



## Correlation of PEFR with height, weight and BMI in school children

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### ABSTRACT

Peak expiratory flow rate is a simple, reliable and promising test of respiratory function. It can be easily measured and correlates well with other lung function measurements and useful guide for monitoring the ventilatory function of healthy and asthmatic children. Aim of the present study was to find out the correlation of PEFR with height, weight and BMI in school children and the objective was to find out if PEFR varies with gender. Study design was observational cross sectional study with convenient sampling. Total 340 samples, both boys and girls between age 8-14 years were selected from a school, in Vadgaon, Pune. Children having acute respiratory infection, asthma, recurrent cough or chest infection A family history were excluded. Pearson's correlation coefficient was used to find out the correlation of PEFR with Height, Weight and BMI. Highest correlation was found between height and PEFR. Moderate correlation was found between weight and PEFR. Minimum correlation was found between BMI and PEFR. PEFR also shows gender variation; boys showing a Higher mean PEFR value.

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### Introduction

Peak expiratory flow rate is a simple, reliable and promising test of respiratory function<sup>1</sup>. It can be easily measured and correlates well with other lung function measurements<sup>2</sup> and useful guide for monitoring the ventilatory function of healthy and asthmatic children.<sup>3</sup> PEFR is an essential measure in the management and evaluation of asthmatic children.<sup>4</sup> It is helpful in monitoring disease progression and response to treatment. Measurement of PEFR has gained worldwide importance in clinical practice for evaluation of patients with obstructive and restrictive airway diseases.<sup>5</sup> PEFR provides a simple quantitative and reproducible measure of resistance and severity of airflow obstruction [2]. The test can be performed easily in any setup with the use of Peak Flow Meter<sup>1</sup>. Peak expiratory flow rate (PEFR) is the largest expiratory flow rate achieved with a maximally forced effort from a position of maximal inspiration (American Thoracic Society, 1995).<sup>6</sup> The PEFR measures maximum flow over 10 milliseconds and is measured in L/min<sup>1</sup>. PEFR varies with sex and body size<sup>1</sup>. Majority of the studies were conducted in rural areas. The need of the study is to see the correlation in the urban population. The predictive normal value of peak expiratory flow rate (PEFR), used in monitoring of healthy and asthmatic children, is correlated with height, but it may vary with other anthropometric measurements and ethnic differences.<sup>7</sup> Studies relating to PEFR and anthropometry among growing children are necessary in India. It is a measurement which is dependent upon several variables including airway resistance, maximal voluntary muscular effort and the possible compressive effect of the maneuver on thoracic airways. Age, height, weight and BSA have all been used either alone, or, in combination to predict PEFR in various studies<sup>3</sup>. PEFR as a measurement of ventilatory function was introduced by Hadron in 1942, and was accepted in 1949 as an index in spirometry (Jain et al., 1983).<sup>4</sup> The association of higher BMI with lower PEFR may indicate that obesity is an important risk factor for reduced airflow or lung function in children.<sup>8</sup> Prevalence of Respiratory diseases in children due to obesity is now

recognized as an important risk factor in the development of several Respiratory diseases.

### Methods

Study design was observational cross sectional study with convenient sampling. Total 340 samples, both boys and girls between age 8-14 years were selected from a school, in Vadgaon, Pune. Exclusion Criteria were Children having acute respiratory infection within 7 days of study, asthma, recurrent cough or chest infection, family history of asthma or any person using metered dose inhaler in the family. Materials used were stadiometer, Weighing scale, Wright's Peak Flow Meter, Nose Clip. After taking permission from the ethical committee of college and school principal, students were explained about the study and assent forms were handed to them. Students whose assent forms were signed were selected for the study. Ages in years, standing height in cm, weight in kg was recorded. The technique was explained and demonstrated to students. A nose clip was used. Each child was asked to blow in the peak flow meter in standing position. Out of three trials, best effort was selected.

