusiasm and interest in learning.

Limitations

Although the demonstration doesn't require any proprietary software like MATLAB, but it requires a Personal computer with dedicated graphic card and Microsoft office. The animation could be played clearly to demonstrate the CFF only if the screen refresh rate is 120Hz and a dedicated graphic card of at least one GB.

Conflicts of Interest: None

Ethical Clearance: Obtained from institutional ethical clearance committee of ESIC Medical College, Gulbarga

Funding: Self

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Association of Anaemia with Helicobacter Pylori in Adult Patients in a Tertiary Care Hospital

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Abstract

Helicobacter pylori has been established as a major cause of various gastro-intestinal diseases like chronic gastritis and peptic ulcers as well as various extra gastrointestinal diseases such as anaemia. The present cross-sectional study was done in the department of Medicine at G.S.V.M Medical College, Kanpur. A total of 194 adult patients attending outpatient department for various gastrointestinal symptoms were screened for Helicobacter pylori using Stool antigen card test. Out of these 194 patients, 98 were found positive for Helicobacter pylori by the test, giving a prevalence of 50.51%. A detailed proforma was filled regarding the age and sex of the patient, education and occupation of the head of the family, sanitary practices and dietary habits. The patients were also examined for pallor and their complete blood count was done. Out of total subjects 77 were found to be suffering from anaemia from which 48 were H. pylori positive (62.3%). A possible association can be established among patients suffering from H. Pylori infection and simultaneously diagnosed as anaemic.

Introduction

Helicobacter pylori, is a gram negative, curved, microphilic and motile organism. It is a common bacterium affecting about half the world's population [1]. There is substantial evidence that it causes chronic gastritis, peptic ulcers, and duodenal ulcers and is also involved in the development of gastric carcinoma [2-4]. Once acquired, Helicobacter pylori infection generally persists throughout life, unless treated by specific antimicrobial therapy.

Various socio-economic conditions comprising of high-density crowding, poor sanitary practices, family income, educational level, and occupation have been held responsible in spreading of the pathogen [5-7]

The present hospital-based cross-sectional study was done on patients attending OPD for various gastrointestinal disorders. Various parameters including age, sex, socioeconomic status, diet and pallor were taken into consideration.

Anaemia is the most common disorder of blood. It is characterized by decrease in number of red blood cells or less-than-normal quantity of hemoglobin in blood. Several studies have indicated an association between H.pylori gastritis and iron deficiency anaemia. Gastritis caused due to H.pylori results in decreased gastric acid secretion and increase in intra-gastric pH that may impair iron absorption. It has been seen that acid secretion returns to normal range after eradication of H. pylori [8,9].

Previous studies have shown that H. Pylori colonization of gastric mucosa may impair iron uptake and increase iron loss, potentially leading to iron deficiency anaemia.

Materials and Method

The study was conducted in the department of

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Medicine at GSVM Medical college, Kanpur. A total of 194 patients with both sexes attending OPD for various symptoms of gastrointestinal disorders were screened for *Helicobacter pylori*. Written informed consent was taken from all the patients after explaining to them the nature and purpose of study. Ethical clearance was taken prior to the study from the ethical committee. Patients who had taken proton pump inhibitors or antibiotic for a month prior to study were excluded. Patient's stools samples were collected in airtight containers and stool assay was performed using Immunocard STAT HpSA test. (Standard diagnostics Inc). Blood samples of all the patients were taken for complete blood count. Their haemoglobin in gram per cent was estimated and the was labelled as anaemic or non anaemic (as per WHO

grading of anaemia.)

