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Original Research Article

Forced Expiratory Flow FEF 25-75 % and Body Mass Index among Young Adolescents

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Abstract

In India, undernutrition coexists with obesity, thus demonstrating a double burden of the disease. The effect of the increased BMI and the body fat percentage on the pulmonary functions has been studied extensively. The effect of undernutrition on the pulmonary functions needs attention. FEF 25-75 (L/S) describes the amount of air expelled from the lung during the middle half of the forced vital capacity test. The study was conducted over 300healthy students (13-19 yrs.), 155 male subjects and 145 female subjects. Medspiror, computerised spirometer was used to record lung function parameter Forced expiratory flow (FEF25-75%). Pulmonary function parameter in different Body Mass Index (BMI) groups was tabulated. 262 subjects had BMI less than 18.5 (underweight), 36 subjects and BMI between 18.5-25 (normal weight), and 2 subjects had BMI more than 25 (overweight). Majority subjects (262) were underweight. subjects who were having low BMI had low Forced expiratory flow (FEF25-75%) as compared to normal BMI subjects. Our study also showed a marked reduction in FEF25-75% in the underweight group. This could be due to malnutrition. It is observed that PFT value FEF25-75% were significantly reduced in underweight young individuals, compared between males and females this study showed fall is more in female than males. Under nutrition should be identified as early as possible and should be corrected in order to ensure health of young individuals.

Keywords: Body Mass Index, Forced expiratory flow (FEF25-75%)

Introduction

Indo-Asian countries are now experiencing the unique challenge of a rapid rise in childhood obesity despite a persistently high burden of undernutrition [1]. Undernutrition coexists with obesity, thus demonstrating a adobe burden of the disease [2]. While the clinical complications of obesity such as diabetes,

vascular disease, and osteoarthritis are well established, less emphasis is traditionally placed on the effects of obesity on the respiratory system [3]. Obese and overweight people are at an increased risk of respiratory symptoms, such as breathlessness, particularly during exercise, even if they have no obvious respiratory illness. The association between obesity and asthma has also raised new concerns about whether the mechanical effects of obesity on the respiratory system contribute to airway dysfunction that could induce or worsen asthma [4]. Pulmonary function values are influenced by race, age, sex, height, weight, waist, hip circumference as well as environmental, genetic, socioeconomic and technical parameter. From various studies it is obvious that there are differences in PFT values between Indian and western world population, also there are regional differences. The development of pulmonary function and growth of physical parameters are coexistent. Hence, measurement of lung function is essential for evaluation of physical development of children and adolescent. Pulmonary function test (PFTs) is considered as an essential component for evaluation of lung functions. The development of pulmonary function and growth of physical parameters go hand in hand in children. Therefore, measurement of lung functions is important for the evaluation of physical development and diseases. Body size is affected by nutrition in young age which directly affects the size of lungs. India being a subcontinent, pulmonary norms may vary according to different geographic locations. Therefore, it is important to have normal pulmonary function data in native population to interpret accurately the pulmonary function changes in childhood pulmonary disease.

Various studies have been done, which have shown the effect of severe and morbid obesity on the pulmonary functions[5-8]. Very few studies have been focused on the effect of moderate weight gain on the pulmonary functions [9]. The studies which have been done on the pulmonary functions in the undernourished population without any comorbidity are very few and there is a need to address this issue to understand the correlation between BMI [Body Mass Index] and the pulmonary functions. Among the forced expiratory volumes FEF25-75 % is defined as the mean forced expiratory flow during the middle half of FVC. It measures the average flow rate on FVC segment which indicates the flow rate in medium and small caliber airways[10] FEF25-75 % is considered abnormal if its value is less than 65% of the predicted value[11-13].Abnormal value indicates early obstruction to the airflow. FEF 25-75 (L/S) describes the amount of air expelled from the lung during the middle half of the forced vital capacity test. Recent research suggests that FEF 25-75% or FEF 25-50% may be a more sensitive parameter than FEV1 in the detection of obstructive small airway disease[14,15].

Materials and Methods

Cross -sectional study was conducted in Department of Physiology of Medical College. The study was conducted over 300 students (13-19 yrs.), 155 male subjects and 145 female subjects. All volunteers were physically healthy without any sign and symptoms. They were evaluated as per standard proforma which included questionnaires. The experimental protocol was explained to all volunteers and written informed consent was obtained from parent. The institution Ethical committee approved the study. The study was carried out in schools and junior colleges. Permission was taken from the principal of school/college.

Inclusion Criteria

- Only those subjects whose parents had given consent were included in project.
- Healthy children in age group (13-19 years) were included

Exclusion Criteria

- History of respiratory symptoms within two weeks prior to test.
- History of smoking.
- History suggestive of cardiac illness like exceptional dyspnea or orthopnea.
- History suggestive of chronic respiratory disease like to Asthma, Bronchitis.
- Structural deformities of Thoracic cage.
- Students having metabolic disorder related to obesity

A detailed history was obtained. Complete general and systemic examination of subjects was done. Only those subjects meeting inclusion criteria were included in study. Height and weight were obtained in volunteers wearing light clothes and bare feet.

