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Original Research Article

Comparison of Peak Expiratory Flow Rate (PEFR) in Obese and Non-Obese Individuals in Age Group of 18-25 Years

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ABSTRACT

Aim: To compare peak expiratory flow rate (PEFR) in obese and non-obese adult volunteers in age group of 18-25 years and to compare and correlate PEFR in obese with normal waist hip ratio and obese with abnormal waist hip ratio.
Method: The study group consisted of 76 healthy adult volunteers in age group of 18-25 years; of which 38 were obese(BMI≥30kg/m^2) and 38 were non-obese(BMI<30kg/m^2). BMI, WHR were calculated and PEFR was recorded with Wrights portable peak flow meter in litre/min. Data was analyzed using unpaired "t" test with p<0.05 was considered significant. Pearson's correlation test was used to find out correlation between PEFR and BMI.
Results: The study showed a strong negative correlation between BMI and PEFR in obese adult (p< 0.005, r=0.727). PEFR was significantly lower in obese compared to non-obese adults. There was a strong negative correlation of PEFR in both obese with normal WHR (p<0.005, r=-0.982) and obese with abnormal WHR (p<0.005, r=-0.996) But the negative correlation was more of PEFR to obese with abnormal WHR than obese with normal WHR.
Conclusion: Abdominal obesity may influence PEFR by restricting the force generated by expiratory muscles primarily the abdominal muscles. Therefore BMI as well as WHR should be considered to study effects of obesity on PEFR.

Keywords: Obesity, Peak expiratory flow rate, Body mass index, Waist - hip ratio.

INTRODUCTION

The World Health Organization (WHO) has declared obesity as a disease of pandemic significance. [1] Obesity (in adults) is defined by WHO as having a body mass index (BMI) greater than or equal to 30kg/m^2.The normal BMI range being between 18.5 to 24.99. [2] BMI values are age independent and are same for both sexes. Obesity has been linked with impaired pulmonary function and airway hyper responsiveness. [3,4] Excess body weight as in obese or overweight person is normally due to accumulation of extra body fat. [5] Weight and BMI as a measure of overall adiposity are used as predictors of pulmonary function in many epidemiological studies. While these measures are widely accepted as determinants of pulmonary function, waist hip ratio (WHR) and waist circumference (WC) are often used as a surrogate measures for abdominal or upper body obesity which may influence pulmonary function mechanically by changing compliance, work of breathing and elastic recoil of lungs. Therefore markers of obesity, such as BMI, waist circumference and waist hip ratio may be correlated to PEFR. [6,7] PEFR was selected because it is widely accepted as a reliable parameter of pulmonary functions and is simple to perform as a bed-side test. Hadorn introduced PEFR in 1942 and it was accepted as a parameter of pulmonary function test (PFT) in 1949. [8] Most of the studies regarding the effects of obesity on pulmonary function tests have been conducted in males, in the age group of 5 to 16 years or in the elderly age groups. But the age group of 16 to 25 years is the crucial adolescent age that is highly susceptible for obesity and surprisingly, this group was least targeted in such type of studies. [9,10] PEFR in the obese individuals should be lower, as the extra fat would exert a mechanical effect on the movement of chest or abdomen but predictability of different adiposity markers for deranged PEFR may vary across population. Therefore, the present study was undertaken to compare PEFR in obese and non-obese adult volunteers.

Aims:

1. To compare peak expiratory flow rate (PEFR) in obese and non-obese adult volunteers in age group of 18-25 years.
2. To compare and correlate peak expiratory flow rate in obese with normal waist hip ratio and obese with abnormal waist hip ratio.

MATERIALS AND METHODS

Study Design: Prospective Observational study.

Calculation of Sample size:

A Pilot study was conducted for calculation of sample size.

Sample size was calculated taking confidence level of 95% and confidence interval 10%.The sample size of 76 was obtained using "McCorr statistical Analysis Software".

Selection of subjects: The study was carried on 76 adults (age group of 18-25 years) fulfilling the inclusion criteria:

Inclusion criteria:

1. Healthy adults in age group of 18-25 years
2. Willing to actively participate in the study
3. Having a sedentary lifestyle

Exclusion criteria:

1. Subjects with history of bronchial asthma, COPD, tuberculosis and known cardiac and respiratory diseases.
2. Subjects with history of smoking, alcohol, severe chest trauma, obvious chest and spinal deformity.
3. Subjects who were chronically ill.
4. Subjects with history of any major surgery (cardiac, pulmonary, abdominal) related to study.
5. Subjects undergoing any physical conditioning program.
6. Subjects with history of active sports training.