Statistical Analysis

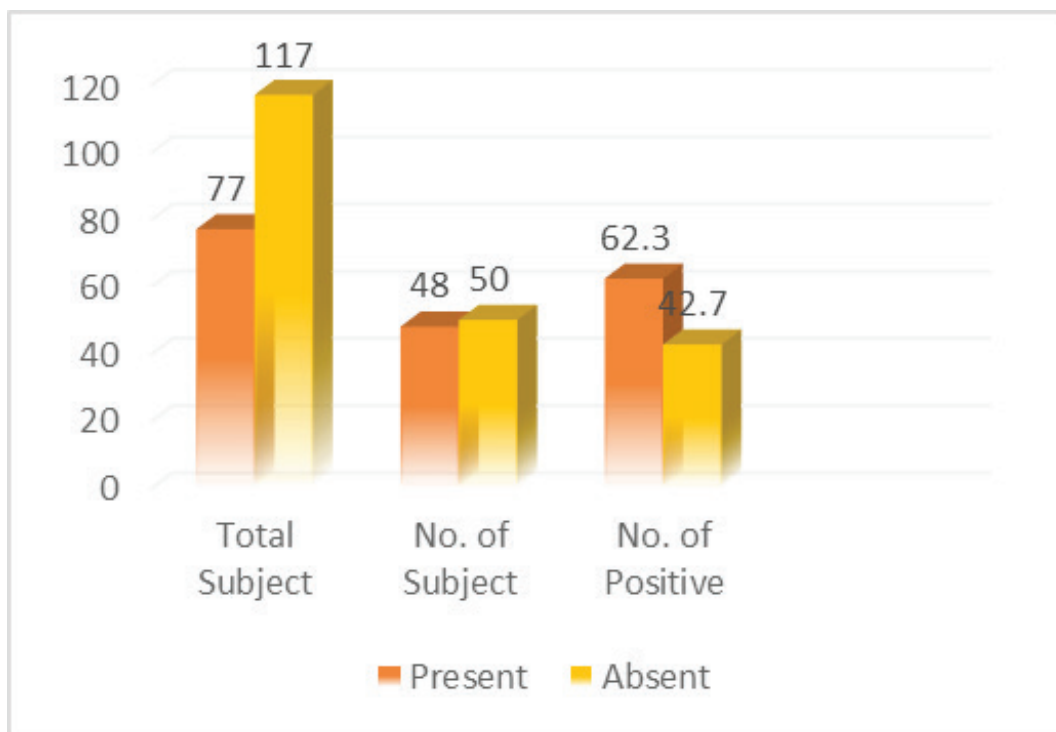
Data was analysed by Chi square test to compare the association between anaemia and *H. pylori* rates. A value of $p < 0.05$ was considered statistically significant. The calculations were done using the software package SPSS 16.0.

Results

Out of total 194 patients examined, 77 were having anaemia while the remaining 117 were non anaemic. Among the 77 anaemic patients 48 were positive for *H. pylori* (62.3%), which was statistically significant ($p < 0.05$).

TABLE 1- Number of *H. pylori* positive patients according to pallor

Pallor	Total subjects	No. of positive patients	Percentage %
Present	77	48	62.3 %
Absent	117	50	42.7 %



Discussion

In this study, 62.3% patients with anaemia were found to be positive for *H. pylori*. In a study by Kibru et al, estimated prevalence of IDA in *H. pylori* infected patients was 31%^[10]. Several cross-sectional surveys have been performed to determine whether there was an association between *H. pylori* infection and iron deficiency anemia. In a study conducted by Darvishi et al, ferritin levels were significantly lower in patients with *H. pylori* than in noninfected patients.^[11] In this study we found a positive association between anemia and *H. pylori* infection. Annibale et al reported that *H. pylori* associated chronic gastritis is the cause of refractory iron deficiency anemia in the absence of bleeding lesions in 18% of their patients.^[12] Gastric acidity and ascorbic acid are essential for iron absorption. Gastric acidity helps to maintain soluble form of Ferric Iron and thus increases its absorption. Several studies have demonstrated that *H. pylori* gastritis also causes hypochlorhydria^[13,14]. A prospective therapeutic study conducted by Mokhtar Mahfouz Shatla^[15] concluded that eradication of *H. pylori* infection along with simultaneous iron supplementations was associated with her faster and greater recovery from iron deficiency anemia as compared with eradication without iron supplement. However, *H. pylori* eradication without iron supplementations was also associated with significantly increased iron absorption and recovery from anemia. Some studies suggest that bacteria including *H. pylori*, contains a system of iron-repressible outer membrane proteins that may be involved in iron uptake as well as system for intracellular storage of iron that consists of ferritin like molecules Pfr and NapA^[16]. In a study by Berg et al^[17], *H. pylori* infection was found to be associated with a decrease in serum ferritin levels. A randomised, placebo controlled trial by Choe et al^[18] showed that eradication of *H. pylori* was associated with a substantial increase in hemoglobin levels. In another study by Huang et al^[19], it was shown that eradication therapy for *H. pylori* combined with iron administration is more affected than only iron therapy given for anaemia.

