Original Article

VARIATION OF PEAK EXPIRATORY FLOW RATE WITH BODY MASS INDEX IN THE FIRST YEAR MALE MEDICAL STUDENTS OF VISWABHARATHI MEDICAL COLLEGE, KURNOOL

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ABSTRACT

Background: Obesity has become one of the major health issues in India. WHO defines obesity as "A condition with excessive fat accumulation in the body to the extent that the health and wellbeing are adversely affected". Obesity results from a complex interaction of genetic, behavioral, environmental and socioeconomic factors causing an imbalance in energy production and expenditure. Peak expiratory flow rate is the maximum rate of airflow that can be generated during forced expiratory maneuver starting from total lung capacity. The simplicity of the method is its main advantage. It is measured by using a standard Wright Peak Flow Meter or mini Wright Meter. The pulmonary disorders due to obesity results in increased mortality and morbidity. **Aim:** To study the effect of Body Mass Index on Peak Expiratory Flow Rate in Medical students. **Methods & Methods:** study was performed on 60 Male age group of 17-22 Years, categorized as normal Weight BMI= 18.5-24.99kg/m2 and overweight BMI= 25-29.99 Kg/m2. There were 30 students with normal Weight BMI and 30 students with overweight BMI. Normal weight BMI subjects acted as control group to compare the Peak Expiratory Flow Rate with over weight. The parameters studied were weight, height, age, body mass index and Peak expiratory flow rate. Student's unpaired t-test was used for two group's comparison. **Results**: The results of the investigation revealed a significantly lower Peak expiratory flow rate (PEFR) among the overweight BMI subjects compared to normal weight BMI subjects. **Conclusion:** Thus it is evident from the present study that obesity significantly affects the pulmonary functions which may give rise to long term complications and may lead to early morbidity and mortality.

Key words: Body Mass Index, Obesity, Peak Expiratory Flow Rate

INTRODUCTION

Overweight and obesity are defined as abnormal or excessive fat accumulation that may impair health. Worldwide obesity has nearly doubled since 1981 [1]. Obesity is a public health problem with increasing incidence and prevalence, high costs and poor outcomes as a disease, with defined Pathologic and pathophysiologic complications. [2]. Obesity a state of excess adipose tissue mass is becoming a global epidemic nowadays [3]. Now a days the problem of under nutrition is coming down, indeed the overweight, obesity and obesity related diseases have risen dramatically and are expected to continue to rise.[4] . PEFR is a good indicator of bronchial hyper responsiveness and good parameter for lung functions in obese as well as non-obese subjects [5].

Pulmonary functional status was assessed by recording peak expiratory flow rate (PEFR). PEFR was selected because it is widely accepted as a reliable parameter of pulmonary functions and is simple to perform as a bedside test. Hadorn introduced PEFR in 1942 and it was accepted as a parameter of pulmonary function test (PFT) in 1949 [6-9].

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The overweight and obese people are at high risk for developing many different co-morbidities and health conditions, including respiratory disease [10]. It happens because obesity stiffens the total respiratory system presumably due to its combined effects on lung and chest wall compliance leading to respiratory problems, such as breathlessness, specifically during exercise, even if they are devoid of any respiratory illness [11].

Obesity has been related to impaired pulmonary function. The truncal fat may compress the thoracic cavity and restrict the diaphragmatic movement resulting in reduced vertical diameter of the thoracic cavity [12]. These changes may reduce the compliance of the lungs and the thoracic cavity and increase the load on the respiratory muscles. This may end up with the reduction in lung volumes and flow rates, especially PEFR. There is relative paucity of literature about the status of PEFR in obese subjects in Kurnool District of Andhra Pradesh. Therefore, this study was undertaken to assess the Peak expiratory flow rate (PEFR) in normal weight male BMI subjects as well as overweight BMI Male subjects.

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MATERIALS AND METHODS

Study design: An observational analytical study

Ethics approval: The protocol of the study was approved by the Institutional Ethics Committee and the subjects, to be enrolled for the study, were informed about the study and procedure details and an informed consent was obtained.

Study location: Department of Physiology, Viswabharathi Medical College, Kurnool.

Study duration: April 2017 to July 2017

Inclusion criteria: To avoid age and gender bias Study was performed on 60 healthy, otherwise asymptomatic young male individuals in the age group of 17 to 22 years selected from first Year medical students of Viswabharathi Medical College, Kurnool.

Control: 30 normal weight BMI subjects (control)

Test: 30 overweight BMI subjects (cases) were assessed for Peak Expiratory Flow Rate.

Exclusion criteria: Exclusion criteria

1. Smokers and/or alcoholic.
2. Presence of any acute or chronic respiratory disorder.
3. Systemic illness which directly or indirectly affects the respiratory system.
4. Structural deformity of the thoracic cage.
5. Those who are doing yoga or any other kind of regular exercise.

Sample size: In each group 30 sample size and total 60 participants were included in the study

Methodology:

Anthropometrical measurements Age, Height and Weight & Body Mass Index were recorded along with the medical history and preliminary clinical examination to exclude any systemic disorder affecting respiratory system.

