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Peak Expiratory Flow Rate in School Going Children

Surinder Pal Singh[1], Harjinder Singh[2], Leena Chopra[3]

[1]Associate Professor, Department of Pulmonary Medicine, Government Medical College, Patiala, [2]Associate Professor, Department of Pediatrics, Government Medical College, Patiala, [3]Post-Graduate Student Department of Pulmonary Medicine, Government Medical College, Patiala.

Abstract

Background: Pulmonary function tests (PFT's) using complete spirometry help us quantify the state of the respiratory system and aid in the management of respiratory tract illnesses in pediatric practice. However, instrumentation is relatively expensive and only available in hospitals. In contrast, peak expiratory flow rate (PEFR) can be measured using relatively inexpensive peak flow meters and are of value in identifying and assessing the degree of airflow limitation of individuals. To detect any abnormality it is necessary to know the normal values of PEFR in particular region as PEFR depends on geographical, climatic, anthropometric, nutritional, and socioeconomic conditions. The purpose of this study is to get values of PEFR in school going children in Patiala region and its correlation if any with anthropometric parameter such as height. **Subjects and Methods:** A total 600 children of age group 10- 14 years from schools of Patiala district were taken and age, height, weight of children were noted and PEFR was measured. **Results:** The correlation of height and weight with PEFR value among rural and urban children was found to be highly significant (p value<0.001). However there was no correlation found between the PEFR values and the age. **Conclusion:** The correlation of height and weight with PEFR values among urban and rural children was found to be highly significant.

Keywords: Pulmonary function test, Spirometry, Peak Expiratory Flow Rate.

Corresponding Author: Dr. Harjinder Singh, Associate Professor Department of Pediatrics, Government Medical College, Patiala.
Email: drsurinderpal09@gmail.com

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Introduction

Pulmonary function tests (PFTs) are the diagnostic tests that aid in diagnosing and monitoring patients suffering from respiratory diseases. These tests give information about both large and small airways, parenchyma, the size and integrity of the pulmonary capillary bearing. While performing Peak Expiratory Flow Rate(PEFR), patients are asked to perform an inspiration to achieve maximum lung volume, and then make a quick forceful exhalation so that maximum possible amount of air from the lungs is removed.[1]

The clinical use of PEFR requires a comparison with normative /standard data e.g. for asthma, flow limitation is diagnosed objectively if PEFR is < 80% of the normal or reference value.[2] Spirometry is the first and most commonly done lung function test. This test quantifies the state of the respiratory system and aid in the management of respiratory tract illnesses in pediatric practice. However, instrumentation is relatively expensive and only available in hospitals.In contrast peak expiratory flow rate can be measured using relatively inexpensive peak flowmeter which can help in identifying and assessing the degree of airflow limitation. Recent attention to PEFR and attempting to improve the methods for recording, displaying and analyzing its data, makes this interpretative tool as a useful practical instrument in the management of asthma.[3]

Described Peak Expiratory Flow Rate was described as measure of the lung function for the first time by Hadorn in 1942. In 1949 it was accepted as a spirometry parameter. European Respiratory Society states that PEFR is the maximal flow achieved during the phase of expiration, delivered with maximum force, which starts from the maximum lung inflation level. It occurs about 100 ms after a forced expiration start and peaks for 10 ms. It is applied to monitor the disease progress and the treatment outcome.[4-6]

The peak expiratory flow rate (PEFR) is a person's maximum speed of expiration. Its subjective and effort-dependent parameter emerging from the large airways within about 100-120 msec of the start of forced expiration remaining at its peak for 10 msec, it varies with anthropometric, climatic, geographic and nutritional conditions.[7-10]

One of the most common respiratory ailment in childhood is bronchial asthma and its prevalence is increasing over 3-fold in urban areas in two decades. It is associated with frequent fluctuations in airway caliber observed as fall in the peak expiratory flow rate (PEFR) .This fluctuation is one of the earliest signs of an impending acute attack. The response to the therapy can be monitored objectively using serial PEFR measurements. Magnitude of airway obstruction in various obstructive airway diseases, especially asthma can be measured by peak expiratory flow rate (PEFR) which is a reliable and objective way of predicting the status of ailment. PEFR can easily be measured using peak flow meter and can be recorded even by the patient or parents at home.[11]

A wide range of geographical, climatic, anthropometric, nutritional, and socioeconomic conditions of India are associated with regional differences in lung function as well documented in literature.[12]

Anthropometric measurements: Standing height is the best single predictor in childhood for PEFR.[13]

PEFR values do not change according to sexes until the age of 18 years.[14,15]

After the age of 18 years the PEFR values does vary significantly among males and females and with height.[16]

It is often essential and important to have regional values for better predictions.

