Original Article

Impact of Anthropometric Parameters on Peak Expiratory Flow Rate

Komal Atta, Sadaf Zia, Farkhanda Jabeen

ABSTRACT

Objective: The aim of the study was to determine the variation of Peak Expiratory Flow Rate (PEFR) with various anthropometric measurements.

Methodology: It was a cross sectional study conducted University Medical and Dental College Faisalabad from August 2019 to September 2019.The study comprised of 210 participants of age 18 to 25 years. A detailed history regarding smoking, respiratory disease and allergies were taken. Body mass index (BMI) was calculated from recorded height and weight. PEFR was measured by Peak flow meter. Data was analyzed by SPSS 21. Mean and SD was calculated for continuous variables. Percentages were estimated for categorical variables. ANOVA and t-test were used for comparison of mean between the groups. Association of PEFR with anthropometric measurements was analyzed by regression analysis.

Results: Of total population of 210 subjects, 60.5% were males 39.5% were females. Mean PEFR was higher in tall than short heighted subjects. This difference was significant. (p value=0.005*). Significant difference in mean PEFR was also noted with respect to weight distribution of subjects (p value = 0.01*). On analyzing the subjects on the basis of BMI, we observed lower PEFR values in underweight and obese subjects in contrast to subjects with normal BMI, however this difference was not significant (p value = 0.42). PEFR was positively associated with height (p value = 0.004*) PEFR was not significantly associated with age, weight and BMI.

Conclusion: PEFR was positively influenced by height and taller subjects have greater PEFR values than short heighted subjects. Age, weight and BMI have no impact on PEFR.

KEYWORDS: Peak expiratory flow rate, Anthropometric measurements, Obese.

INTRODUCTION

Peak Expiratory Flow Rate (PEFR) is a simple and reliable diagnostic tool used for the assessment of pulmonary function for researches as well as clinical settings.[1]It is expiratory parameter which estimates the caliber of the large airways.[2] It is a simple index of lung functions and commonly used in clinical setups for diagnosis and the assessment of progression of air way obstruction including Asthma.[3] It is proved to be a valuable tool in lung function studies for selection of the treatment regimens.[4] Its normal values vary according to racial, geographical, genetic and nutritional background.

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Evidences are available showing impact of age, height, weight and body mass index (BMI) on PEFR, however concerning these always conflicting result have been reported. BMI is an indicator of overweight and obesity and has been found to be associated with pulmonary function parameters.[5]

Many previous studies have documented negative impact of obesity on respiratory parameters due to overall distribution of body fat which limits diaphragm expansion that results in impaired pulmonary function and airway hyper-responsiveness.[5,6] Significant differences have been documented in the Pulmonary pressures and PEFR among the various diverse ethnicities most probably because of variation in body surface area, height and body mass index.

Different ways of lifestyle including physical activity has effect on PEFR.[3] It is imperative to determine the accurate PEFR measurement of population of industrialized regions in respect to distinct influencing factors and to suggest normal reference values as they are more prone to airway obstruction and airway hypersensitivity. Current study was designed to determine PEFR values in non-smoker healthy employees of a private medical college in Faisalabad**.** These people are more prone to airway obstruction due

to excessive smoke and waste disposal in the city. We also aimed to evaluate the variation in PEFR with age, height, weight and BMI, as there paucity of data concerning this association for Faisalabad population.

METHODOLOGY

This cross sectional study was conducted at University Medical and Dental College Faisalabad from August 2019 to September 2019, after taking ethical approval. A total of 210 non-smoker subjects of 18 to 25 years of both genders were recruited from the institute by convenience sampling technique. Relevant information about ethnicity, occupation, lifestyle, history regarding smoking, allergies and frequent respiratory tract diseases were recorded on pre-designed questionnaire. Smokers, subjects with history of respiratory disease, structural deformity of spine and thoracic cage like kyphosis, scoliosis and fused ribs were excluded. Informed consent from each participant was taken and confidentiality was assured. Height in centimeters (cm) and weight in kilograms (kg) were recorded by standard stadiometer (M306800-ADE). BMI was estimated by weight in kg/height in m^2. Physical examination was done to exclude any structural deformity affecting respiratory system. PEFR was recorded by peak flow meter following the standard guidelines. The subjects were instructed to inhale and exhale as hard as possible in a single blow into the apparatus. Test for each patient was repeated three times and highest reading was taken in account for analysis.