Weight

It was measured by using Krup's weighing machine with light clothing and without shoes Body weight was recorded in Kg. on empty bladder and before lunch: on a standard weighing scale. The weight measurement was recorded to nearest 0.1 kg.

Height

The subjects were asked to stand against the wall on which a measuring scale was inscribed. The subject was bare foot on a flat floor with feet closed and parallel to each other's, heels, buttocks and occiput touching wall firmly. Head was held erect, and subjects were asked to look at front. Highest point on vertex was marked on wall by a ruler and them height was measured at nearest 0.1 cm.

Body mass index – It was calculated by quetelets index

$$\text{BMI} = \frac{\text{Wt in Kg}}{(\text{Height in meter})^2}$$

Table 1: Classification of BMI

Weight	BMI	Obesity class
Under Weight	< 18.5	
Normal	18.5 –24.9	
Over Weight	25 –29.9	
Obesity	30 –34.9	I
	35 –39.9	II
Extreme Obesity	> 40	III

Medspiror, computerised spirometer was used to record lung function parameter Forced expiratory flow (FEF25-75%), subjects were explained about the procedure of recording of these parameters and parameters were recorded. Pulmonary function parameter in different Body Mass Index (BMI) groups was tabulated.

Forced expiratory flow (FEF25-75%)

FEF is flow of air coming out of Lung during the middle portion of forced expiration. It can be given at described time generally defined by what fraction remains of the FVC. The used intervals are 25%, 50%, 75%.

Stastical Analysis:

Descriptive statistics was applied like Mean, standard deviation. Student's t test was used to compare FEF25-75% values between underweight and normal weight boys and girls. Grouping of subjects was done into low BMI (<18.5 Kg/meter2), normal BMI (18.5-24.9Kg/meter2). Probability was also calculated. Probability less than 0.05 was considered as statistically significant. All calculation was done with help of SPSS version 10.02.

Results:

Table 2: Shows Pulmonary function tests parameter in male and female Groups.

PFT Parameter	Male		Female		P Value
	Observed Value Mean ± SD		Observed value Mean ± SD		
FVC (In Litres)	1.81	± 0.61	1.37	± 0.41	0.001
FEF 25-75%(In Litres / Sec)	2.21	± 1.07	1.69	± 1.11	0.0001

All the pulmonary function parameters were statistically significantly higher in boys as compared to girls.

Table 3: Pulmonary function parameters in different Body Mass Index (BMI) groups.

BMI	<18.5	18.5 –23		23.1 –25		>25	
	n=262	n=31		n=5		n=2	
FVC (in Liters)	1.59±0.56	1.68 ±0.63		1.64	± 0.55	1.54	± 0.29
FEF25-75% (in Liters / Sec)	1.97 ± 1.15	2.11	± 0.87	2.33	± 1.16	1.64	± 0.61

Above table shows that 262 subjects had BMI less than 18.5 (underweight), 36 subjects and BMI between 18.5-25 (normal weight), and 2 subjects had BMI more than 25 (overweight). Majority subjects (262) were underweight, and their lung function parameters were less than subjects having normal BMI. Only 2 subjects were overweight, and their lung function parameters were less than that of normal BMI subjects. This shows that those subjects who were having low BMI had low Forced expiratory flow (FEF25-75%) as compared to normal BMI subjects.

Discussion

The primary factors that affect lung function parameters are the strength of expiratory muscles generating the force of contraction, elastic recoil. Pressre of lungs and the airway size [16]. Lung function may vary due to age, gender, height, weight [17]. The study of T. J. Ong showed that malnourished children were found to have low lung function parameters [18]. M. M. Faridi, Pratibha Gupta and co-workers showed that lung function reduces in undernourished young individuals [19]. 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 PFT values in underweight. Present study shows lung function parameters have significant correlation with BMI, similar findings were reported by some authors [20]. In the underweight population, the body fat and BMI showed a significant positive correlation with FVC and FEV1 in males as well as in females, thus stating that an improvement in the nutritional status of the underweight group could help in improving the pulmonary functions of the underweight population. Malnutrition unfavourably influences the lung functions by decreasing the respiratory muscle mass, strength, endurance and the defense mechanisms of the lung immune system. Muscle wasting leads to reduction in the diaphragmatic mass and a weaker respiratory muscle function diminishes the respiratory muscle strength and it changes the ventilator capacity. It has been reported that malnutrition resulted in a significant reduction in diaphragm weight and was affected proportionately in the same way as the other skeletal muscles. Malnutrition reduced the cross-sectional area of fast-twitch muscle fibres to a greater extent

than that of slowtwitch fibres which would have considerable impact on both contractile and fatigue properties of the diaphragm [21]. Another recent study [22] demonstrated that diaphragm mass and thickness were related to body weight.

Conclusion:

Our study also showed a marked reduction in FEF25-75% in the underweight group. This could be due to malnutrition. It is observed that PFT value FEF25-75% were significantly reduced in underweight young individuals, compared between males and females this study showed fall is more in female than males. 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 individuals to avoid future respiratory problems. Under nutrition should be identified as early as possible and should be corrected in order to ensure health of young individuals.

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