The purpose of this study is to get values of PEFR in school going children in Patiala region and its correlation if any with anthropometric parameter such as height.

Review of Literature

Aims and Objectives

1. To measure the PEFR of school going children in Patiala region and its relation if any with anthropometric parameters such as height.

Subjects and Methods

A total 600 children of age group 10- 14 years from schools of Patiala district were taken and age, height ,weight of children were noted and PEFR was measured.

Type of Study: This is a observational study.

Inclusion criteria:

1. Children of both the sexes (male and female) between 10-14 year age group.
2. Normal healthy school children of Patiala district.

Exclusion criteria:

1. Child suffering from asthma or having past history of asthma or wheeze.
2. Child with thoracic deformity, or history of ARI within past 2 weeks.
3. Child having history of atopic condition like eczema, hay fever or atopic rhinitis.

Data collection procedure:

For this study, schools (in and around Patiala) were selected randomly. Permission was taken from principal/ headmasters of the institute. 600 students of age group 10-14 years, who fulfilled the inclusion criteria and who did not have any of the exclusion criteria were taken.From each school, targeted samples were selected randomly. Peak expiratory flow rate (PEFR) values were noted for the above mentioned children.

Method Used

The Wright's Peak Flow Meter (Air Med, UK) has been used universally to measure PEFR. The instructions adopted for using the peak flow meter were as follows :

1. Name, age, sex were noted.
2. Height of each child was measured.
3. Weight of each child was noted.
4. Child was asked to take a full deep breath in and hold the peak flow meter horizontally.
5. Put mouth piece of peak flow meter in mouth blow out as hard and as fast as one can in a short sharp blow with flowmeter still horizontally.
6. With such standard procedure,3 readings are to be taken at a time and the best reading to be considered.

For each subject the recordings were noted and normal values were calculated.

Results

In this observational study conducted on 600 subjects, age group 10-14 years. Three PEFR values of each subject were taken and its relation if any with anthropometric parameters such as height was observed.

Table 1: Socio-demographic profile & PEFR of the study population among rural and urban areas.

	Rural		Urban		P value
	Mean	±SD	Mean	±SD	
AGE	11.41	1.089	11.58	1.111	0.059
HEIGHT	141.86	3.063	141.62	3.269	0.341
WEIGHT	38.53	2.472	38.47	2.289	0.758
BMI	19.13	1.032	19.21	1.052	0.356
BEST PEFR	243.50	16.050	241.50	20.530	0.184

Table 2: Correlation of the PEFR values with the anthropometric parameters among Rural children.

Rural	BEST PEFR Summer		BEST PEFR Winter	
	r value	P value	r value	P value
AGE	-0.018	0.756	-0.024	0.683
HEIGHT	0.572	<0.001**	0.699	<0.001**
WEIGHT	0.355	<0.001**	0.402	<0.001**
BEST PEFR Summer			0.774	<0.001**
BEST PEFR Winter	0.774	<0.001**		

Pearson correlation: **p < 0.001; Highly Significant

[Table 1] shows socio-demographic profile & best PEFR of the study population among rural and urban areas. The differences in the age distribution & other sociodemographic parameters i.e. height, weight, BMI among the rural and the urban groups were not statistically significant.

[Table 2] shows correlation of the PEFR values with the anthropometric parameters among rural children. The correlation of height and weight with PEFR value among rural children was found to be highly significant (p value<0.001). However there was no correlation found between the PEFR values and the age.

[Table 3] shows correlation of the PEFR values with the anthropometric parameters among urban children. The correlation of height, weight and BMI with PEFR values among urban children was found to be highly significant (p value<0.001). However there was no correlation found between the PEFR values and the age.