Figure 1- Stadiometer



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Figure 2- Weighing scale



Figure 3- Wright's Peak Flow Meter

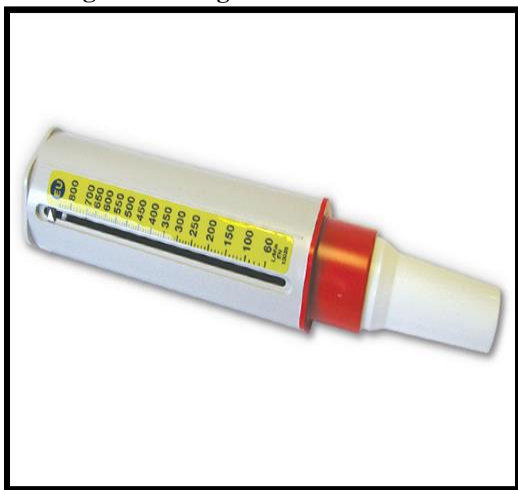


Figure 4- Nose Clip

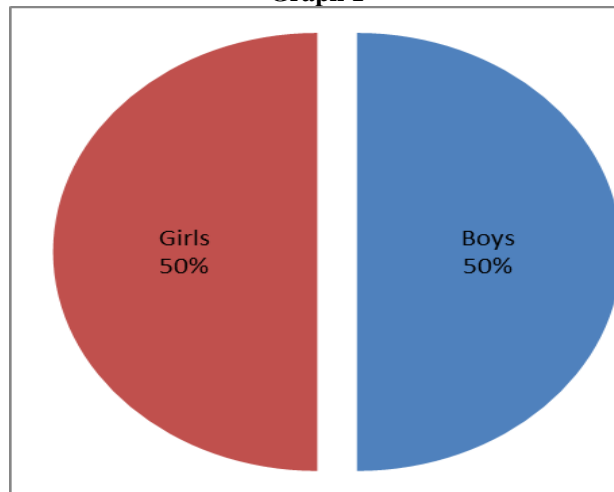


Gender distribution of samples

Table 1

GENDER	Subjects
Boys	170
Girls	170
Total	340

Graph 1

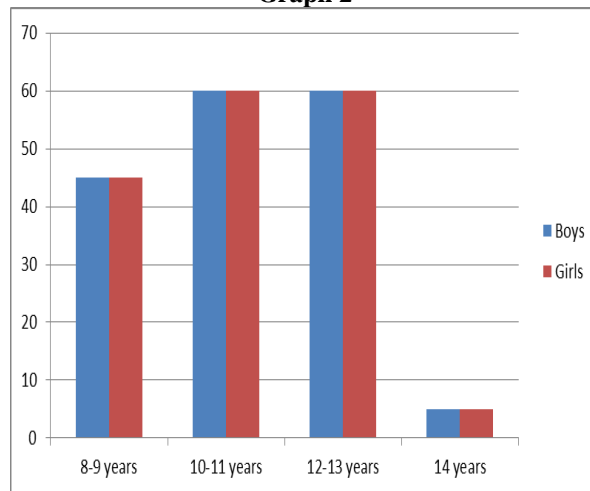


Age Distribution of Samples

Table 2

Age Group(Years)	Boys	Girls	Total
8-9	45	45	90
10-11	60	60	120
12-13	60	60	120
14	5	5	10
Total	170	170	340

Graph 2



Mean and standard deviation

Table 3

Group	Samples	Age (years) mean +-SD	Height (cm) Mean +-SD	Weight(kg) Mean +-SD	BMI (kg/m <sup>2</sup> ) Mean+-SD	PEFR (L/min) Mean+-SD
Boys	170	10.82+-1.67	144.72+-11.27	40.97+-11.27	19.28+-3.43	271.53+-57.12
Girls	170	10.82+-1.67	143.54+-48.47	39.35+-9.66	18.87+-3.25	254.88+-48.47
Combined	340	10.82+-1.67	144.12+-10.12	40.14+-10.12	19.07+-3.34	263.20+-53.57

**Results**

In statistical analysis BMI was calculated using Quetelet Index-weight/ (Height)<sup>2</sup>Standard deviation and mean were found for height, weight, BMI, PEFR.Pearson's correlation coefficient was used to find out the correlation of PEFR with Height, Weight and BMI

**Pearson's Coefficient of PEFR (Boys)**

**Table 4**

	r	r <sup>2</sup>	P
Height	0.8538	0.7290	<0.0001*
Weight	0.6609	0.4368	<0.0001*
BMI	0.1858	0.03452	0.0153**

