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Research Article

PEAK EXPIRATORY FLOW RATE (PEFR) MEASUREMENTS IN HEALTHY SCHOOL CHILDREN IN SRINAGAR, KASHMIR

Uruj Altaf Qureshi*, Mahbooba Rasool and Inaam ul Haq

Govt.Medical College, Srinagar

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ABSTRACT

Background: Peak expiratory flow rate recording is an important measure in the management and evaluation of chidren with asthma. The aim of the study was to construct the normal PEFR values of school going children in the age group of 10 – 16 years.

Objective: To obtain reference values for PEFR among children aged 10 to 16 years in Srinagar.
Material and methods: This cross sectional study was conducted among 639 children (336 boys and 303 girls) of Srinagar city aged 10 to 16 years studying in V to VII standard during March 2012 to May 2013. A preformed, pretested questionnaire was used and detailed general physical and systemic examination was done to label children as normal. Height and weight were measured. PEFR measurements were done in standing position with Wrights Mini Peak Flowmeter after taking informed consent from parents.

Results: Of all 639 subjects studied, males comprised 52.6% and females comprised 47.4%. Mean age was 12.93 years (SD = 2.00 years). Mean PEFR was 277.38 L/min (males: 300.6 L/min and females: 250.8 L/min). The difference between PEFR in girls and boys was significant. A positive correlation was found between PEFR and anthropometric variables, with highest correlation with height. For same height there was a significant difference in PEFR in boys and girls.

Conclusion: The normal reference ranges for PEFR as per sex and height given in this study can serve as a standard, since there is a need to have regional values for PEFR in a country like India with considerable diversity.

INTRODUCTION

Pulmonary function tests of various types are utilized to understand the severity, course and progress of airway diseases. The peak expiratory flow rate (PEFR) measurement is a simple, reproducible and reliable way of understanding the airway obstruction in asthma. The peak expiratory flow rate (PEFR) is an effort-dependent parameter, emerging from the large airways within about 100-120 m sec of the start of forced expiration. It remains at its peak for 10 msec.[1] A wide range of geographical, climatic, anthropometric, nutritional and socioeconomic conditions are associated with differences in lung function including PEFR .[2] Therefore, the importance of having regional reference values cannot be overlooked. No data is available about PEFR measurements in children in Srinagar. This study aims to construct normal PEFR values in both sexes in the age group of 10 to 16 years according to height and weight in normal children of Srinagar.

Aims and Objectives

1. To establish normal values of PEFR in children of Srinagar (10-16 years).
2. To find out the correlation of various anthropometric parameters with PEFR.
3. Derive predictive correlative equations of PEFR with age, weight and height.

MATERIALS AND METHODS

Study period: March 2012 to May 2013.
Study design: Prospective cross sectional study.
Place of study: Schools of Srinagar.

The study was conducted on normal healthy school children of 10-16 years in Srinagar, J&K region. The study was approved by ethical committee of Government Medical College, Srinagar. Prior permission from chief educational officer and school authorities was taken. Written consent from the parents of the selected subjects was also taken.

Corresponding author:* **Uruj Altaf Qureshi
Govt.Medical College ,Srinagar

Inclusion criteria

1. Normal Healthy children of both sexes, aged 10 to 16 years of age.

Exclusion criteria

1. History of respiratory illness within week prior to study.
2. History and examination suggestive of allergic rhinitis, atopic dermatitis orasthma.
3. History and examination suggestive of any major systemic disease.
4. Family history of asthma.
5. Structural deformity of thoracic cage.
6. History of smoking.

Subjects who were not able to cooperate with the procedure were also excluded.