Study procedure: The study was conducted in tertiary care teaching hospital with approval from the institutional ethics committee. The nature of the study was explained and informed written consent was obtained from each participant prior to participation in the study.

The health of the participants was assessed by noting their present, past, family and personal history and by a thorough general and systemic examination. The age, standing height and weight was measured by standard method. Body mass index (BMI) was calculated by formula Weight (in kg)/height in (meter). [2] Volunteers were divided into 2 groups depending upon their BMI.

Study group I (obese): Consisted of 38 volunteers having BMI≥30kg/m^2 as per WHO criteria.

Study group II (non-obese): Consisted of 38 volunteers having BMI, <30kg/m^2 as per WHO criteria.

Waist circumference (WC) and Hip circumference (HC) was measured and then Waist Hip ratio was calculated (WHR).

The PEFR was recorded with Wrights portable peak flow meter in litre/min according to standard procedure.

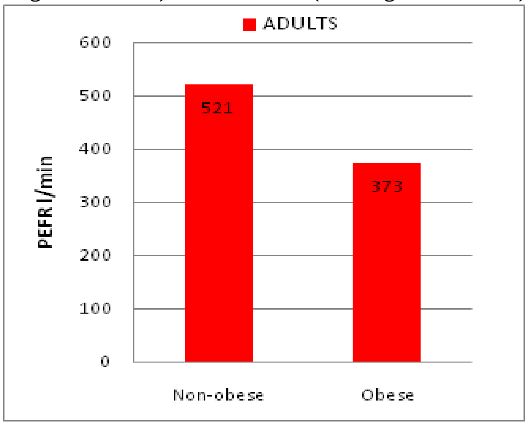
Statistical Analysis

1. Unpaired "t" test was performed to find the values of PEFR in obese and non-obese group. The value of $p<0.05$ was considered significant.
2. Pearson's correlation test was used to find out correlation between PEFR and BMI.

RESULTS

Table 1& Chart 1: Comparison of PEFR between obese (mean age=19.09±1.75) and Non-obese (mean age =19.40±1.79) adults.

	NO of Persons	PEFR (MEAN+_SD) (l/min)
Non-obese	38	521.32±52.72
Obese	38	372.89±53.92



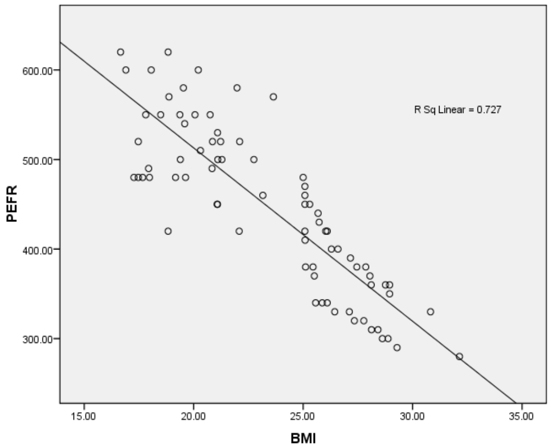


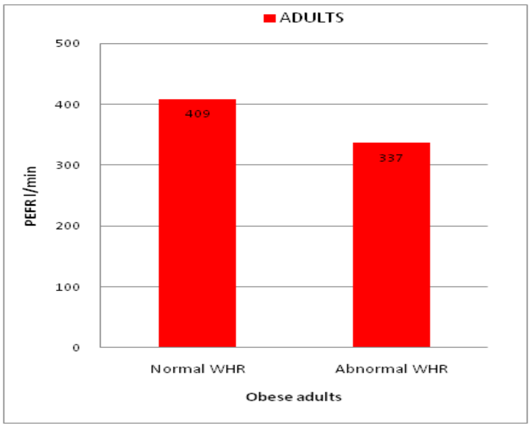
Chart 2: Scatter Plot showing relationship FPEFR and BMI.

r= -0.727

There is a strong negative correlation of PEFR with increasing BMI

Table 2 & Chart 3: Comparison of PEFR between obese with normal WHR and obese with abnormal WHR.