Although these studies support role of *H. pylori* in iron deficiency anemia, they do not prove that the organism is a cause of the anemia. Further trials are

needed with a sufficient number of subjects and long term follow up to establish any association between *H. pylori* and iron deficiency **anemia**. However it can be explained that a patient with refractory anaemia should be considered for assessment and treatment of *H. pylori*.

Conclusion

The present study concludes that there is a probable association between *H. pylori* and anaemia. Some studies have also reported that the rate of recovery is faster and greater if iron supplementation is given along with *H. pylori* eradication therapy. Hence, the clinicians might consider this while treating *H. pylori* in an anaemic patient.

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Conflict of Interest : Nil

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Cognition and Quality of Life in Patients with Type-2 Diabetes

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Abstract

The present study was undertaken to observe the cognition and quality of life in type-2 diabetic patients. The study included thirty type 2 diabetic patients and thirty age and gender matched healthy participants. The following criteria were used in the selection of cases. Spatial and verbal memory test was used to assess the cognition functions of the participants. Quality of life was assessed by using WHOQOL-BREF questionnaire which is standardized questionnaire by World Health Organization. There was significant decrease in the spatial memory scores in the diabetic participants when compared with healthy individuals ($P < 0.001$). Verbal memory scores in the cases were significantly lower in the diabetic participants when compared with healthy individuals ($P < 0.01$). The four domains of the quality of life that is physical health, psychological, social relationships and environmental scores were significantly lower in the diabetic participants when compared with healthy individuals ($P < 0.001$). There was a significant decrease in the cognitive functions and quality of life in the patients with type 2 diabetes when compared with healthy individuals. We recommend further detailed studies in this area to plan and develop better management methods for the benefit of diabetic population.

Key words: *Type-2 diabetes, cognition, quality of life*

Introduction

Diabetes results due to lack of insulin secretion or non-responsiveness of the receptors to insulin. The diabetic cases were increasing day by day and it was reported that India is going to become diabetic capital of the world. The metabolism of carbohydrate, protein and fat was altered in diabetes which results in long-term complications. Cognition is defined as “the mental action or process of acquiring knowledge and understanding through thought, experience, and the senses”.⁶ There was decrease in the memory, executive functions and decrease in the processing speed of information.^{1,2} It was evident that there is increase in the risk of cognitive

impairment and dementia in diabetic population.³⁻⁵ The quality of life was lower in diabetic patients when compared with healthy individuals.⁴ Vascular, metabolic, and psychosocial factors were reported to contribute the impairment of cognition in diabetes population. The prevalence of cognitive impairment is two times greater in diabetic individuals when compared to healthy individuals.⁷ It was reported that there was progressive decrease in the cognitive functions in diabetic patients.⁸ There was significant decline in the quality of life in diabetic population. All the components of quality of life were affected in diabetic patients.⁹ The present study was undertaken to observe the cognition and quality of life in type-2 diabetic patients.

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Materials and Methods

Study design: Case control study

Study participants: The study included thirty type 2 diabetic patients and thirty age and gender matched

healthy participants. The following criteria were used in the selection of cases.

Inclusion and exclusion criteria: Type 2 diabetic patients within 30 to 50 years of age and those willing to participate in study were included in the study. Those with any severe complications, those following any stress management methods or techniques and those not willing to not willing to participate were excluded from the study.

Assessment of cognition: Spatial and verbal memory test was used to assess the cognition functions of the participants.¹⁰

Assessment of quality of life: Quality of life was assessed by using WHOQOL-BREF questionnaire which is standardized questionnaire by World Health Organization.¹¹

Ethical Consideration: The study was approved by institutional ethical committee and informed consent

was obtained from all the participants after explaining the details of the study and ensuring the confidentiality.

Data Analysis

Data was analyzed by SPSS 20.0. Unpaired t test was used to observe the significance of difference between the groups. P value less than 0.05 was considered as significant.

Results

Results are presented in table no 1. There was significant decrease in the spatial memory scores in the diabetic participants when compared with healthy individuals ($P < 0.001$). Verbal memory scores in the cases were significantly lower in the diabetic participants when compared with healthy individuals ($P < 0.01$). The four domains of the quality of life that is physical health, psychological, social relationships and environmental scores were significantly lower in the diabetic participants when compared with healthy individuals ($P < 0.001$).