Based on the ISSAC (International study on Allergy and Asthma in Childhood) and ECRHS II (The European Community Respiratory Health Survey II) questionnaire, a modified pretested questionnaire was formulated and children with asthma like symptoms excluded.[3,4] A detailed general physical and systemic examination was done to rule out any cardiac or respiratory disease. Out of a total of 806 children examined, 639 children (336 boys and 303girls) qualified for the study. Age, sex, weight and height were recorded. Age was taken from the date of birth recorded in school register. Weight was measured with subject dressed in light clothes by bathroom scale which was calibrated by a known weight every morning. Height was recorded by a stadiometer. All children's Peak Expiratory Flow Rate (PEFR) was measured in standing position holding the Wrights Mini Peak Flowmeterin horizontal position, without interfering with the movement of marker or covering the slot. After demonstration, subjects were asked to take deep inspiration and then to blow into the instrument as forcibly as possible after maintaining a tight air seal between the lip and mouth piece of the instrument. Three readings were taken and highest of the three was taken into consideration. The mouthpiece was washed and sterilized for each subject.

Statistical analysis

The data comprised PEFR values, which were processed for mean and standard deviation. Age, height, and weight were the independent variables, while PEFR value was the dependent variable. Student's unpaired *T*-test was used to compare the PEFR values between groups. *P* value of < 0.05 was considered statistically significant. Correlation between age, height, weight, and PEFR was done using Pearson's correlation. Regression equations based on age, height and weight were constructed for both boys and girls. The statistical analysis was carried out with SPSS version 20.

RESULTS

639 healthy school children of both sexes were analyzed for PEFR values. There were 336 (52.6%) boys and 303 (47.4%) girls. Mean PEFR was 277.38 L/min (SD = 78 L/min).

The mean age of boys was 12.76±2.07 years, mean height was 151.65±13.18 cm and mean weight was 41.44±9.77 kg. The mean age of girls was 13.12 ± 1.91 years, mean height was149.75±8.92 cm and mean weight was 42.19±9.96 kg. The mean PEFR of boys and girls was 300.6 ± 81.6 L/minand 250.8 ±64.2 L/min respectively (Table 1).

Table 1 Anthropometric variables and Peak Expiratory Flow Rate (mean ±SD).

Variable	Boys (n= 336)	Girls (n= 303)	p value*
Age (years)	12.76±2.07	13.12 ± 1.91	0.026
Height (cm)	151.65±13.18	149.75±8.92	0.033
Weight (kg)	41.44±9.77	42.19±9.96	0.335
PEFR (L/min)	300.6±81.6	250.8±64.2	0.000

*p < 0.05 is significant

The age of children ranged from 10 to 16 years with a mean age of 12.93 years (SD = 2.00years). The height of children was in the range of 120-177cm with a mean height of 150.75cm (SD = 11.39cm). The weight was in the range of 21 to 80 kg, with a mean weight of 41.80 kg (SD=9.86). The PEFR values increased in linear relation with age, weight and height. Further, the difference between mean PEFR of different age, weight and height groups was statistically significant (Table 2).

Table 2 Description of the PEFR values of Anthropometric variables

PEFR/	Minimum	Maximum	Mean	SD	CI	P value
Age groups(years)						
10-11	120	396	259.8	64.92	250.2-269.4	
12-13	120	426	265.8	62.46	256.8-275.4	
14-15	180	600	274.2	87.36	274.2-300	0.000
≥ 16	168	708	317.4	96.6	297-337.8	
Height groups(cm)						
120-140	120	390	238.2	58.44	228.6-248.4	
141-160	120	438	273	63.9	266.4-279	0.000
161-180	168	708	344.4	105.12	324-364.8	
Weight groups(kg)		420	257.4	61.8	250.2-264	
20-40	120	600	292.2	83.4	282.6-301.2	
41-60	156	708	339	120	284.4-393.6	0.000
61-80	198					

Correlation coefficient of PEFR with age, height and weight was calculated. Positive correlation was seen between PEFR and anthropometric variables with highest correlation found with height. On comparing correlation coefficient between boys and girls, significant difference was found in height and weight coefficients between the two groups (Table 3).

Table 3 Comparison of PEFR values as per height groups in boys and girls

PEFR/Height	Boys		Girls		P value
	N	Mean±SD	N	Mean±SD	
120-140	83	254.4±62.82	55	214.2±40.8	0.000
141-160	162	295.2±55.2	234	257.4±64.8	0.000
161-180	91	352.8±105.6	14	288.6±81	0.033

For same height there was a significant difference in PEFR in boys and girls (Table 4).

