ISSN- O: 2458 - 868X, ISSN –P: 2458 - 8687

International Journal of Medical Science and Innovative Research (IJMSIR)

IJMSIR : A Medical Publication Hub

Available Online at: www.ijmsir.com

Volume – 2, Issue – 4, July - August - 2017, Page No. : 103 - 107

Influence of Low Body Mass Index on Peak Expiratory Flow Rate in Young Individuals

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Conflicts of Interest: None to Declare

Abstract

BMI is one of important factor for each human to keep oneself healthy. Assessment of BMI made easy to investigate the amount of adiposity. Many health consequences were associated with underweight and overweight. Underweight due to poor nutrition is a serious problem in our country. The objective of the study was to study the association of underweight on peak expiratory flow rate in young individuals. The nutritional status of participants was assessed by measuring Body mass index.PEFR was measured by computerised spirometer medspiror. PEFR was found to be significantly lower in underweight boys and girls as compared to predicted values. On comparison between males and females, PEFR was reduced more in girls than boys ($P<0.05$). It may be concluded that lower BMI tends to decrease the PEFR in young individuals.

Keywords: BMI, PEFR, Young Individuals, Underweight.

Introduction

Both physiological and pathological factor affect Lung function [1]. Our country is facing a dual problem of underweight and overweight. Underweight due to under nutrition is most common in developing countries [2,3].Underweight is not a disease by itself but its ramifications are very vast [4].PEFR is an important lung function factor and it serves as valuable tool which indicates caliber of lung airways. Underweight reduces diaphragm contractility by reducing muscle mass and also reduces other respiratory muscle mass. Underweight subjects show reduced diaphragmatic motion [5].Stature, height, and weight, of an individual's affect pulmonary functions [6].

BMI is a simple index of weight for height that is commonly used to classify underweight, normal, overweight individuals. In under nutrition depletion of body resources of protein and calories is associated with wasting of skeletal muscles including respiratory muscles. In undernourished lower body mass that cause poor respiratory muscle strength may result in reduced PEFR. The present study was undertaken to establish relationship of low BMI on PEFR in young Indian individuals. PEFR was selected because it is widely accepted as reliable parameter of pulmonary function. Low BMI was used as parameter to identify undernourished subjects. There are very few studies done to study effects of low BMI on PEFR. So this study will help in knowing the effect of undernourishment on PEFR in young individuals.

Material and Methods:

A cross sectional study was conducted on 300 school students having age between 13-19 years.155 male subjects and 145 female subjects. All subjects were physically healthy without any sign or symptoms. They were evaluated as per standard proforma. The study protocol was explained to them. Written informed consent was obtained from parents.

Inclusion Criteria:

1] Only those subjects whose parents had given consent were included in study.

2] Healthy subjects in age group 13-19 years were included.

Exclusion Criteria:

1] History of respiratory symptoms within 2 weeks prior to test.

2] History of smoking.

3] History of suggestive of cardiac or respiratory diseases.

4] Structural deformities of thoracic cage.

Detail history was obtained .Complete general and systemic examination was done of subjects.

Nutritional Status:

Body composition was assessed in light weight of clothing .Body weight was recorded on Krups weighing machine. The body weight was recorded bare footed to nearest 0.1 Kg. The height was measured using meter scale without footwear to nearest 0.1 cm. BMI was calculated by formula.

$$BMI = \frac{\text{Weight in Kg}}{\text{Height in meter}^2}$$

Classification	BMI
Underweight	<18.5
Normal	18.5-24.99
Overweight	>25

PEFR:

It is maximum speed with which air is expired out forcefully after taking full inspiration. It is measured in litres/minute. Computerised pulmonary function testing (Medspiror) was used to obtain PEFR values in subjects. Percentage predicated values of PEFR were also obtained by medspiror. The procedure was explained to subjects. The subject's inhales maximally, inserts the mouth piece just past his/her front teeth, seals lips around mouth piece and blows the air forcefully and rapidly. For each subject 3 readings were taken at full effort and best one was taken for the study as per guideline of the American thoracic society [7].

Stastical Analysis:

Descriptive statistics was applied like Mean, standard deviation. Student's **t** test was used to compare PEFR values between underweight and normal weight boys and girls. Grouping of subjects was done into low BMI (<18.5 Kg/meter^2), normal BMI (18.5-24.9Kg/meter^2). Percentage predicted values were obtained. Person's correlation coefficient was calculated and its 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:

The result of anthropometric parameter of normal male and female subjects is given in Table no.1.

