Peak expiratory flow rate assessment in obese and non-obese subjects in western Uttar Pradesh

kumar D, Puri R, Sinha N, Hasan SN, Agarwal V, Mishra SB

ABSTRACT

Background: Prevalence of obesity is ever growing globally. Obese persons experience alterations in baseline pulmonary mechanics including airflow obstruction, decreased lung volumes and impaired gas exchange.
Aim: To assess peak expiratory flow rates (PEFR)in obese and non-obese subjects in western Uttar Pradesh.
Methods: One hundred and thirty four non-obese and eighty four obese persons in the age range of twenty to sixty years of both sexes were assessed for PEFR in the department of Physiology, LLRM Medical College, Meerut. Former acted as control group to compare the Peak expiratory flow rate (PEFR) with obese subjects. The parameters studied were weight, height, age, body mass index and Peak expiratory flow rate (PEFR).
Result: The results of the investigation revealed a significantly lower the Peak expiratory flow rate (PEFR) among the obese subjects compared to non-obese subjects
Conclusion: Regular pulmonary functions monitoring may be an important tool to assess the adverse effects of obesity.

Keywords: body mass index, spirometry, pulmonary function test, peak expiratory flow rate

INTRODUCTION

Obesity (in adults) is defined by World Health Organization (WHO) as having a body mass index (BMI) greater than or equal to 30 kg/m^2.The normal BMI range is between 18.5 to 24.99 kg /m^2.[1, 2] BMI values are age independent and the same for both sexes. Pulmonary function tests are useful in evaluation of respiratory health of a person. These tests measure airflow rates, lung volumes and the ability of lung to transfer gases across the alveolar capillary membrane. Physiological values of pulmonary function tests vary with age, sex, height, weight, body mass index, chest circumference and smoking habit. PEFR is a good indicator of bronchial hyper responsiveness and good parameter for lung functions in obese as well as non-obese subjects.[3] Obesity has been related to impaired pulmonary function. There is relative paucity of literature about the status of PEFR in obese subjects in Western Uttar Pradesh. Therefore, this study was undertaken to establish the relationship between PEFR and obesity in resident of Western Uttar Pradesh.

MATERIALS AND METHODS

Present study was conducted to assess the Peak expiratory flow rate (PEFR) in obese as well as non-obese subjects of both sexes for a period of one year. It was conducted in Department of Physiology, LLRM Medical College, Meerut, in collaboration with Department of Medicine of associated SVBP Hospital, Meerut.

134 non obese (control) and 84 obese (cases) subjects were assessed for respiratory evaluation. Prior institutional Ethical Committee approval was obtained. Only those people were included who do not have any respiratory tract infection or cardiac diseases and within age group of 20-60 years in both groups. Subjects with history of allergy, bronchial asthma, smoking, hypertension, diabetes, chest disease or deformity, any known endocrinal disorder, pregnancy and any cardio respiratory diseases were excluded from study. Preliminary and medical information was collected through help of a questionnaire. Written informed consent was obtained from all participants for Spirometric evaluation of lung functions by using Helios computerized spirometer.

ANTHROPOMETRIC MEASURMENTS: Height was measured to the nearest 0.1 cm using a free stediometer. The weight of the subject was measured to the nearest 100 grams using classical

weighing machine. The BMI was calculated as body weight in kilograms divided by the body height in meter square. (Quetelet's Index).

All the measurements were taken with clothes on without shoes, with the shoulders in relaxed position in the fasting state.

SPIROMETRIC ASSESSMENT

The PEFR was measured with advanced computerized Helios spirometer according to standard procedure. The subject was made to sit comfortably in a quiet room with optimum temperature during morning hours on a chair and asked to first take 3-4 normal breaths through the mouthpiece of spirometer, to make him familiarize with the instrument and asked to take slow and deep inspiration and then instructed to blow out forcefully and rapidly through the mouthpiece of spirometer followed by deep and rapid inspiration. At least three reading were noted and best of three was recorded.