Table 3: Correlation of the PEFR values with the anthropometric parameters among Urban children.

Urban	BEST PEFR Summer		BEST PEFR Winter	
	r value	P value	r value	P value
AGE	0.008	0.884	-0.007	0.908
HEIGHT	0.819	<0.001**	0.881	<0.001**
WEIGHT	0.344	<0.001**	0.377	<0.001**
BMI	-0.284	<0.001**	-0.308	<0.001**
BEST PEFR			0.927	<0.001**

Pearson correlation: **p < 0.001; Highly Significant

Discussion

In a study by Paramesh H et al in 2003, a total of 5477 normal children were selected for the study. 2838 (51.8%) were boys; 2639 (48.2%) were girls. 4817 (87.9%) were from urban area and 660 (12.1%) were from rural areas. PEFR values correlated best with height, there was no difference in sexes, religion and urban/rural children.[17]
Manjunath CB et al in 2013 measured PEFR in 1028 children aged 5 to 16 years by using Wright's mini peak flow meter and they concluded that reference values of PEFR are affected by regional, environmental and anthropometric factors.[18]
In a study by Kaur Harpreet et al in 2013, 300 healthy women who were aged 20-50 years were selected from the Malwa region of Punjab and their PEFRs were determined. The influences of age, height, weight, BSA and BMI on the PEFR were studied. The PEFR test was performed by using a mini Wright Peak Expiratory flow meter. It was concluded that the PEFR increases with an increase in age, height, weight and BSA, but that decreases with an increase in the BMI.[19]
In a study conducted by Shallu Mittal et al in 2013, PEFR was measured in 366 healthy school children (186 boys and 180 girls) of Patiala district. Using the Mini Wright Peak Flow Meter the best of the three attempts was recorded.[20]

Study	Result and conclusion
Manjunath et al,[18]	Significant correlation of PEFR with height in boys (p<0.001, r=0.7624) and in girls (p<0.001, r=0.8825). However there was no correlation found between the PEFR values and the age
Kaur Harpreet et al,[19]	The study showed that PEFR increased with an increase in height and weight.
Taksande et al,[21]	Positive correlation between height and PEFR
Pulickal et al,[22]	Linear relation between PEFR and height in males and in females.
In our study	Our study showed that PEFR increased with an increase in height.

Mean height in rural and urban groups in study population which is 141.86 in rural group and 141.62 in urban subjects. The correlation of height with PEFR values among rural and urban children was found to be highly significant(p value<0.001) as supported by studies of Manjunath et al,[18] in 2013 .In a study by Manjunath CB,[18] in 2013 ,they showed a significant linear correlation of PEFR with height in boys (p<0.001, r=0.7624) and in girls (p<0.001, r=0.8825). However there was no correlation found between the PEFR values and the age .In a study by Kaur Harpreet et al,[19] in 2013, it was concluded that the PEFR increases with an increase in height and weight. Taksande et al,[21] in 2008,carried study on 1078 children and found positive correlation between height and PEFR. Pulickal et al,[22] in 2007 found a significant linear relation between PEFR and height in males (p < 0.001, r = 0.856) and in females (p < 0.001, r = 0.762)
Mean weight in rural and urban groups in study population which is 38.53 and 38.47 respectively. The correlation of weight with PEFR value among rural and urban children was found to be highly significant (p value<0.001). In a study by Kaur Harpreet et al,[19] in 2013, it was concluded that the PEFR increases with an increase in weight. Taksande et al,[21] in 2008,carried study on 1078 children and found positive correlation between weight and PEFR.

Study	Result and conclusion
Kaur Harpreet et al,[19]	The study showed that PEFR increased with an increase in weight.
Taksande et al,[21]	Positive correlation between weight and PEFR.
In our study	The study showed that PEFR increased with an increase in weight

Conclusion

In our study it was concluded that:

1. The correlation of height and weight with PEFR values among rural children was found to be highly significant (p value<0.001) i. e. PEFR in rural subjects depends on height and weight.
2. The correlation of height and weight with PEFR values among urban children was found to be highly significant (p value<0.001) i.e. PEFR in urban subjects depends on height and weight.

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