Statistical analysis was performed by SPSS 21. Mean±SD was estimated for age, height, weight, BMI and PEFR. Mean values for PEFR among gender were compared by student's t-test. ANOVA was used for comparison of PEFR among the various categories of height, weight and BMI. Association of dependent variable (PEFR) with independent variables (age, height, weight and BMI) was assessed by linear regression analysis. Results of regression analysis were expressed as beta coefficient (β). p value ≤0.05 was taken as statistically significant.

RESULTS

The study comprised of 210 male and female participants. 127(60.5%) of total population comprised of males and 83(39.5%) were females. The mean age of study population was 21.94 ± 4.62 years. Mean height, weight and BMI of participants were 159 ± 7.27, 62.7 ± 11.5 and 24.6 ± 3.3 respectively. The mean PEFR of the study population was 364 ± 63.01 with range 213 to 534 L/min. Males have higher PEFR values in contrast to females (371±59.6 vs 357±67.6), however the difference was not statistical different (p value =0.42). Significant difference was note in PEFR values with respect to weight (p value =0.01*),Table 1.

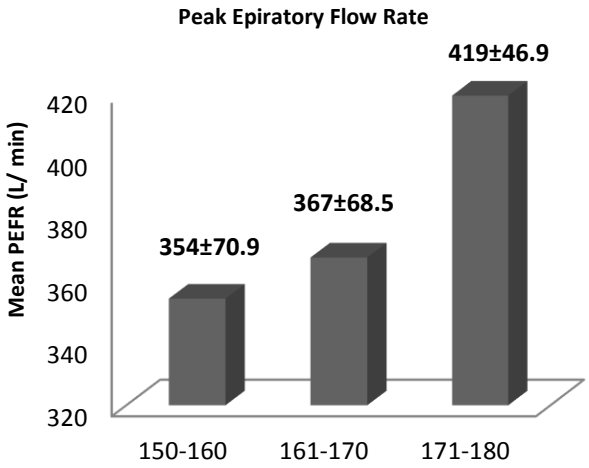
Table 1: Variation in Peak Expiratory Flow Rate with Weight (n= 210)

Weight (Kg)	Frequency n (%)	PEFR (L/min) Mean± SD
30 - 50	43 (20.5)	380.41 ± 74.72
51 - 70	111 (52.9)	372.75 ± 71.03
70 - 90	56 (26.7)	341.62 ± 68.95
p value	**0.01***	

L/min=liters/minute, *statistically significant value at p ≤ 0.05

Mean PEFR values of shorter subjects were lower as compared to taller subjects, which was statistical significant difference. (p value= 0.005*), Figure 1.

Figure 1: Mean Peak Expiratory Flow Rate Sorted by With Height (n= 210)



PEFR = Peak Expiratory Flow Rate, comparison by t-test p value =0.005*, statistically significant value at p ≤0.05

On analyzing the subjects on the basis of BMI, we found lower PEFR values in obese and underweight subjects as compared to normal weight subjects but this difference was not statistically significant (p value =0.28), Table 2. Regression analysis is showing significant positive association of PEFR with height (p value =0.004*). β coefficient of 1.89 shows that increase in 1 cm of height will increase PEFR by 1.89 liters/min. PEFR is not significantly associated with age (p value =0.12), weight (p value =0.27) and BMI (p value =0.93).

