e-ISSN: 0976-822X, p-ISSN:2961-6042

Available online on http://www.ijcpr.com/

International Journal of Current Pharmaceutical Review and Research 2024; 16(1); 62-65

Original Research Article

Study of Peak Expiratory Flow Rate in Obesity

Kunipuri Sarala[1], Indla Devasena[2], M. Vijaya Nirmala[3], S. Sarah Nightingale[4]

[1]Professor and HOD, Department of Physiology, GMC, Anantapur, Andhra Pradesh, India

[2]Associate Professor, Department of Physiology, SV Medical College, Tirupati Andhra Pradesh , India

[3]Associate Professor, Department of Physiology, GMC, Kadapa, Andhra Pradesh, India

[4]Assistant Professor, Department of Physiology, Siddhartha Medical College, Vijayawada, Andhra Pradesh, India

Received: 17-10-2023 Revised: 23-11-2023 / Accepted: 24-12-2023
Corresponding Author: S. Sarah Nightingale
Conflict of interest: Nil

Abstract

Obesity is one of the major health issues worldwide . It has enormously contributed to the increase in incidence of diabetes and cardiopulmonary problems. However, very few studies are available where the effects of obesity on pulmonary functions have been investigated in young healthy Subjects. The aim of this study was to examine the lung function in the form of Peak Expiratory Flow Rate (PEFR) in healthy adults grouped into normal and obese. The sample size of the study was 30 subjects in each group . Two groups were made group A – BMI normal 18-21.9 kg/m2 and group B - BMI obese: 25 onwards. Peak Exploratory Flow Rate Procedure Using Wright's peak flow meter PEFR was evaluated. PEFR values were low in females as compared to male subjects and it was highly significant. PEFR values were less in obese subjects as compared to normal BMI subjects and it was highly significant. Obesity produces significant deterioration in the PEFR in young healthy subjects

Keywords: Obesity, PEFR.

Introduction

Obesity is characterized by excess deposition of fat. This is a serious issue involving the people of both developing as well as developed countries of the world [1] .The problem is recognized internationally [2] because of its increasing incidence and its association with cardiovascular diseases[3], Stroke, Type2 Diabetes[4], Hypertension, Cancers[5], Osteoarthritis [6], Respiratory problems including Asthma [7,] Depression [8] as well as reduction in the ability to perform physical activities [9]. Further, incidence of obesity is not confined to any particular age group or socioeconomic class but is found in people of all ages and socioeconomic classes mainly because of sedentary life style and excess energy intake. Moreover, obesity is found to increase the chances of respiratory symptoms, like breathlessness particularly during exercise[10] and recognized as an important risk factor in the development of respiratory diseases like obstructive sleep apnoea (OSA)[11] and obesity hypoventilation syndrome (OHS) [12].The present study was undertaken to assesses and correlate the obesity and pulmonary functional status in obese and non-obese male and female subjects. 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 bed-side test. Hadorn introduced PEFR in 1942 and it was accepted as a parameter of pulmonary function test (PFT) in 1949 [13-15]. The truncal fat may compress the thoracic cavity and restrict the diaphragmatic movement resulting in reduced vertical diameter of the thoracic cavity [16]. 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 [17].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. PEFR varies in an individual according to the age, sex and anthropometric variables. The PEFR values are also affected by various other factors, such as sex, body surface area, obesity, physical activity, posture, environment, and racial differences.[18-20] The average PEFR of healthy young Indian males and females is around 500 and 350 L/min, respectively.[21] Obesity has been linked with

impaired pulmonary function and airway hyperresponsiveness.[22,23] Different studies of PEFR have been done with respect to age, sex, height, and weight, but fewer studies have done with body mass index (BMI). Thus, this study was proposed to observe the change in PEFR with respect to BMI and gender , find the relationship between BMI and PEFR

Materials and methods

The sample size of the study was 30 subjects in each group . Two groups were made group A – BMI normal 18-21.9 kg/m2 and group B - BMI obese: 25 onwards. Inclusion / Exclusion criteria All were healthy subjects without any medical illness like cardio-respiratory and neurological diseases or endocrinal and allergic disorders and none of them were on medication for any ailments. Subjects with habit of smoking and alcohol consumption were not included in the study. Both males and females were included in study. Peak Exploratory Flow Rate Procedure Using Wright's peak flow meter PEFR was evaluated. 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 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: Weight, Height, PEFR in male and female adults

Variables	Males n=30 Mean ± SD	Females n=30 Mean ± SD
Height (kg)	160.6±10.4	154.8±3.8
Weight (cm)	68.4±11.6	54.2±6.4
PEFR (L/min)	470±64	360±38

Table 2: BMI and PEFR values in males and females

Gender	Normal BMI, Group A (kg/m^2) n=30	Obese BMI, Group B (kg/m^2) n=30	P value
Males	488.64±54	390.86±42.23	<0.001
Females	370±34.26	354.64±14.41	<0.001

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

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

Discussion

Our study shows that increase BMI decrease PEFR values. Obesity is a condition in which a person has excess body weight relative to other people of the same gender and height. A study by Saxena, et al. suggested that obesity itself and specially the pattern of body fat distribution have independent effects on PEFR [24]. You chen, et al. showed that abdominal fat is negatively and consistently associated with pulmonary function [25]. N.K. Mungreiphy, et al. found PEFR to be maximum among subjects with normal BMI, followed by overweight and obese [26]. Jones, et al. also found that the reduction in PEFR is proportional to the increase in BMI [27]. So, our study is an attempt to bring awareness about variation of lung function with increase BMI. The information may help to acknowledge the pulmonary health risks that crop up with increasing body mass index and fat accumulation. The significant reduction in PEFR in obese 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 [28].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 [29]. 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,BMI 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. The information may help to acknowledge the pulmonary health risks that crop up with increasing body mass index and fat accumulation.

