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Correlation between Anthropometric Measurements and Peak Expiratory Flow Rate in Healthy Young Adults

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Abstract

Background: *Peak Expiratory Flow Rate is a dynamic lung function test and an accepted index of pulmonary function which is widely used in respiratory medicine.*

With the unplanned growth of industries and vehicular traffic the environment is getting polluted day by day. As a result respiratory problems have become a common ailment. Respiratory ailments such as bronchial asthma and emphysema have become common even among children

Aim: *the purpose of this study was to assess the peak expiratory flow rate in adolescents, to correlate the peak expiratory flow rate in boys and girls and to find out the correlation between peak expiratory flow rate and anthropometric measurements such as body weight, height and age.*

Materials and methods: *A cross-sectional survey of student volunteers was conducted A sample of 100 healthy student volunteers comprising 44 boys and 56 girls with ages ranging from 17 to 21 were selected for the study. The following anthropometric measurements were verified in all the individuals – weight, height, BMI,BSA.*

1)The participants were weighed on a weighing machine (Edryl India) using light clothing and bare foot. 2)Standing height was measured without shoes to the nearest 0.1 cm using a standard measuring scale.3) BMI was obtained using the following formula. BMI = Weight in Kg/Height in m^2

1) BSA was obtained using the Dubois & Dubois formula: $BSA = (Weight^{0.425\,x}\ Height^{0.725)} \times 0.007184$

2) The Wright's Peak flow meter was used for the measurement of PEFR.

Results: *The present study done on 100 students (44males and 56 females) shows that there is an excellent correlation between height and PEFR, weight and PEFR and BSA and PEFR. The correlation between PEFR and BMI was less significant*

Conclusion: *In the present study there were no significant differences by gender for any of the correlations. Peak flow is effort dependent. It primarily measures large airway function and muscular effort. Decreased PEF values should be evaluated for consistent patient effort.*

Keywords: *PEFR. Anthropometric Measurements, Healthy Young Adult*

INTRODUCTION

Peak Expiratory Flow Rate is one of the lung function tests which is easy to perform. It is the maximal rate of air flow which a subject can achieve by a forced expiration.

In the modern day life everybody is exposed to a polluted atmosphere. With the unplanned growth of industries and vehicular traffic the environment is getting polluted day by day. As a result respiratory problems have become a common ailment. Respiratory ailments such as bronchial asthma and emphysema have become common even among children.

Peak Expiratory Flow Rate is a dynamic lung function test and an accepted index of pulmonary function which is widely used in respiratory medicine.

PEFR have been shown to be very useful in the routine monitoring of healthy and asthmatic children. There is a need for a simple effective technique such as PEFR measurement to screen for and control asthma in the community, particularly when the prevalence of asthma and asthma related hospital admissions are rising.

PEFR will enable general practitioners to identify early stages of chronic bronchitis with much greater confidence than is possible on clinical grounds. With the better control of asthma, the number of children admitted to hospital is likely to decrease and management costs in terms of funds and time can be reduced.

PEFR depends on airway resistance. The principal factor which determines PEFR is the degree to which the bronchial airways are patent or obstructed. It is a common clinical observation that if a patient with emphysema is asked to blow out a lighted match with his mouth open he is unable to do unless it is held very close to him. The ability to expire forcibly is what is measured by the peak flow meter. However PEFR depends on other factors as well, notably the sex, age, body size and muscular forces of the individual subject.

In general the PEFR is high in taller and healthy individuals. Normal males have a higher PEF than normal females of the same age and height. PEFR also depends upon nutritional factors. Studies reveal that malnutrition has a negative effect on PEFR.

The PEF is not an absolute index of bronchial obstruction. In this respect it differs from such tests as blood urea for which there is an accepted normal range regardless of the age, size or sex of the subject concerned. PEF on the other hand must be evaluated in the light of all these factors. In practice this means that it must be compared with a predicted normal value for an individual of the given age and height.

In normal males the range of PEFR lies between 450 - 700L/min. Normal females have a lower range between 300 -500L/min . Patients with chronic bronchitis are unlikely to achieve a PEF higher than 400L/min. If their condition is complicated by emphysema, values less than 200L/min are usually found. A fall in peak flow can signal the onset of a flare of lung disease, especially when accompanied by

symptoms such as increased cough, wheezing, shortness of breadth. This may require early treatment to prevent complications.

