ORIGINAL RESEARCH

Assessment of peak expiratory flow rate and spirometry in obese and nonobese school children

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ABSTRACT

Background: Childhood obesity is a severe health issue that impacts both adults and children, increasing the risk of diabetes, high blood pressure, and high cholesterol. The present study was conducted to assess peak expiratory flow rate and spirometry in obese and nonobese school children. **Materials & Methods:**120 students aged 12-16 years of both genders were studied. FVC, FEV1, and forced expiratory flow (FEF) at the mid portion of FVC (FEF 25–75). PEFR was measured by Wright's mini peak flow meter. **Results:** Out of 120 subjects, males were 50 and females were 70. The age group 11 years had 5obese and 10 nonobese subjects. 12 years had 7 and 14, 13 years had 4 and 11, 14 years had 8and 9, 15 years had 6 and 13 and 16 years had 12 and 21 obese and nonobese subjects respectively. The difference was significant (P< 0.05). The mean FEV1 in obese male was 88.3 and in obese female was 89.0. FVC was 88.6 and 88.9, FEV1 /FVC was 99.7 and 99.3, FEF25%-75% was 79.5 and 79.1 and PEFR (L/min) was 228.1 and 228.4 in male and females respectively. The difference was non- significant (P> 0.05). **Conclusion:** Authors found that comparing obese patients to non-obese patients, lung function is normal in obese patients. Expanding the use of this tool by patients and medical professionals alike will aid in the early detection of respiratory conditions and enhance the quality of care for young patients. One can enhance our lung function by maintaining a fit and healthy body.

Key words: non-obese, forced expiratory flow, lung

INTRODUCTION

A large accumulation of fat on the body that causes an increase in body mass is called obesity. It is a multifactorial illness that can cause both sociopsychological and medical issues.[1] It impairs the respiratory system and other systems in several ways, including the ability to engage in functional exercise. Because of poor diet and inactivity, it is the biggest health issue; the modern sedentary lifestyle is contributing to a host of other issues.[2]

Childhood obesity is a severe health issue that impacts both adults and children, increasing the risk of diabetes, high blood pressure, and high cholesterol.[3]Despite their ability to identify airflow blockage clinically, doctors are not able to determine the extent or reversibility of the obstruction. Therefore, submaximal exercise tests and pulmonary function tests (PFT) can help with the diagnosis and treatment of a variety of respiratory diseases as well as the effects of morbidity and mortality on children, such as obesity and weight growth.[4] Gaining weight impairs lung compliance, small airway impairment, expiratory flow blockage, respiratory muscle strength, and gas exchange on peak expiratory flow to name a few consequences.[5] PFTs are essential for assessing lung function and are a useful diagnostic and therapeutic tool for patients with respiratory conditions in both adult and pediatric evaluations. It determines the pattern and severity of respiratory diseases.[6]The present study was conducted to assess peak expiratory flow rate and spirometry in obese and nonobese schoolchildren.

MATERIALS & METHODS

The present study consisted of 120 students aged 12-16 years of both genders. All gave their written consent to participate in the study.

Data such as name, age, gender etc. was recorded. FVC, FEV1, and forced expiratory flow (FEF) at the mid portion of FVC (FEF 25–75). PEFR was

measured by Wright's mini peak flow meter. The subject was instructed to take deep inspiration and asked to blow out forcefully through the mouthpiece. Data thus obtained were subjected to statistical analysis. P value < 0.05 was considered significant.

RESULTS

Table I Distribution of patients

Total- 120		
Gender	**Male**	**Female**
Number	50	70

Table I shows that out of 120 subjects, males were 50 and females were 70.

Table II Age wise distribution

Age group (years)	Obese (42)	Nonobese (78)	P value
11 years	5	10	0.03
12 years	7	14	
13 years	4	11	
14 years	8	9	
15 years	6	13	
16 years	12	21	

Table II, graph I show that age group 11 years had 5 obese and 10 nonobese subjects. 12 years had 7 and 14, 13 years had 4 and 11, 14 years had 8 and 9, 15 years had 6 and 13 and 16years had 12 and 21obese and nonobese subjects respectively. The difference was significant (P< 0.05).

