Original research article

Study of Peak Expiratory Flow Rate in Underweight and Overweight Young Adults.

[1*]Dr S Priyanka, [2] Dr G N Shashirekha, [3] Dr J Raja Kattaiah

[*1]Assistant Professor, Department of Physiology, Government Medical College, Siddipet, Telangana.

[2] Associate Professor, Department of Physiology, Government Medical College, Siddipet, Telangana.

[3]Civil Assistant Surgeon, Community Health Centre, Gudur, Mahabubabad, Telangana.

Corresponding author : Dr S Priyanka
Email : drspriyanka.05@gmail.com

Abstract
Peak expiratory flow rate (PEFR) gives the measure of maximal expiratory flow rate sustained by a subject for at least 10 milliseconds expressed in Liter per minute. It measures the level of airway obstruction. PEFR varies in an individual according to the age, sex and anthropometric variables. The present study was undertaken to assesses and correlate the Body mass index and Peak expiratory flow rate in overweight and underweight male and female young adult subjects. A total number of 40 healthy young adults aged between 18-26 years were included in this study. PEFR was measured in standing position. BMI was calculated. PEFR values were low in females as compared to male subjects and it was highly significant. PEFR values were less in low BMI and overweight subjects as compared to normal BMI subjects and it was highly significant. PEFR was low in these subjects as compared to subjects having normal BMI. Early identification of risk individuals prior to onset of disease is imperative in our developing country. It is necessary to have a good physical activity and proper nutrition in young adults to avoid future respiratory problems.
Key words : Peak expiratory flow rate (PEFR), Body mass Index (BMI) , Young adults

Introduction

Peak expiratory flow rate (PEFR) gives the measure of maximal expiratory flow rate sustained by a subject for at least 10 milliseconds expressed in Liter per minute. It is used for assessment and management of asthma control as it measures the level of airway obstruction[1]. PEFR varies in an individual according to the age, sex and anthropometric variables[2]. According to Seo. WH et al, PEFR increases with increasing height showing a positive correlation with R2 of 0.81 in boys and 0.76 in girls. The same study has also shown that PEFR is positively correlated with body surface area, weight and age[3]. Increasing body mass index (BMI) above the normal range for age puts children at increased risk of respiratory symptoms, such as breathlessness, particularly during exercise, even if they have no obvious respiratory illness[4]. On contrary, malnutrition (BMI below the normal range for age) is also associated with impairment of PEFR perhaps because of slow growth of the larger airways [5]. The present

study was undertaken to assesses and correlate the Body mass index and pulmonary functional status in overweight and underweight male and female young adult subjects. Pulmonary functional status was assessed by recording peak expiratory flow rate (PEFR).[6] 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 [7-9]. The truncal fat may compress the thoracic cavity and restrict the diaphragmatic movement resulting in reduced vertical diameter of the thoracic cavity [10]. 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 [11].

Material and Methods

A total number of 40 healthy young adults aged between 18-26 years were included in this study. 20 were males and 20 females. They are nonsmokers and have no history of regular physical training, sports activity or respiratory diseases like, Bronchitis, Pneumonia, tuberculosis and Asthma during last three years. None of the subjects had cough, wheeze, dyspnoea or nasal congestion at the time of study. An informed verbal consent was obtained prior to participation in the study. Anthropometric measurements such as; Weight, Height, BMI of each subjects were recorded. PEFR was measured in standing position with standard range Pocket Peak flow meter. The subjects were instructed to take maximum inspiration and blow into the mouthpiece as rapidly, forcefully and completely as possible. They were trained well to blow into the instrument maintaining a tight sealing between the lips and mouthpiece of the peak flow meter. Standing height was recorded without shoes, with light clothes on a wall by measuring tape. Weight was recorded without shoes and with light clothes on a weighing machine. Body mass index was calculated a BMI=weight in kg / height in m^2. Subjects were classified into 3 groups as per WHO recommendation depending upon BMI as follows:
Under weight : < 18.5 (kg/ m2)
Normal weight : BMI = 18.5 – 24.9 (kg/ m2)
Over weight : BMI = 25.0 – 29.99(kg/ m2

Statistical analysis

Statistical analysis was done using SPSS and MS Office excel 2007. Variables analysed were age, height , weight , BMI and PEFR. Mean and standard deviation was calculated. P values were calculated for correlation of BMI with PEFR in male and female subjects.

Results

Table 1: Age, Weight,Height in male and female adults

Parameters	Males n = 20 Mean ± SD	Females n =20 Mean ± SD
Age (Years)	22 ± 4	21 ± 2
Weight (Kg)	62.4 ± 8.6	50.2 ± 3.4
Height (Cm)	150.6 ± 6.8	140.4 ± 8.2

Table 1 shows age, weight , height of male and female subjects . Female subjects has all values less as compared to males.

Table 2: BMI and PEFR values in male and female adults

BMI	PEFR (L/min) Males Mean ± SD	PEFR (L/min) Females Mean ± SD	P value
Low < 18.5 kg/m^2	398 ± 34	300 ± 18	< 0.001
Normal 18.5-24.9 kg/m^2	490 ± 48	360 ± 38	<0.001
Overweight 25-29.9 kg/m^2	450 ± 36	320 ± 26	<0.001

P <0.001 Highly significant.

Table 2 shows PEFR values were low in females as compared to male subjects and it was highly significant. PEFR values were less in low BMI and overweight subjects as compared to normal BMI subjects and it was highly significant. PEFR values were comparatively higher in overweight subjects as compared to low BMI subjects.