Obese	NO of Persons	PEFR (MEAN+_SD) (l/min)
Normal WHR	19	408.94±41.35
Abnormal WHR	19	336.84±39.02
	P value<0.005 *statistically significant	



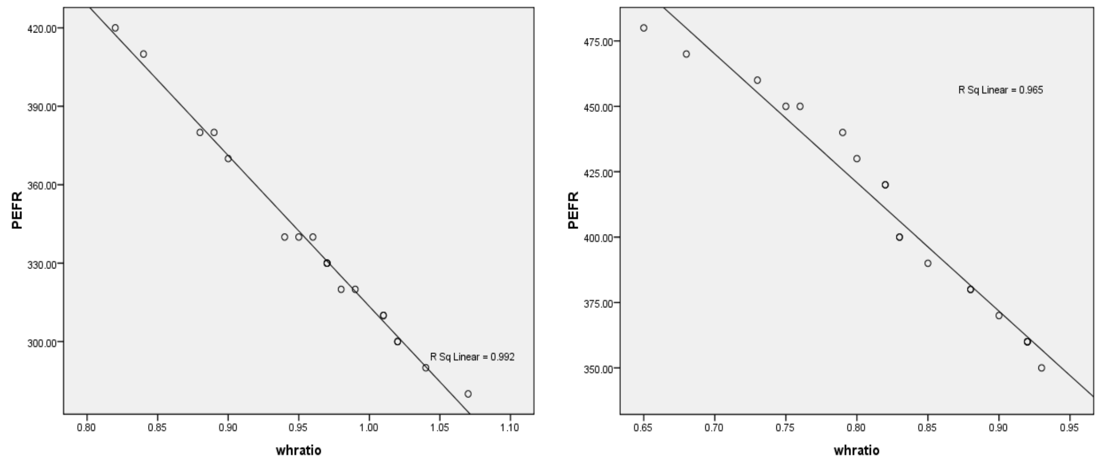


Chart 4 & Chart 5: Scatter Plot showing relationship of PEFR of obese with normal WHR and obese with abnormal WHR normal WHR and obese with abnormal WHR.

r= -0.982, r= -0.996

There is a strong negative correlation of PEFR in both obese with normal WHR and obese with abnormal WHR. But the Negative correlation is more of PEFR to obese with abnormal WHR than obese with normal WHR.

DISCUSSION

The primary factors that affect PEFR are the strength of the expiratory muscles producing the contraction, the recoil pressure of the lungs and the airway competency. The results of the present study showed that there is a strong negative correlation between BMI and PEFR in obese adults. According to Naimark A et al. the compliance of the lung and thoracic cavity was reduced to one third of the normal lung compliance due to obesity-induced increase in pulmonary blood volume and closure of dependent airways. The compliance of the thoracic cavity was decreased also because of excess truncal fat. [11] Jones et al also found that the reduction in PEFR is proportional to the increase in BMI. [12] 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. [13]

A strong negative correlation was also found in our study between BMI and PEFR in adults, more the BMI lesser the PEFR. As far as WHR and PEFR were concerned there is a strong negative correlation of PEFR in both obese with normal WHR and obese with abnormal WHR. But the Negative correlation is more of PEFR to obese with abnormal WHR than obese with normal WHR.

Yogesh Saxena et al, reported that obesity itself and body fat distribution have independent effects on PEFR. [14] Chen *et al* 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. [15] In contrast to our study, Lazarus *et al* [16] observed no effect of the central pattern of fat distribution (WHR) in the mean age 35.2±1.3 years. Lazarus et al and Collins et al also did not find any correlation between WHR and PEFR. [16,17]

CONCLUSION

The study concludes that abdominal obesity may influence PEFR by restricting the force generated by expiratory muscles primarily abdominal muscles. Therefore BMI as well as WHR should be considered to study the effects of abdominal obesity on

PEFR. Regular pulmonary function monitoring may be an important tool to assess the adverse effects of obesity. Proper and timely advice to the subjects will prevent unwanted complications.

Abbreviations: PEFR-Peak expiratory flow rate BMI-Body mass index WHR- waist hip ratio

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