The peak flow meter has promising applications for research in chronic bronchitis & asthma which is eminently suitable for general practitioners to carry out.

MATERIAL AND METHODS

A cross-sectional survey of student volunteers was conducted in the Department of Physiology, Amrita Institute of Medical Sciences and Research Centre, Kochi.

A sample of 100 healthy student volunteers comprising 44 boys and 56 girls with ages ranging from 17 to 21 were selected for the study. The study was approved by the Research Ethics Committee at Amrita Institute of Medical Sciences, Kochi.

Data collection forms were distributed and the students were asked to fill it up and return them. It contained the information regarding their physical activity, sedentary behavior.

Anthropometry

The following anthropometric measurements were verified in all the individuals – weight, height, BMI,BSA.

The participants were weighed on a weighing machine (Edryl India) using light clothing and bare foot.

Standing height was measured without shoes to the nearest 0.1 cm using a standard measuring scale.

BMI was obtained using the following formula

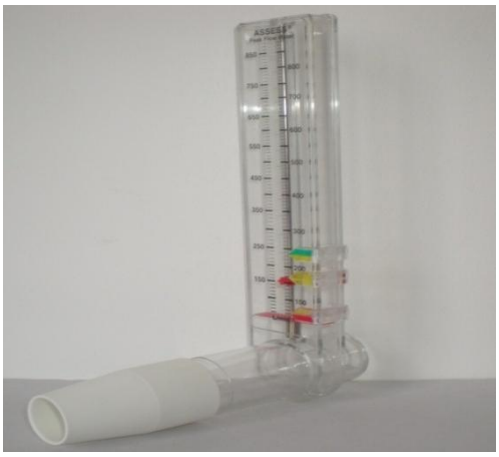
$BMI = \text{Weight in Kg/Height in } m^2$

BSA was obtained using the Dubois & Dubois formula:

$BSA = (\text{Weight}^{0.425\ x}\ \text{Height}^{0.725)} \times 0.007184$

The test was carried out during the afternoons. The test was explained to the students. The indicator was brought at the bottom of the scale. The peak flow meter was kept upright. The subject was told to inhale deeply and to place the mouth firmly around the mouthpiece , making sure their lips form a tight seal

The Wright's Peak flow meter was used for the measurement of PEFR.



Statistical analyses

Statistical analyses were performed using the SPSS for windows software. A 'p' value of less than 0.05 was considered statistically significant.

Results

Diagram -1 Comparison of Mean Height in Males and Females

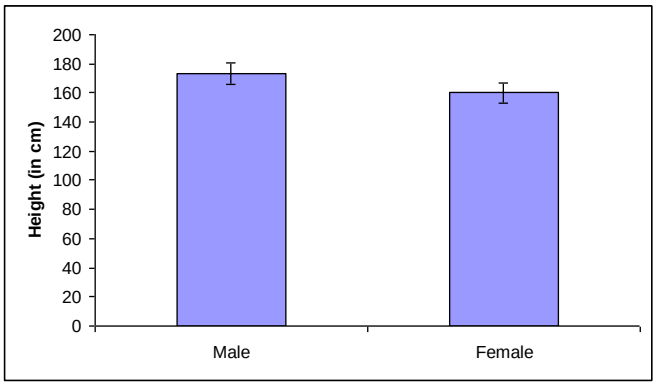


Table -1 Mean & Standard deviation of Height of Males and Females

	Sex	Mean	Standard Deviation	*'P'* value
Height	Male	173.5114	7.26531	<0.001
	Female	160.2500	6.98830	

Diagram -1 shows the comparison of mean height in males and females. Mean height of males is high as compared to that of females.

Diagram -2 Comparison of mean Weight in Males and Females

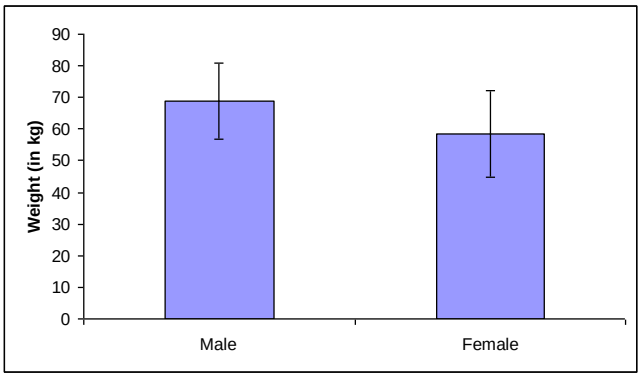


Table -2 Mean & Standard deviation of Weight of Males and Females

	Sex	Mean	Standard Deviation	*'P* 'value
Weight	Male	68.8068	12.10718	<0.001
	Female	58.4018	13.72106	