Anthropometric measurements: Standing height was recorded without shoes and with light clothes on a wall mounted measuring tape to the nearest of 0.1 centimeter. Weight was recorded without shoes and with light clothes on a Krups weighing machine with a least count of 100 grams. Body mass index was calculated by the formula, BMI=Weight (Kg)/Height (meter)2 . All the measurements were taken with clothes on without shoes, with the shoulders in relaxed position in the fasting state.

Peak Exploratory Flow Rate Procedure: The peak expiratory flow rate was determined as previously described (13,14) using Wright's peak flow meter. The subjects were asked to stand in an upright position with the Wrights peak flow meter held horizontally in front of their mouth and allowed to take a deep breath in, and closed the lips firmly around the mouthpiece, making sure that no air leaks around the lips. The subject was asked to breathe out as hard and as fast as possible and the around the lips. The subject was asked to breathe out as hard and as fast as possible and the number indicated by the cursor was noted and the sequence was repeated twice more, thus obtaining three readings. The highest or best reading of all three measurements was taken as the peak flow rate.

Statistical Analysis: the effect of body mass index on Peak Expiratory Flow Rate was compared in control (BMI18-25Kg/m2) & overweight (>25 Kg/m2) groups by the unpaired T test. Data were expressed as Mean±SD. Statistical significance was indicated by 'P' value <0.05.

RESULTS

A total of 60 Male Students, recruited for this study were divided into two groups based on their

BMI. The normal Weight BMI group (Control) comprised of 30 Individuals and Overweight BMI group comprised of 30 Individuals.

Table 1. Comparison of age & BMI among controls & overweight subjects

Table-I gives information about the age and BMI among normal weight BMI & overweight BMI individuals.. The

Parameter	Control (n=30)	Overweight (n=30)
AGE	18.06±1.04	18.86±1.22
BMI	21.43±1.22	28.15±2.30, P<0.05

Mean age of control was 18.06±1.04 and Mean age of overweight was 18.86±1.22. There was no much age difference between control and overweight subjects. The Mean BMI of control was 21.43±1.22 and the Mean BMI of overweight was 28.15±2.30. It can be noted that there is significant change of BMI among Control group and Overweight group.

Table 2. Comparison of PEFR among controls and overweight BMI subjects

	CONTROL BMI (18.5-24.99kg/m^2)	OVERWEIGHT BMI (25-29.99 Kg/m^2)	P VALUE
PEFR (Lit/Min)	437±40.8	385±45.54	<0.05

Table 2 gives information about the values of PEFR with their corresponding values of BMI respectively. . The Mean PEFR of control was 437±40.8 and The Mean PEFR of overweight was 385±45.54. It can be noted that there is significant decrease of PEFR with increased BMI.

DISCUSSION

The primary factors that affect PEFR are the strength of the expiratory muscles generating the force of contraction, the elastic recoil pressure of the lungs and the airway size.[15] Abdominal adiposity may influence pulmonary functions by restricting the descent of the diaphragm and limiting lung expansion as compared to overall adiposity which may compress the chest wall.. Similar findings were observed by Collins et al[16] who reported a lower FEV1 in subjects with higher WHR even without adjustment for age, stature and relative obesity. Chen et al[17] in a six-year follow-up study on patients with the extreme obesity (W/H >0.9) have reported that forced expiratory flow during mid expiratory phase was significantly reduced. King GG et also observed a strong relationship between body mass index and both lung volume and airway caliber in obese individuals which reflects that, with increasing body mass index, airways were narrower than expected on the basis of the reduction in lung volume, suggesting that there were structural or functional changes in the airways . In another study, Chen et al [18] showed a positive correlation between maximum mean expiratory flow (MMEF) and increasing BMI, that was significant in the middle age group of 40 to 69 years. The MMEF is generally regarded as “effort independent” and it may be that higher levels of BMI are associated with increased chest wall elastic recoil, and thus, with a change in the balance of elastic recoil [19].

In the present study, PEFR values for obese individuals were found to be lower than the nonobese individuals. The study by Chinn et al[20] on young adults found evidence of linearity in relation of slope to BMI. The “Slope” declined with increasing BMI in males, that is, bronchial hyper responsiveness increased. The statistical significance of the results was similar to our study. In the study conducted by Carey et al[21] on obese healthy subjects suggests that both total respiratory resistance and airway resistance increased significantly with the level of obesity, disclosing a significant linear relationship between airway conduction and functional residual capacity.

CONCLUSION

The lower values of PEFR could be linked to obesity through several mechanisms, such as mechanical effects on the diaphragm (impeding descent into the abdominal cavity) and also because of the fat deposition between the muscles and the ribs that can lead to increase in the metabolic demands and work-load of breathing.

Limitations: A larger sample size and a longitudinal study will definitely be of a great value in predicting the relationship between pulmonary function tests and obesity. Further, the association needs to be studied in female subjects.

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Conflict of interest : Nil

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