\*Considered extremely significant

\*\*considered significant

**Pearson's coefficient of PEFR (girls)**

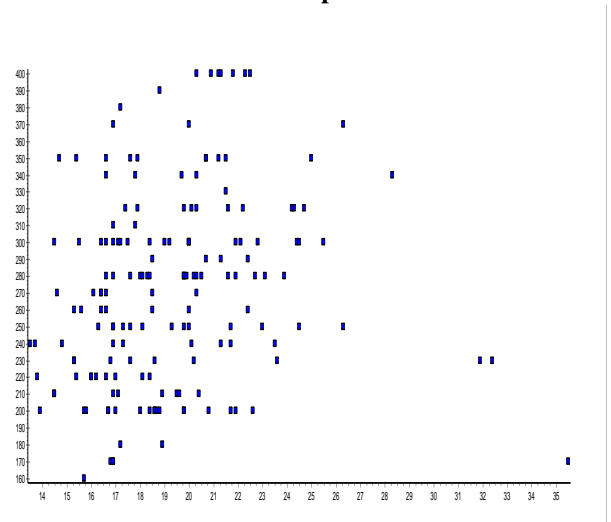
**Table 5**

	r	r <sup>2</sup>	P
Height	0.9191	0.8448	< 0.0001 *
Weight	0.6979	0.4870	< 0.0001 *
BMI	0.2766	0.07648	0.0003*

\* Considered extremely significant

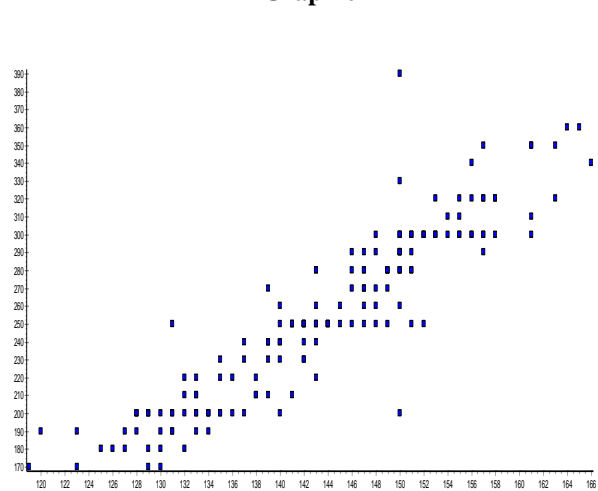
**Graph of correlation between PEFR and BMI in Boys**

**Graph 5**



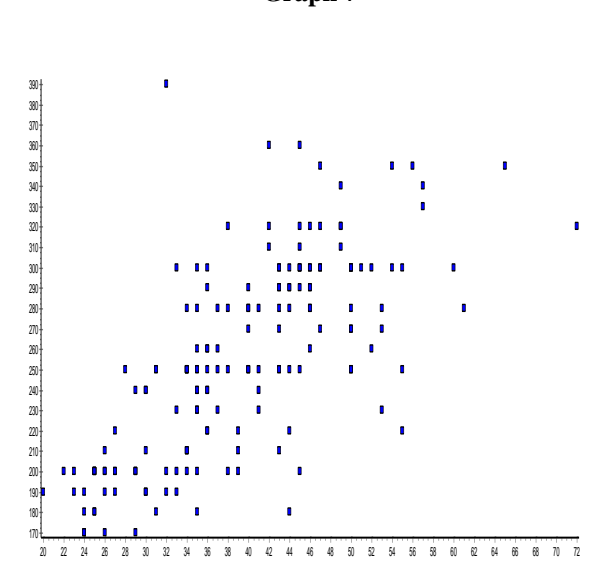
**Graph of correlation between PEFR and Height in Girls**

**Graph 6**



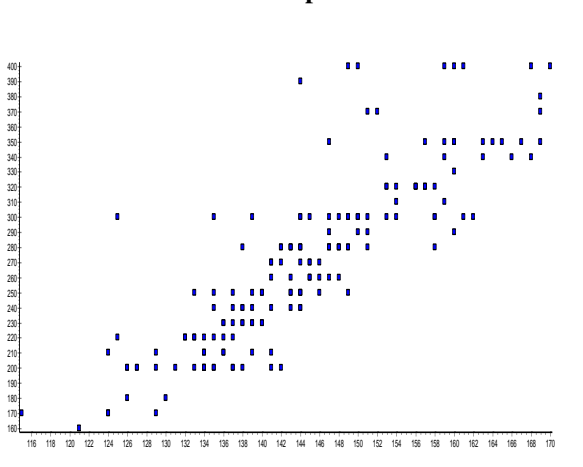
**Graph of correlation between PEFR and weight in Girls**