Statistical Analysis

Tukey-test was used to find the significance of study parameters between two groups of subjects. Student t-test (unpaired t-test and two tailed) has been used to find the significant changes of studied parameters in obese and non-obese subjects. Collected data were statistically treated using the SPSS software.

RESULTS

Table 1 shows the age distribution in all age group. It exhibits that all subjects in both groups are having similar age and are comparable.

Table.1. Age distribution in non-obese and obese subjects

Age group (yr)	Non-obese (n=134)		Obese (n=84)	
	n	Mean ± SD	n	Mean ± SD
20 -30	60	21.77±1.89	30	22.93±2.49
31- 40	24	35.75±3.25	22	35.55±3.42
41-50	22	45.27±2.10	20	45.00±2.83
51-60	28	55.71±2.23	12	54.50±3.56
Mean ± SD	134	35.22±13.90	84	36.00±11.86

Table.2. Height distribution in non-obese and obese subjects

Height (cm)	Non-obese (n=134)		Obese (n=84)	
	n	Mean ± SD	n	Mean ± SD
< 160	34	153.47±4.89	52	152.31±2.80
161 - 170	54	165.63±2.82	28	166.29±2.73
>170	46	176.61±3.73	04	174.50±0.71
Mean ± SD	134	166.31±9.65	84	158.02±8.03

The mean heights of all subjects are matching and comparable. The mean weight of obese subjects is significantly more than non obese individuals and it is one of the basis of case selection in the present study.

Table.3. Body mass index (wt/ht^2) in non-obese and obese subjects

BMI(Kg/m2)	BMI in Non-obese (n=134)		BMI in Obese (n=84)		Total
	n	Mean ± SD	n	Mean ± SD	
< 20.00	22	19.00±0.74	00	--	22
20.01- 30.00	112	23.89±2.33	04	--	116
30.01- 40.00	00	--	66	32.97±2.37	66
> 40.00	00	--	14	47.44±2.37	14
Mean ± SD	134	23.09±2.82	84	35.38±5.95	218

Table.3. gives an idea of BMI of the two studied groups, the BMI of latter is within normal range as compared to that of obese group. Fourteen subjects were severely obese.

Table.4. Mean ± SD of peak end expiratory flow rate PEFR (l/sec) in non-obese and obese subjects

Age group (yr)	PEFR in Non-obese (n=134)		PEFR in obese (n=84)		P value
	n	Mean ± SD	n	Mean ± SD	
20 - 30	60	7.53±1.46	30	6.01±1.36	0.0016*
31-40	24	6.71±1.24	22	6.68±1.98	0.9693
41-50	22	6.46±1.67	20	5.05±1.34	0.0482*
51-60	28	5.75±2.00	12	4.87±0.60	0.3102
Total	134	6.84±1.70	84	5.79±1.59	0.0019*

It shows that the average PEFR values are lower in obese subjects of all age groups with variable significance levels. But the overall values of PEFR are significantly lower in obese people as compared to non obese ones.

DISCUSSION

Obesity is a chronic disease that can affect every

organ system in the body. Obesity is not simply the consequence of excessive calorie consumption and inadequate physical activity. The occurrence of obesity is determined by many factors, including genetic, metabolism, behavior, life style, environment, culture, and socioeconomic status.

Central obesity may affect pulmonary functions by hampering the descent of the diaphragm and limiting the lung expansion. PEFR is affected by the strength of the expiratory muscles which generates the force of contraction and elastic recoil pressure of the lungs and the airway size.[4] The lung function tests including PEFR are influenced by various factors such as age, body size, physical activity, environmental condition and ethnicity etc.[5]

The mean weight and BMI in obese subjects of both sexes was significantly greater as expected and there was significant reduction (15%) in PEFR in obese subjects as compared to non obese ones. The fall in PEFR was found to be 13% in young obese but gradually increased to 29% in elderly obese people. Anuradha et al observed the correlation of pulmonary functions with body fat percentage in young individuals. In male's body fat % showed negative correlation with peak expiratory flow rate.[6] But in females body fat percentage had negative correlation with ERV, FVC and MVV only and not with PEFR. These results indicate that increase in percentage of body fat and central pattern of fat distribution may affect the pulmonary function tests in both sexes.