Diagram -2 shows the comparison between mean weight in males and females

Diagram – 3 Comparison of Mean BMI in Males and Females

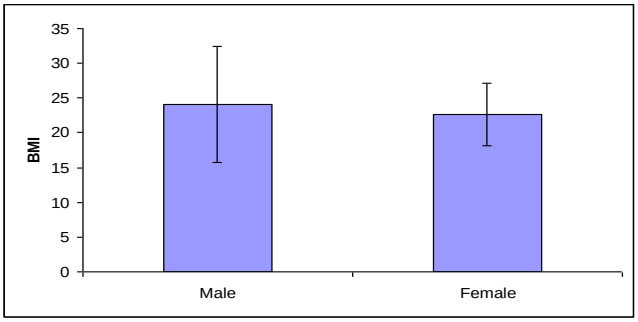


Table -3 Mean & Standard deviation of BMI of Males and Females

	Sex	Mean	Standard Deviation	*'P'* value
BMI	Male	24.0986	8.29767	0.267
	Female	22.6486	4.50430	

In Diagram -3 mean BMI is compared in males and females

Diagram -4 Comparison of Mean BSA in Males and Females

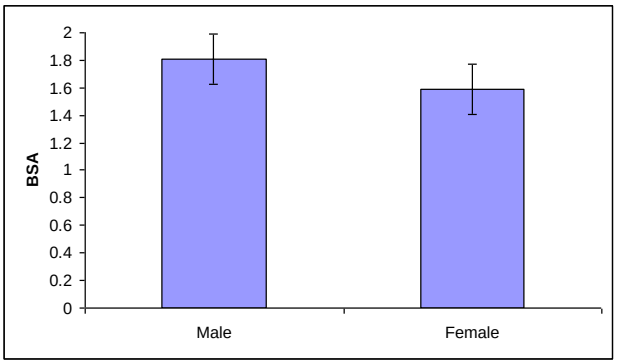


Table -4 Mean & Standard deviation of BSA of Males and Females

	Sex	Mean	Standard Deviation	*'P'* value
BSA	Male	1.8077	0.17502	<0.001
	Female	1.5893	0.18134	

Diagram -4 shows the comparison between mean BSA in males and females

Diagram – 5 Comparison of Mean PEFR in Males and Females

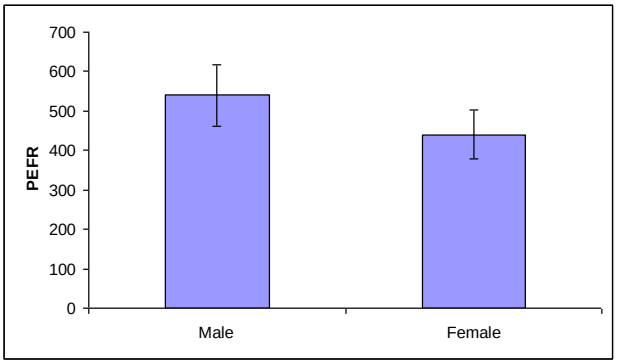


Table -5 Mean & Standard deviation of PEFR of Males and Females

	Sex	Mean	Standard Deviation	*'P'*value
PEFR	Male	540.6818	78.06967	<0.001
	Female	440.5357	62.79605	

Diagram -5 shows the comparison between mean PEFR in males and females.

Diagram -6 – correlation between PEFR and height in males and females

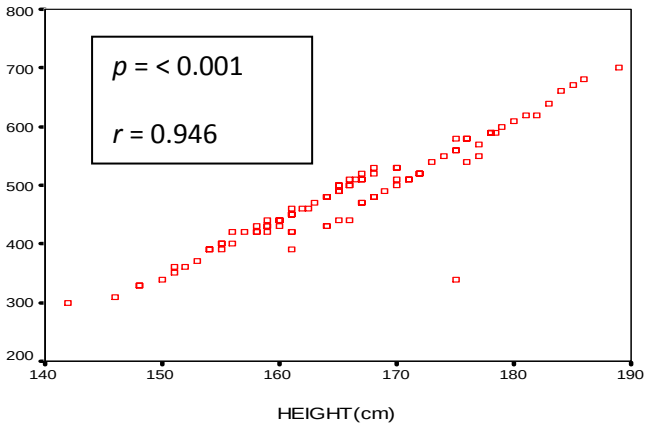


Diagram-6 shows the correlation between PEFR and height in males and females. It shows a p-value of <0.001.It shows that it is highly significant.