Graph I Age wise distribution

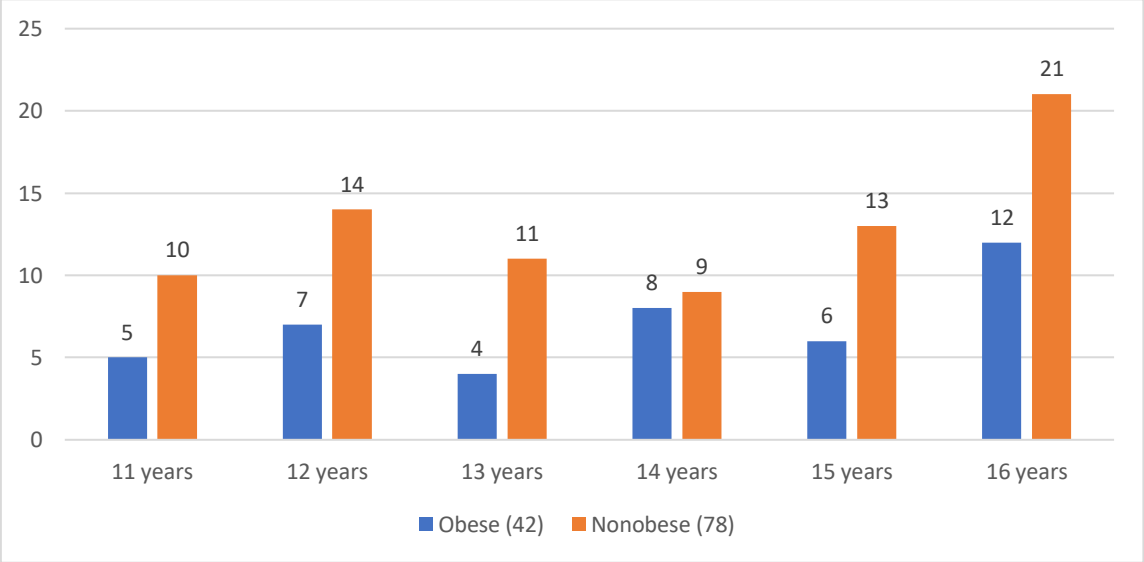

Table III Assessment of pulmonary function test and peak expiratory flow rate

PFT	Male	Female	P value
FEV1	88.3	89.0	0.91
FVC	88.6	88.9	0.15
FEV1 /FVC	99.7	99.3	0.26
FEF25%-75%	79.5	79.1	0.62
PEFR (L/min)	228.1	228.4	0.85

Table III shows that mean FEV1 in obese male was 88.3 and in obese female was 89.0. FVC was 88.6 and 88.9, FEV1 /FVC was 99.7 and 99.3, FEF25%-75% was 79.5 and 79.1 and PEFR (L/min) was 228.1 and 228.4 in male and females respectively. The difference was non- significant (P> 0.05).

DISCUSSION

PEF is especially susceptible to dynamic compression of extrapulmonary airways because, while they are under pleural pressure, their walls are not supported by traction from lung tissue.[7] Throughout childhood and adolescence, the mass of the body grows in tandem with the expansion of the skeleton.[8] Lung capacity and function are affected by each of these changes. A number of variables, including age, sex, height, weight, body surface area, body mass index

(BMI), and ethnic and environmental variations, can affect PEFR.[9,10] PEFR is a patient-specific measure of the health of the major airways. Anthropometric measures, age, sex, malnourishment, and environmental impact are among the variables that influence an individual's peak expiratory rate.[11,12]The present study was conducted to assess peak expiratory flow rate and spirometry in obese and nonobese school children.

We found that out of 120 subjects, males were 50 and females were 70. Raji et al[13]study was conducted on school children in the age group of 11–17-year-old obese and nonobese students. Lung function was measured using the spirometry and mini-Wright's peak expiratory flow (PEF) meter to identify differences among children. A total of 245 healthy boys and girls, ranging from 11 to 17 years of age, were recruited for the study. There is no statistical difference between mean spirometric values of forced vital capacity (FVC), forced expiratory volume in the first (FEV1), FEV1/FVC %, FEF 25%–75% and PEF rate for obese groups in comparison with the nonobese control group.

We found that the age group 11 years had 5 obese and 10 nonobese subjects. 12 years had 7 and 14, 13 years had 4 and 11, 14 years had 8 and 9, 15 years had 6 and 13 and 16 years had 12 and 21 obese and nonobese subjects respectively. Das et al[14]compared dynamic lung function parameters of overweight and thin boys with normal boys.One hundred and fifty school boys of age group 12–16 years were divided into normal (n = 50), overweight (n = 50), and thinness (n = 50) group. Forced vital capacity (FVC), forced expiratory volume in 1 s (FEV1), FEV3, peak expiratory flow rate (PEFR), and forced expiratory flow (FEF) at the midportion of FVC (FEF25-75) were measured by MEDSPIROR. Thin boys had lower FVC (P = 0.019), FEV1 (P = 0.048), FEV3 (P = 0.007), PEFR (P = 0.0002), and FEF25-75 (P = 0.003) compared to normal boys. Overweight boys showed significantly increased FVC (P = 0.019), FEV1 (P < 0.0001), and FEV3 (P = 0.0005) compared to normal boys. BMI of thin boys showed positive correlation with FVC (r = 0.49, P = 0.0003), FEV1(r = 0.40, P = 0.003), and FEV3 (r = 0.53, P < 0.0001). Correlation coefficients were not significant for BMI and dynamic lung function test parameters in normal and overweight boys.

