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Original Research Article

Study of Pulmonary Function Parameters in Different Body Mass Index (BMI) Groups

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Abstract

Objective: Pulmonary function values are influenced by race, age, sex, height, weight, waist, hip circumference as well as environmental, genetic, socioeconomic parameter. The development of pulmonary function and growth of physical parameters are coexistent. Measurement of lung function is essential for evaluation of physical development of children and adolescents. The present work was undertaken to evaluate pulmonary function in normal healthy school children of age group 13-19 years having different body mass index. The study was conducted over 300 students (13-19 years.), 155 male subjects and 145 female subjects. Pulmonary function parameters FVC, FEV1, FEV1%, FEF25-75%, PEFR, MVV, were measured by medspiror. BMI was calculated of all subjects by measuring height and weight. BMI was classified into various groups. It was found that 262 subjects had low BMI and were underweight, PFT parameters were 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 individuals to avoid future respiratory problems.

Keywords: BMI, PFT.

INTRODUCTION

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) are considered as an essential component for evaluation of lung functions [1]. 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. The present work was undertaken to evaluate pulmonary function in various BMI groups of normal healthy school children of age group 13-19 years. Among the various investigation modalities available, pulmonary function test (PFT) is an invaluable tool for the assessment of lung function. The purpose of this study was to assess lung function tests in young individuals in relation to BMI.

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 were bare foot on a flat floor with feet closed and parallel to each others, 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 [2].

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

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 35 – 39.9	I II
Extreme Obesity	> 40	III

The following PFT parameters were selected for study.
FVC (forced vital capacity),
Forced expiratory volume in 1 second (FEV1),
FEV1 / FEV ratio (FEV1 %),
Forced expiratory flow (FEF25-75%),
Peak expiratory flow rate PEFR,
MVV (Maximum Voluntary Ventilation)

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

RESULTS

Table-1 shows Pulmonary function tests parameters in male and female Groups of the study population.

Table-1:

PFT Parameter	Male	Female	P Value
	Observed Value	Observed value	
FVC (In Litres)	1.81 ± 0.61	1.37 ± 0.41	0.001
FEV1 (In Litres / Sec)	1.41 ± 0.69	0.97 ± 0.51	0.002
FEV1 %	79.91 ± 27.83	73.53 ± 23.65	0.008
MVV(In Litres / Min)	61.09 ± 20.50	48.76 ± 16.30	0.001
PEFR(In Litres / Min)	2.95 ± 1.66	2.22 ± 1.65	0.0002
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-2 below shows pulmonary function parameters in different Body Mass Index (BMI) groups.

Table-2:

BMI	<18.5 n=262	18.5 – 23 n=31	23.1 – 25 n=5	>25 n=2
FVC(in Liters)	1.59±0.56	1.68 ±0.63	1.64 ± 0.55	1.54 ± 0.29
FEV1(In Liters/Sec)	1.18±0.65	1.35 ± 0.66	1.49 ± 0.46	1.32 ± 0.07
FEV1/FVC	75.99±31.57	80.42 ± 27.34	93.99 ± 8.41	88.23 ± 16.63
PEFR(in Liters / Min)	2.64 ± 1.77	2.24 ± 1.12	2.92 ± 0.42	2.62 ± 0.37
$FEF_{25-75\%}$(in Liters / Sec)	1.97 ± 1.15	2.11 ± 0.87	2.33 ± 1.16	1.64 ± 0.61
MVV(in Liters / Min)	55.07 ± 19.5	55.93 ± 19.72	56.43 ± 27.91	51.75 ± 14.81

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 there 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 lung function 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 [3]. Lung function may vary due to age, gender, height, weight [4]. The study of T. J. Ong showed that malnourished children were found to have low lung function parameters [5]. M. M. Faridi, Pratibha Gupta and co-workers showed that lung function reduces in undernourished young individuals [6]. 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 [7].

CONCLUSION

Our study proved the positive correlation between BMI and lung function parameters. It is observed that PFT values 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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