Diagram -7 Correlation Between Weight And Pefr In Males And Females

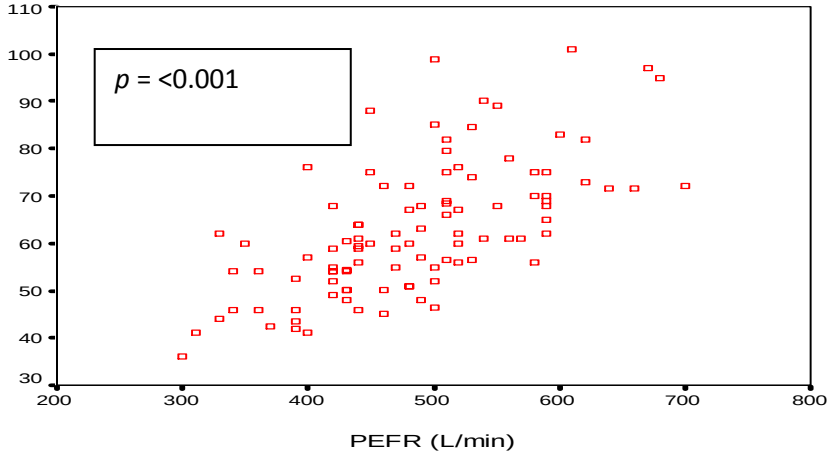


Diagram -7 shows the correlation between PEFR and weight in males and females'p'–value is <0.001 which is significant.

Diagram -8 Correlation Between Bmi And Pefr In Males And Females

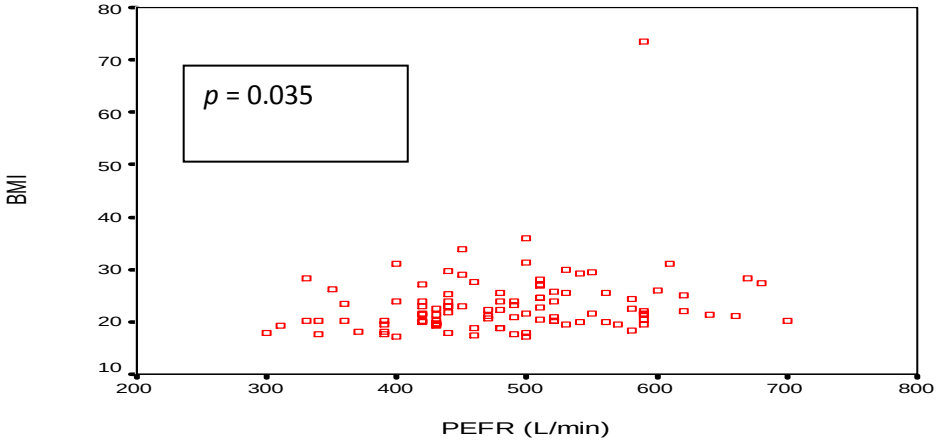


Diagram -8 shows the correlation between PEFR and BMI in males and females. The p-value is 0.035 which is less significant. This may be due to the less sample size as compared to the previous studies.