We found that The mean FEV1 in obese male was 88.3 and in obese female was 89.0. FVC was 88.6 and 88.9, FEV1 /FVC was 99.7 and 99.3, FEF25%-75% was 79.5 and 79.1 and PEFR (L/min) was 228.1 and 228.4 in male and females respectively. Budhiraja et al[15] enrolled 600 normal children between 6–15 years age from different urban and rural schools. Pulmonary function tests were measured by using Micromedical Gold standard fully computerized portable auto spirometer. The study shows, all three independent variables (age, weight and height) have linear positive correlation with lung function parameters, both for boys and girls. Lung function values in boys were significantly higher as compared to that of girls. Urban children had higher lung function parameters than rural children except IRV, FEF25%. Among all anthropometric parameters, height was the most independent variable with maximum coefficient of correlation.

The limitation of the study is the small sample size.

CONCLUSION

Authors found that comparing obese patients to non-obese patients, lung function is normal in obese patients. Expanding the use of this tool by patients and medical professionals alike will aid in the early detection of respiratory conditions and enhance the quality of care for young patients. One can enhance our lung function by maintaining a fit and healthy body.

REFERENCES

1. Nair SJ, Daigle KL, DeCuir P, Lapin CD, Schramm CM. The influence of pulmonary function testing on the management of asthma in children. J Pediatr2005;147:797-801.
2. Koenig SM. Pulmonary complications of obesity. Am J Med Sci 2001;321:249-79. 10. Faintuch J, Souza SA, Valezi AC, Sant'Anna AF, Gama-Rodrigues JJ. Pulmonary function and aerobic capacity in asymptomatic bariatric candidates with very severe morbid obesity. Rev Hosp Clin Fac Med Sao Paulo 2004;59:181-6.
3. Salome CM, King GG, Berend N. Physiology of obesity and effects on lung function. J Appl Physiol (1985) 2010;108:206-11.
4. Jain SK, Gupta CK. Lung function studies in healthy men and women over forty. Indian J Med Res 1967;55:612-9.
5. Jain SK, Ramiah TJ. Spirometric studies in healthy women 15-40 years age. Indian J Chest Dis 1967;9:1-12.
6. Jain SK, Ramiah TJ. Normal standards of pulmonary function tests for healthy Indian men 15-40 years old: Comparison of different regression equations (prediction formulae). Indian J Med Res 1969;57:1453-66.
7. Trabelsi Y, Ben Saad H, Tabka Z, Gharbi N, Bouchez Buvry A, Richalet JP, et al. Spirometric reference values in Tunisian children. Respiration 2004;71:511-8.
8. Ip MS, Karlberg EM, Karlberg JP, Luk KD, Leong JC. Lung function reference values in Chinese children and adolescents in Hong Kong. I. Spirometric values and comparison with other populations. Am J Respir Crit Care Med 2000;162:424-9.
9. Raju PS, Prasad KV, Ramana YV, Ahmed SK, Murthy KJ. Study on lung function tests and prediction equations in Indian male children. Indian Pediatr2003;40:705-11.
10. Cotes JE, Chinn DJ, Miller MR. Lung Function: Physiology, Measurement and Application in Medicine. New Jersey, USA: John Wiley and Sons; 2009.
11. Lutfi MF. The physiological basis and clinical significance of lung volume measurements. Multidiscip Respir Med 2017;12:3.

12. Joshi AR, Singh R, Joshi AR. Correlation of pulmonary function tests with body fat percentage in young individuals. Indian J PhysiolPharmacol2008;52:383-8.
13. Raji G, Kumar K, Ganga N, Narasimhan M. Analysis of peak expiratory flow rate and spirometry in obese and nonobese schoolchildren. Indian J Respir Care 2022;11:337-40.
14. Das D, Mondal H, Patnaik M. Study of dynamic lung function parameters in normal, overweight, and thin school boys. J Sci Soc 2017;44:36.
15. Budhiraja S, Singh D, Pooni PA, Dhooria GS. Pulmonary functions in normal school children in the age group of 6-15 years in North India. Iran J Pediatr2010;20:82-90.