**Graph 7**



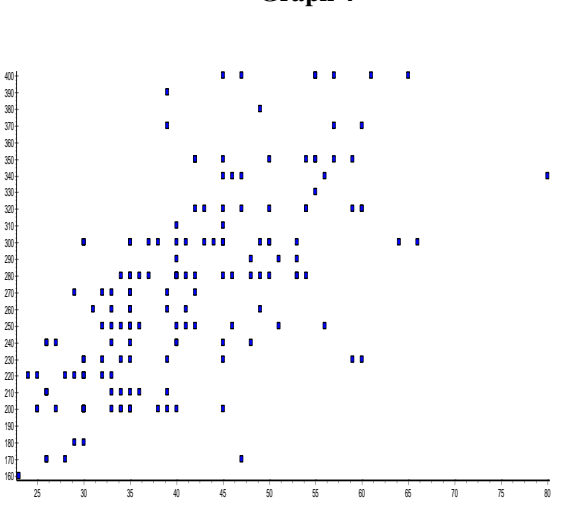
**Graph of correlation between PEFR and Height in Boys**

**Graph 3**

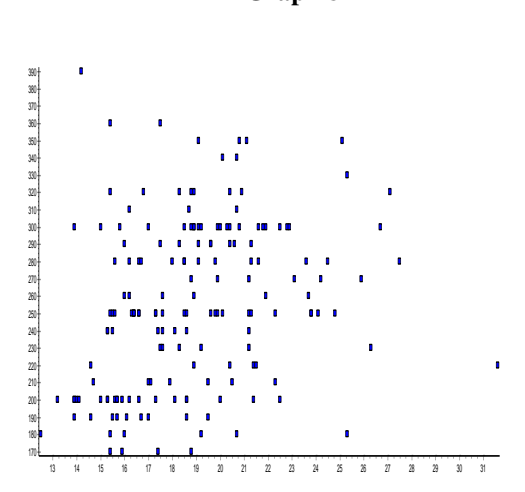


**Graph of correlation between PEFR and weight in Boys**

**Graph 4**



**Graph of correlation between PEFR and BMI in Girls**  
**Graph 8**



**Gender Variation**

The mean value of PEFR is lower in girls as compared to boys.

**Table 6**

Boys	Girls
271.53L/min	254.88L/min

### Discussion and Conclusion

PEFR is the maximal expiratory flow that can be achieved and sustained for a period of 0.01 second. PEFR is very useful in monitoring the long term management of asthma and determining its severity. PEFR is expressed in L/min. PEFR is a simple and reliable way of monitoring the severity of bronchial asthma and assessing the response to treatment<sup>(9)</sup>. Parmar et al studied PEFR values in healthy north Indian school children, which were similar to the findings from the western countries<sup>(10)</sup>. Significant correlation was found between height, weight and BMI with PEFR for both the genders in this study. Highest correlation was found between height and PEFR for both genders. This has also been reported in studies conducted before. Weight also showed a moderate correlation with PEFR for both genders. BMI and PEFR showed minimum correlation in this study. Height is the reliable parameter and correlates well with PEFR. It is the most accurate measurement when taken properly. Weight is influenced by the nutritional status. The difference in height, weight, muscle mass in both the genders could be responsible for different values of PEFR in boys and girls. Similar to our study results, many other authors have also found a significant positive correlation of PEFR with age, height, and weight, out of which height has been maximally correlated with PEFR<sup>(11)</sup>. Within India also, ethnic differences have been shown to account for the variations in the pulmonary functions<sup>(12)</sup>.

It has been shown that pulmonary function, especially lung volume show racial and ethnic differences<sup>(13)</sup>. Mahajan et al reported higher predicted values of PEFR than those in children of other Indian states<sup>(14)</sup>. Kashyap et al<sup>[12]</sup> measured the PEFR of healthy tribal children living at high altitude in the Himalayas and found that the values are comparable with those of north Indian urban children<sup>(15)</sup>.

Future Scope of the study is the study can be further carried out using more variables like BSA, Mid-Arm circumference and Chest circumference. A comparison can also be done between the PEFR in obese and non obese children.

Conclusion of the study was that Highest correlation was found between height and PEFR. Moderate correlation was found between weight and PEFR. Minimum correlation was found between BMI and PEFR. PEFR also shows gender variation; boys showing a Higher mean PEFR value.

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Conflict of interest - None

Ethical clearance -Approved

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