Diagram -9 Correlation Between BSA And PEFR In males and females

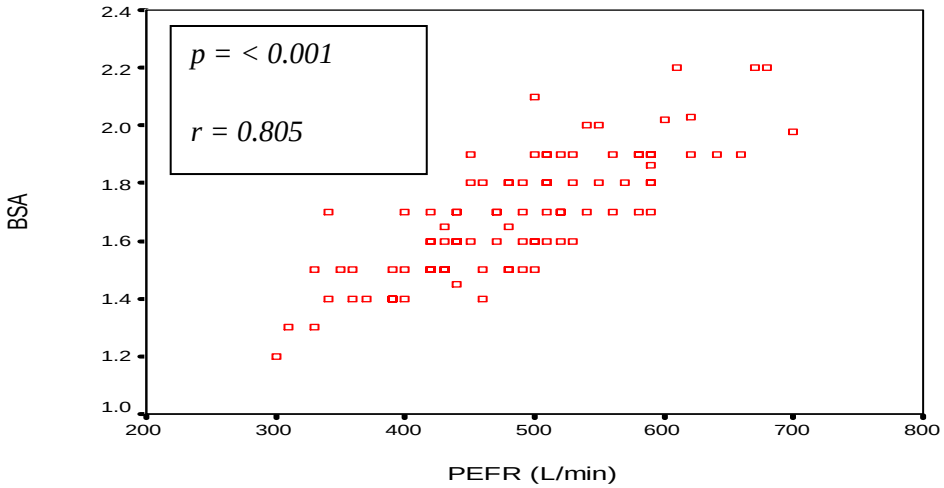


Diagram -9 shows the correlation between PEFR and BSA in males and females.P – value is <0.001 which is highly significant

DISCUSSION

The present study done on 100 students (44males and 56 females) shows that there is an excellent correlation between height and PEFR, weight and PEFR and BSA and PEFR. The correlations being significant at the 0.001 level (2- tailed).This is consistent with the values obtained in many of the previous studies conducted in other countries and in India.

The correlation between PEFR and BMI was less significant, the *'p'* value being 0.035.

In a study on lung function tests and prediction equations in Indian male children, P.Sitarama Raju et al had found that age, height, sitting height, weight, chest circumference, and fat free mass showed significant association with lung functions. The study was done on 1555 normal healthy school boys who were in the age group of 5 – 15 years.

In a study done on 2828 healthy children of age group 12 - 14, J.W.K.Carson et al had found that peak expiratory flow rate increased with age, height and weight.

Debidas Ray et al carried out a study in rural population of Tamil Nadu. In this study 100 males and 100 females of 10 -59 year age were involved. In this study Peak flow ranged from 150 to 500l/min in females and 150 to 600l/min in males. Maximum values of PEF were attained at the age of 32.5 years in men and 35.6 years in women.

The National Asthma Education and Prevention Program suggests a "zone" system, based on the individual's personal best or predicted PEF. The zone system uses green, yellow, and red as indicators for maintaining or altering therapy.

Zone system:

Green 80% -100% personal best

Routine treatment can be continued

Consider reducing medications.

Yellow 50% _ 80% of personal best

Acute exacerbation may be present;

Temporary increase in medication may be indicated; maintenance therapy may need to be increased.

Red < 50 % of personal best

Bronchodilators should be taken immediately; begin oral steroids;

Clinician should be notified if PEF fails to return to yellow or green Within 2 – 4 hours.

CONCLUSIONS

In the present study there were no significant differences by gender for any of the correlations.

The increasing prevalence of pulmonary diseases in a population is an early indicator of an emerging health burden due to the increasing mortality and morbidity due to this in the developing societies.

The PEF attainable by healthy young adult may exceed 10L/sec or 600L/min, BTPS. Peak flow is effort dependent. It primarily measures large airway function and muscular effort. Decreased PEF values should be evaluated for consistent patient effort. PEF values for patients without hyperreactive airways are usually similar with repeated efforts. Asthmatic patients often have a pattern of decreasing PEF with repeated trials. Widely varying peak flows without a pattern of induced bronchospasm suggest poor effort or cooperation. Effort dependence of PEF makes it a good indicator of patient effort during spirometry. Maximal transpulmonary pressures correlate well with maximal PEF. Patients who exert variable effort during FVC maneuvers are seldom able to reproduce their PEF. Some clinicians use PEF in addition to the FVC and FEV1 to gauge maximal effort during spirometry.PEF measurements,when performed with a good effort, correlate well with the FEV1 as measured by spirometry.

Patients with early small airway obstruction may initially have high flows during an FVC maneuver. Despite obstruction, these individuals show relatively normal PEF values. When small airway obstruction becomes severe, PEF also decreases. Reduction in PEF is often less than the decrease in FEF 50% FEF 75% in patients with severe obstruction.

PEF measurements are particularly useful for monitoring asthma patients at home. Daily monitoring of PEF can provide early detection of asthmatic episodes. It can be used to detect day-night patterns (circadian rhythms) related to airway reactivity.PEF monitoring provides objective criteria for treatment. It can help determine specific triggers (e.g., allergens) or workplace exposures that cause symptoms. Daily morning and evening readings are recommended. For patients taking inhaled bronchodilators, PEF may be measured before and after treatment. Significant variation from their personal best or from one reading to the next should be emphasized.

The data from the present study show a significant increase in PEFR with height weight and BSA in boys and girls.

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