Discussion

The significant reduction in PEFR in overweight subjects may be explained on the basis of mass load of adipose tissue around the rib cage, abdomen and in the visceral cavity that results in a shift in the balance of inflationary and deflationary pressure on the lungs as reported by J.T. Sharp et al [12].These obese subjects may also have limited lung expansion and air flow because of the restricted downward movement of the diaphragm due to increase abdominal adipose tissue leading to significantly reduced PEFR [13].

The primary factors that affect lung function parameters are the strength of expiratory muscles generating the force of contraction, elastic recoil. Pressure of lungs and the airway size [14]. Lung function may vary due to age, gender, height, weight [15]. The study of T. J. Ong showed that malnourished children were found to have low lung function parameters [16]. M. M. Faridi, Pratibha Gupta and co-workers showed that lung function reduces in undernourished young individuals [17]. This difference is probably due to differences in body composition of underweight and normal weight young individuals. Lower body fat in underweight as compared to normal weight may be responsible for lower PEFR values in underweight. The principal factor that affects PEFR is airway diameter primarily under the control of bronchial tone. Other factors that affect PEFR are the strength of expiratory muscles and elastic recoil of lungs. There is a relationship between height, weight, chest circumferences with PEFR. PEFR is an important diagnostic and prognostic tool of lung functions which predicts variations in airflow. PEFR was low in these subjects as compared to subjects having normal BMI. Early identification of risk individuals prior to onset of disease is imperative in our developing country. It is necessary to have a good physical activity and proper nutrition in young adults to avoid future respiratory problems.

Conclusion

In this study, we found low PEFR in both over weight and under weight subjects in comparison to normal subjects. This signified that with increase in BMI, there was decrease in PEFR. Previous studies shown low PEFR in obese subjects, but in this study, we found low PEFR both in over weight and under weight subjects both in male and female.

References

1. Mrindha M, Amin M, Kabir A. Peak Expiratory Flow Rate (PEFR)-A Simple Ventilatory Lung Function Test. JSSMC. Oct 2012 ;3(2):44-7[DOI]
2. Philips N, Krucik G. Peak Expiratory Flow Rate [Internet]. 2012 July 20. Available from:

http:// www.healthline.com/health/peak-expiratory-flowrate#overview[DOI]
3. Seo WH, Ahn SH, Park SH, Kim J, Ahn KM, Ko BJ et al. The standard range of peak expiratory flow rates of Korean children. Asian Pac J Allergy Immunol. 2011 Jun;29(2):143-9.[PubMed]
4. Li AM, Chan D, Wong E, Yin J, Nelson EA, Fok TF. The effects of obesity on pulmonary function. Arch Dis Child. 2003 April; 88(4):361-3 [PubMed]
5. Faridi MM, Gupta P, Prakash A. Lung functions in malnourished children aged five to eleven years. Indian Pediatr. 1995 Jan;32(1):35-42 [PubMed]
6. Joshi V, Shah S. Effect of Body Mass Index (BMI) on Peak Expiratory Flow Rate in young adults. IAIM, 2016; 3(5): 85-88.
7. Jain SK, Kumar R, Sharma DA. Factors influencing peak expiratory flow rate in normal subjects. Lung India, 1983; 3: 92-97.
8. Harpreet Kaur, Jagseer Singh, ManishaMakkar, Khushdeep Singh, RuchikaGarg. Variations in the Peak Expiratory Flow Rate with Various Factors in a Population of Healthy Women of the Malwa Region of Punjab. J ClinDiagn Res., 2013; 7(6): 1000–1003
9. K. Sembulingam, PremaSembulingam, V. Poornodai, Gigi Chandran. Effect of oil pulling on peak expiratory flow rate. International Journal of Research in Health Sciences, 2013; 1(3): 136.
10. Onadeko BO, Iyun AO, Sofowora EO, Adamu SO. Peak expiratory flow rate in normal Nigerian children. Afr J Med medSci., 1984; 13(1-2): 25-32.
11. Saraswathi Ilango, Christy A, Saravanan.A, PremaSembulingam. Correlation of Obesity Indices with Peak Expiratory Flow Rate in Males and Females. IOSR Journal of Pharmacy, 2014; 4(2): 21-27.
12. sharpjt, henry jp, sweanysk, meadows wr, pietrasrj. effects of mass loading the respiratory system in man. J ApplPhysiol (1985). 1964 Sep;19:959– 66.
13. Guenette JA, Jensen D, O'Donnell DE. Respiratory function and the obesity paradox.CurrOpin Clin NutrMetab Care. 2010 Oct 31;13(6):618–24.
14. Sahebjami, H. (1998). Dyspnea in obese healthy men. Chest, 114(5), 1373-1377.
15. Vijayan, V. K., Kuppurao, K. V., Venkatesan, P., Sankaran, K., & Prabhakar, R. (1990). Pulmonary function in healthy young adult Indians in Madras. Thorax, 45(8), 611-615.
16. Ong, T. J., Mehta, A., Ogston, S., & Mukhopadhyay, S. (1998). Prediction of lung function in the inadequately nourished. Archives of disease in childhood, 79(1), 18-21.
17. Faridi, M. M. A., Gupta, P., & Prakash, A. (1995). Lung functions in malnourished children aged five to eleven years. Indian pediatrics, 32, 35-35