Table 2: Variation in Peak Expiratory Flow Rate (PEFR) with BMI (n= 210)

Body Mass Index (BMI)	Frequency n (%)	PEFR (L/min) Mean±SD
Under Weight (BMI<18.5 kg/m^2)	11 (4.28)	360 ± 97.52
Normal Weight (BMI=18.5-22.9 kg/m^2)	61 (26.19)	384 ± 61.66
Over Weight (BMI= 23-24.9 kg/m^2	29 (13.80)	346 ± 85.11
Obese (BMI ≥ 25 kg/m^2)	109 (50.95)	355 ± 66.2
p value	**0.42**	

L/min=liters/minute, statistically significant value at p ≤ 0.05

DISCUSSION

PEFR is a valuable tool for assessing airway caliber and obstruction and has a pivotal role in the identification of obstructive and hyperactive pulmonary diseases.[7] Evidences are available showing impact of anthropometric parameters on PEFR values, due to which the PEFR varies among residents of different geographic areas and ethnicity. Correct assessment of an observed reading of PEFR required knowledge for its range in normal subjects.[1,3]

The Present study was focused to explore range of PEFR among the residents of Faisalabad and to elucidate the impact of age, height, weight and BMI on it which are the key factors for influencing the PEFR. The average PEFR of participants of current study was between 534 and 213 L/min.

A Study conducted at Karachi also reported the similar range between 580 - 250 L/min.[3] In accordance with current results Jena SK also reported the similar reference values of ranged 500 - 340 L/min for the Indian population.[9] The present study observed increase in PEFR with increase in height and this positive association was found to be statistically significant (p value =0.004*). This observation was supported by the previous research conducted in Karachi which also reported the increase in PEFR values with increase in height most probably due to greater thoracic volume, greater strength of expiratory muscle and more muscular effort in tall subjects than short heighted subjects.[3] Similar results were also reported by previous study conducted by Sandhu PK in Punjab India.[7]

Moreover, our study also identified decrease in mean PEFR with increase in weight which was statistically significant difference (p value =0.01*). The association analyzed by regression analysis between these two parameters was negative, however it was found to be statistically non-significant (p value =0.27).

This report was in agreement with previous Indian study that did not establish any significant association between PEFR and weight. Current results are contrasted by the report of Kuti BP who found the significant positive association between PEFR and weight.[8] Conflicting results have been documented concerning relation of PEFR and BMI by various previous researches. On analyzing the impact of BMI on PEFR we found interesting relationship showing decline in PEFR with increase as well decrease in BMI as compared to normal weight subjects. However we did not establish any significant association (p value = 0.93) between theses parameters. Similar observations were made by Sandhu PK and his colleagues.[7] Contradictory results have been reported by Jena SK and his colleagues, they documented significant negative correlation between these two parameters.[9]

Present study also found higher PEFR values in males as compared to females might be because of greater height of males than females. Higher BMI of females than males might be the contributing factor for lower PEFR in females in contrast to males. These findings are also in accordance with documentations of Dharamshi HA and his colleagues in Pakistan.[3] Mukherjee S and his co-researchers also reported same observations.[1] Some researchers had reported decline in PEFR with advancing age due to senile degenerative changes in bronchial epithelium and loss of strength of respiratory muscles.[10] Reduction in PEFR also attributed to oxidative stress in older age which causes release of elastases and subsequent diminution of elastic recoil activity of lung.[10] As we had selected narrow age group of 15-25 years so, we were unable to find the above relationship in our study. Mukherjee S documented the reduction in PEFR with advancing age in Indian population.[1]

Limitations: This is a single center study, results may not be generalized to whole population.

CONCLUSION

PEFR is affected positively by increase in height. Weight and BMI have not significant impact on PEFR.

Recommendation: Future studies on a larger scale from a general population of Faisalabad are required for reference values and generalization of results to whole population.

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Conflicts of Interest: None.

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Author's Contribution:

Dr. Komal Atta	Study design, data collection, manuscript writing and approval. Accountable for provided information.
Dr. Sadaf Zia	Study concept, data collection and drafting, editing and review of article.
Dr. Farkhanda Jabeen	Statistical analysis, interpretation of results, formulation of tables and figures.