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.[7] Dhungel KU et al showed the PEFR values of Nepalese males of the present study are found to be higher as compared to their female counterparts.[8] Farida M.El-Baz et al observed the obese children had statistically significant higher rate of chest symptoms suggestive of bronchial asthma than the control group.[9] BMI had significant negative correlation with FVC, FEV1, PEF max, flow rates (FEF25 %, FEF50 %, and FEF25-75 %) and MVV.

Lazarus et al showed no effect of centripetal obesity of fat distribution in younger age groups. Rather, upper body subcutaneous fat was significantly associated with the flow rate[10] however; Heather MD et al suggested that abdominal adiposity is a better predictor of pulmonary function than weight or BMI. In addition, another author found the pattern of body fat distribution have independent effect on PEFR and waist-hip ratio was a better predictor of expiratory flow than weight or BMI.[11]

The findings of present study are comparable with major number of work mentioned above. Therefore, the significant greater reduction in PEFR may be attributed to more numbers of obese subjects in the present work.

CONCLUSION

Respiratory functions demonstrate declining tendency with age in both groups however the Peak end expiratory flow rate was more reduced in obese subjects. Obesity and aging appears to be important contributing factors to cause patho-physiologic changes responsible for altered lung functions. 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 in them.

AUTHOR NOTE

Durgesh kumar, Assistant Professor
(Corresponding author) Rama Medical College and Research Institute, Kanpur;
email: drdurgeshgautam@gmail.com
Rajeev Puri, Assistant Professor, SN Medical College, Agra
Nitesh Sinha, Assistant Professor, L.P.S. Institute of Cardiology, Kanpur
Syed Neyaz Hasan, Assistant Professor, Muzaffarnagar Medical College, Muzaffarnagar
Vinay Agarwal, Professor, L.L.R.M. Medical College,Meerut
S B Mishra, Professor, Rama Medical College and Research Institute, Kanpur

REFERENCES

1. Obesity: Preventing and managing the global epidemics. Report of a WHO consultation. World Health Organ Tech Rep Ser 2000; 894: 1-253.
2. WHO. Tech Rep. 1995; 854.
3. Chinn S, Jarvis D, Burney P. Relation of bronchial responsiveness to body mass index in the ECRHS. *Thorax* 2002; 57:1028-33.
4. William F Ganong. Review of Medical Physiology.21st edition; 655.
5. Vijayan VK, Kuppurao KV, Venkatesan P, Sankaran K, Prabhakar R. Pulmonary function in healthy young adult Indian in Madras. *Thorax* 1990; 45: 611-5.
6. Anuradha RJ, Ratan Singh and A.R. Joshi.Correlation of pulmonary function tests with body fat percentage in young individuals. *IJPP*.2008; 52(4): 383-388.
7. King GG, Brown NJ, Diba C, et al. The effects of body weight on airway caliber. *Eur Respir Journals*. 2005; 25: 896-901.
8. Dhungel KU, Parthasarathy D, Dipali S. Peak expiratory flow rate of Nepalese children and young adults. *Kathmandu University Medical Journal* (2008), Vol. 6, No. 3, Issue 23, 346-354.
9. Farida M. El-Baz, Eman A. Abdelaziz, Amal A Abdelaziz,Terez B. Kamel, Aza Fahmy. Impact of obesity and body fat distribution on pulmonary function of Egyptian children. *Egyptian Journal of Bronchology.*2009;; 3:1.
10. Lazarus R, Sparrow D and Weiss ST. Effect of obesity and fat distribution, the normative aging study. *Chest* 1997; 111: 891-898.
11. Yogesh Saxena, Brijesh Purwar and Rashi Upmanyu. Adiposity: Determinant of peak expiratory flow rate in young Indian adults male. *Indian J Chest Dis Allied Sci.* 2011; 53:29-33.