Table no 1: Comparison of cognition and quality of life in cases (diabetic participants) and control (healthy individuals).

Parameter	Cases	Controls	P value
Spatial memory	4±1.25	6±2.48	P=0.0002***
Verbal memory	3.52±2	5.48±3.17	P=0.0058**
Physical health score	45±10.33	64±14.28	P<0.0001***
Psychological score	41±12.72	66±11.44	P<0.0001***
Social relationships score	55±8.32	72±10.31	P<0.0001***
Environmental score	38±4.21	59±8.92	P<0.0001***

(*P<0.05 is significant, **P<0.01 is significant, ***P<0.001 is significant).

Discussion

The present study was aimed to observe the cognition and quality of life in type-2 diabetic patients. There was a significant decline in the spatial and verbal memory scores in the patients with diabetes when compared with

the healthy individuals. The overall quality of life also significantly deteriorated in the individuals with diabetes when compared with healthy individuals. Diabetes is a complex metabolic disease which affects almost all the systems of the body.¹² As it is well known that the diabetes affect mainly the memory and executive

functions of the cognition, there may be decrease in the both spatial and verbal memory. The cognitive decline in the diabetic population may be due to the vascular defects and lack of insulin or any defect in the transportation of glucose in the brain.¹³ Earlier studies reported that there was existence of cerebral vascular diseases in the patients with diabetes. Further there was clinical and sub-clinical infarctions were present in diabetic patients, which also contributes for impairment of memory.¹⁴ Interestingly, there was negative correlation between the duration of diabetes and memory status.^{15,16} Another study reported that the inflammatory cytokines produced in the diabetic patients are the key factors that reduce the memory and other cognitive functions.¹⁷ However, the increased blood glucose levels itself is enough to cause the vascular damage and leads to atrophy of brain and also damage of the neurons.^{18,19} It was also reported that the excessive glucose may trigger the formation of amyloid plaques.²⁰⁻²² The present study results are in accordance with earlier studies as we have observed significant decrease in the memory scores in the diabetic participants. Assessment of quality of life is a well-accepted measure in the bio-behavioral research. The assessment of quality of life gives information about the effect of illness on the patient. Decreased quality of life was observed in the patients with diabetes irrespective of duration and type.²³ The mean scores of quality of life was lower in diabetic patients when compared with non-diabetic individuals.^{24,25} The present study results are in accordance with earlier studies, as we have observed significant decrease in the quality of life in the diabetic patients.

Limitations: the sample size was less in the study and the study was conducted at one center. So the results cannot be generalized.

Conclusion

There was a significant decrease in the cognitive functions and quality of life in the patients with type 2 diabetes when compared with healthy individuals. We recommend further detailed studies in this area to plan and develop better management methods for the benefit of diabetic population.

Conflicts of Interest: None declared

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Sleep Quality and Day Time Sleepiness in Patients with Type-2 Diabetes

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Abstract

The present study was undertaken to observe the sleep quality and day time sleepiness in patients with type-2 diabetes. The study included thirty type 2 diabetic patients and thirty age and gender matched healthy participants. Pittsburgh Sleep Quality index (PSQI) was used to assess the sleep quality of the participants. Epworth sleepiness scale was used to assess the day time sleepiness. There was significantly lower sleep quality in the diabetic patients when compared with the healthy individuals ($P < 0.001$). There was significantly higher day time sleepiness in the diabetic patients when compared with the healthy individuals ($P < 0.001$). The study results suggest that there was a significant deterioration of sleep quality in diabetic individuals which is reflected in day time sleepiness scores as diabetic individuals have higher day time sleepiness. We recommend further detailed studies to understand the association and also to develop better treatment strategies for the benefit of population in general.

Key words: Sleep quality, day time sleepiness, Diabetes.