Conclusion

PEFR values were low in females as compared to male subjects and it was highly significant. PEFR values were less in obese subjects as compared to normal BMI subjects and it was highly significant. So our study is an attempt to bring awareness about the variation of lung function with increase BMI. The information may help to acknowledge the pulmonary health risk that crop up with increasing Body Mass Index and fat accumulation.

References

1. Racette SB, Deusinger SS, Deusinger RH. Obesity: overview of prevalence, etiology, and treatment. PhysTher. 2003.
2. James PT, Leach R, Kalamara E, Shayeghi M. The worldwide obesity epidemic.Obes Res. 2001 Oct 31;9Suppl 4:228S–233S.
3. Manson JE, Colditz GA, Stampfer MJ, Willett WC, Rosner B, Monson RR, et al. A prospective study of obesity and risk of coronary heart disease in women. N Engl J Med. 1990 Mar 28;322(13):882–9.
4. Hu FB, Manson JE, Stampfer MJ, Colditz G, Liu S, Solomon CG, et al. Diet, lifestyle, and the risk of type 2 diabetes mellitus in women. N Engl J Med. 2001 Sep 12;345(11):790–7.
5. Stoll BAB. Perimenopausal weight gain and progression of breast cancer precursors. Cancer Detect Prev. 1998 Dec 31;23(1):31–6.
6. Davis MA, Ettinger WH, Neuhaus JM. Obesity and osteoarthritis of the knee: evidence from the National Health and Nutrition Examination Survey (NHANES I). Semin Arthritis Rheum. 1990 Nov 30;20(3 Suppl 1):34–41.
7. Chen Y, Dales R, Tang M, Krewski D. Obesity may increase the incidence of asthma in women but not in men: longitudinal observations from the Canadian National Population Health Surveys. Am J Epidemiol. 2002 Jan 31;155(3):191–7.
8. Friedman KE, Reichmann SK, Costanzo PR, Musante GJ. Body image partially mediates the relationship between obesity and psychological distress. Obes Res. 2002 Jan;10(1):33–41.
9. Tsuritani I, Honda R, Noborisaka Y, Ishida M, Ishizaki M, Yamada Y. Impact of obesity on musculoskeletal pain and difficulty of daily movements in Japanese middle-aged women. Maturitas. 2001 Dec 31;42(1):23–30.
10. Sahebjami H. Dyspnea in obese healthy men. CHEST Journal. 1998.
11. Young T, Peppard PE, Gottlieb DJ. Epidemiology of obstructive sleep apnea: a population health perspective. Am J RespirCrit Care Med. 2002 Apr 30;165(9):1217–39.
12. Akashiba T, Akahoshi T, Kawahara S. Clinical characteristics of obesity hypoventilation syndrome in Japan: a multi-center study. … (Tokyo. 2005.
13. Jain SK, Kumar R, Sharma DA. Factors influencing peak expiratory flow rate in normal subjects. Lung India, 1983; 3: 92-97.
14. 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
15. K. Sembulingam, Prema Sembulingam, V. Poornodai, Gigi Chandran. Effect of oil pulling on peak expiratory flow rate. International Journal of Research in Health Sciences, 2013; 1(3): 136.
16. 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.
17. Saraswathi Saravanan.A, Ilango, Prema Christy A, Sembulingam. Correlation of Obesity Indices with Peak Expiratory Flow Rate in Males and Females. IOSR Journal of Pharmacy, 2014; 4(2): 21-27.
18. Benjaponpitak S, Direkwattanachai C, Kraisarin C, Sasisakulporn C. Peak expiratory flow rate values of students in Bangkok. J Med Assoc Thai 1999;82 Suppl 1:S137-43.
19. Srinivas P, Chia YC, Poi PJ, Ebrahim S. Peak expiratory flow rate in elderly Malaysians. Med J Malaysia 1999; 54:11-21.
20. Raju PS, Prasad KV, Ramana YV, Murthy KJ. Pulmonary function tests in Indian girls – Prediction equations. Indian J Pediatr 2004; 71:893-7.
21. Dikshit MB, Raje S, Agrawal MJ. Lung functions with spirometry: An Indian perspective – I. Peak expiratory flow rates. Indian J Physiol Pharmacol 2005; 49:8-18.
22. Gibson GJ. Obesity, respiratory function and breathlessness. Thorax 2000;55 Suppl 1:S41-4. 10.
23. Rubinstein I, Zamel N, DuBarry L, Hoffstein V. Airflow limitation in morbidly obese, nonsmoking men. Ann Intern Med 1990; 112:828-32.
24. Saxena Y., Sidhwani G., Upmanya R. Abdominal obesity in pulmonary functions. Indian J. Physiol. Pharmacol., 2009; 53(4): 318-26.
25. You chen, Donna Rennie, Yvon F Cormier, James circumference is Dosmen. associated Waist with pulmonary function in normal weight, overweight, and obese subjects. Am J Clin Nutr., 2007; 85(1): 35-39. 1

26. NK Mungreify, Meenal Dhall, Renu Tyagi, Kiran Saluga, Ankit Kumar. Ethnicity, obesity and health pattern among Indian population. IOSR, 2012; 3(1): 52-59.
27. Jones RL, Nzekwu MM. The effects of body mass index on lung volumes. Chest, 2006; 130(3): 827–833.
28. sharpjt, henry jp, sweanysk, meadows wr, pietrasrj. effects of mass loading the respiratory system in man. J Appl Physiol. 1985; 1964 Sep; 19:959 66.
29. Guenette JA, Jensen D, O'Donnell DE. Respiratory function and the obesity paradox. Curr Opin Clin Nutr Metab Care. 2010 Oct 31;13(6):618–24.