Table No. – 1

Average Age, Height, Weight, BMI and in study population.

Anthropometric Parameters	Male	Female
Age (In years)	15.25 ± 1.36	14.72 ± 1.28
BMI	15.93 ± 2.43	16.09 ± 2.39
HEIGHT (In Cm)	158.27 ± 9.75	152.48 ± 4.92
WEIGHT (In Kg)	40.01 ± 7.37	37.48 ± 6.23

Table no.2 shows mean values of PEFR with standard deviation in male and female subjects. It shows PEFR values are more in males than females and it is significant (P=0.0002)

Table No. - 2

PEFR in male and female Groups of the study population.

PFT Parameter	Male	Female	P Value
	Observed Value	Observed value	
PEFR (In Litres / Min)	2.95 ± 1.66	2.22 ± 1.65	0.0002

Table no. 3 shows PEFR values in different BMI groups. 262 subjects were having low BMI.

36 subjects had normal BMI and 2 subjects were overweight. So maximum subjects in study were undernourished as there BMI was low. It can be seen that PEFR values in low BMI subjects was less than the subjects with normal BMI.

Table No. – 3

PEFR values in different Body Mass Index (BMI) groups.

BMI	<18.5 n=262	18.5-25 n = 36	>25 n=2
PEFR (in Liters / Min)	2.64 ± 1.77	4.03 ±1.90	2.62 ± 0.37

Table 4 and 5 shows age wise distribution of PEFR values in boys and girls. It is observed that observed PEFR values were less as compared to percentage predicated values. Also values were less in girls as compared to boys.

Table No. – 4

Age wise distribution of peak expiratory flow rate (PEFR in Litres/min) in boys.

Age in Yrs.	Observed value	S.D.	% Predicted	S.D.
13 – 15	2.7148	1.7990	57.8947	36.72105
15 – 17	3.3278	1.4385	63.4117	24.32791
17 – 19	3.3633	1.0714	44.2222	18.3560

Table No. - 5

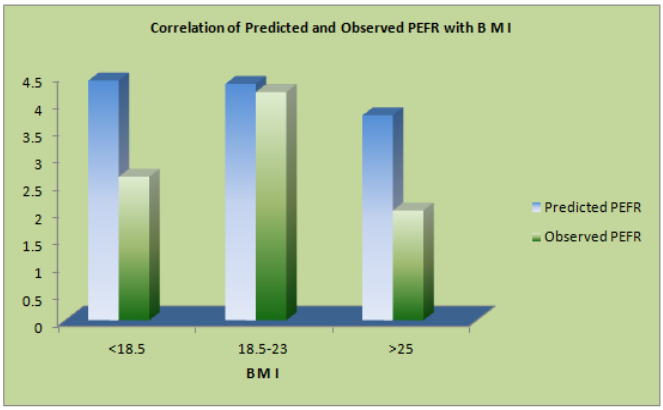
Age wise distribution of peak expiratory flow rate (PEFR in Litres/sec) in girls.

Age in Yrs.	Observed value	S.D.	% Predicted	S.D.
13 – 15	3.8595	16.2971	59.4339	32.8433
15 – 17	2.0000	0.9346	53.5	27.7736
17 – 19	2.7725	1.3721	42.5	21.31

Bar Graph shows observed and predicted PEFR values with BMI groups of low BMI, normal BMI and overweight subjects. In subjects with lower BMI the observed PEFR values are less than predicted values. In subjects with normal BMI observed values were almost equal to predicted values.

The above results shows that PEFR values are less in underweight subjects as compared to normal weight subjects.

Bar Graph



Discussion:

The primary factors that affect PEFR are the strength of expiratory muscles generating the force of contraction, elastic recoil. Pressre of lungs and the airway size [8]. Lung function may vary due to age, gender, height, weight [9].The study of T.J.Ong showed that malnourished children were found to have low PEFR[10].M.M.Faridi ,Pratibha Gupta and co-workers showed that lung function reduces in undernourished young individuals[11].

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. Present study shows PEFR have significant correlation with BMI, similar findings were reported by some authors [12]. PEFR observed values were less than PEFR predicted values as per height of subjects.

Conclusion:

Our study proved the positive correlation between BMI and PEFR . It is observed that PEFR 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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