Introduction

Sleep can be defined as natural state of unconsciousness where some of the body functions are depressed and some are activated. Sleep is essential for maintenance of homeostasis. Though it was not clear why do we sleep, but it is an essential component for our survival. Deficiency of sleep has been linked with diabetes as an individual who does not have adequate sleep are at risk of developing the diabetes. The minimum recommended sleep for healthy life style was about seven hours without any interruption.¹ In the present day life style very less people are following his recommended sleep hours. This lack of sleep is intern linked with day time sleepiness, which affects the work and increases the stress and stress is a booster for development of diabetes. There is increase in the burden of diabetes worldwide and in India there is highly increase in the rate of diabetes people every year. According to the statistics released by the world health organization, approximately, three hundred and forty seven millions

of people affected by diabetes worldwide. Interestingly, out of these about ninety percentages of patients were having type 2 diabetes.²⁻⁴ It was reported that about one third of the diabetic patients are having history of insomnia.⁵ Disorders of sleep was reported to be correlated with insulin resistance in obese individuals.⁶ Further, the diabetic management is difficult in the individuals with sleep difficulties including day time sleepiness. The present study was undertaken to observe the sleep quality and day time sleepiness in patients with type-2 diabetes.

Materials and Methods

Study design: Case control study

Study participants: The study included thirty type 2 diabetic patients and thirty age and gender matched healthy participants. The following criteria were used in the selection of cases.

Inclusion and exclusion criteria: Type 2 diabetic patients within 30 to 50 years of age and those willing

to participate in study were included in the study. Those with any severe complications, those following any stress management methods or techniques and those not willing to participate were excluded from the study.

Assessment of sleep quality: Pittsburgh Sleep Quality index (PSQI) was used to assess the sleep quality of the participants.⁷

Assessment of day time sleepiness: Epworth sleepiness scale was used to assess the day time sleepiness.⁸

Ethical consideration: The study was approved

by institutional ethical committee and informed consent was obtained from all the participants after explaining the details of the study and ensuring the confidentiality.

Data analysis: Data was analyzed by SPSS 20.0. Unpaired t test was used to observe the significance of difference between the groups. P value less than 0.05 was considered as significant.

Results: The results are presented in table no 1. There was significantly lower sleep quality in the diabetic patients when compared with the healthy individuals ($P < 0.001$). There was significantly higher day time sleepiness in the diabetic patients when compared with the healthy individuals ($P < 0.001$).

Table no 1: Sleep quality and quality of life in cases (diabetic participants) and controls (healthy individuals).

*** $P < 0.05$ is significant, ** $P < 0.01$ is**

Parameter	Cases	Controls	P value
Sleep Quality (PSQI)	12±2.43	6±1.83	<0.0001***
Epworth Sleepiness score	15±3.28	8±1.74	<0.0001***

significant, * $P < 0.001$ is significant).**

Discussion

Sleep is an essential component of our life. We spent approximately half of our life in sleep. Lack of sleep is extremely dangerous and prolonged sleep deprivation leads to death. Hence, sleep affects multiple organ systems in our body. The study aimed to observe the sleep quality and day time sleepiness in patients with type-2 diabetes. There was significant decrease in the sleep quality and increase in the day time sleepiness in the diabetic individuals when compared with healthy individuals. Earlier researchers related the gamma-aminobutyric acid (GABA) as a link between the sleep and diabetes. It was reported that GABA also secreted by pancreas. Lack of sleep has negative impact on the release of GABA. This decrease in the GABA may affect the secretion of insulin and leads to diabetes mellitus.⁹⁻¹² The other chemical substance that can be linked between sleep and diabetes is orexins. Orexins

expression decreases in sleep deprivation and affects the metabolism which leads to diabetes.¹³ It was reported that the poor sleep quality and short duration sleep was associated with diabetes.^{14,15} It was reported that sleep deprivation and disturbed sleep tend to decrease glucose tolerance and compromise insulin sensitivity.¹⁶ Patients with T2D have high sleep disorder rate negatively impacting glycaemic control.¹⁷ It was reported that poor sleep is common in type 2 diabetes and may adversely impact quality of life.¹⁸ The present study results are in accordance with earlier studies as we have observed poor sleep quality in the patients with diabetes patients. This understanding between multiple factors and their association with diabetes help us to understand the disease and also to plan the management strategies effectively.

Conclusion

The study results suggest that there was a significant deterioration of sleep quality in diabetic individuals which is reflected in day time sleepiness scores as diabetic individuals have higher day time sleepiness. We recommend further detailed studies to understand the association and also to develop better treatment strategies for the benefit of population in general.

Conflicts of Interest: None declared

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