Table 4 Correlation between anthropometric variables and PEFR in study group

Variable	co-efficient (r)Correlation			Significance
Peak expiratory flow rate	Boys(n=3	Girls(n=369)	Total(n=746)	(2 tailed)
Age	0.296	0.258	0.236	0.149
Height	0.447	0.252	0.388	0.0005
Weight	0.428	0.299	0.339	0.002

The prediction equation for estimation of the expected values of PEFR based on height was calculated, since highest correlation of PEFR was found with height. Separate prediction formulas were predicted for boys and girls.

For boys the prediction equation derived is
PEFR = 2.76(Ht cm) -121.08 L/min

For girls the prediction equation derived is
PEFR = 1.8(Ht cm) – 22.5L/min

Table 5 Comparison of PEFR (L/min) predicted from the present series with those of previous studies in children of other states in India.

Source of data	Height					
	120 cm		160 cm		140 cm	
	Boys	Girls	Boys	Girls	Girls	Boys
Parmar (1977) [5]	198.29	228.51	299.45	312.17	400.61	395.83
Singh &Peri (1978) [6]	179.60	169.20	279.60	269.80	379.60	370.40
Malik (1982) [7]	222	216	320	314	418	412
Mahajan et al (1984) [8]	196.70	-	296.70	-	396.70	-
Kashyap et al (1992) [9]	202.33	175.10	303.73	263.30	405.13	351.50
Swaminathan (1993) [10]	205	193	286	272	368	350
Sharma R (2002) [11]	199.20	186.70	285.88	273.90	372.50	361
Taksande A (2006) [12]	217.49	178.94	311.49	251.74	405.49	324.54

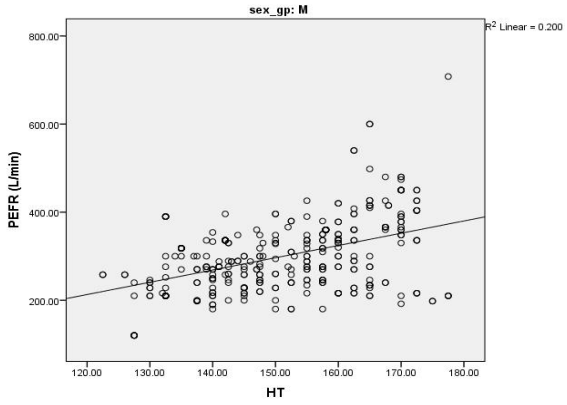

Fig 1 Correlation between PEFR and height in males

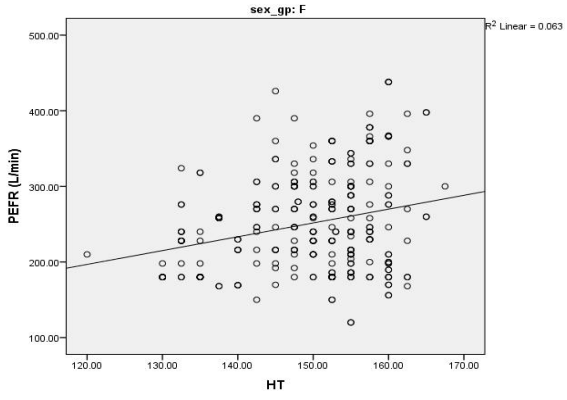

Fig 2 Correlation between PEFR and height in females

DISCUSSION

Pulmonary function tests of various types are utilized clinically as well as epidemiologically to measure functional status of respiratory system. Though they do not provide a specific diagnosis, they help us to understand the severity, course and progress of the respiratory diseases. The peak expiratory flow rate (PEFR) measurement is simple, reproducible and reliable way of judging the degree of airway obstruction in various obstructive pulmonary diseases, especially asthma. Peak expiratory flow rate is easily measured by using a mini-Wright's peak flow meter, which is easy to use, reliable and can be recorded even by the patients or by the parents at home. Pulmonary functions exhibit racial and ethnic differences. This study aimed to establish reference values for PEFR for healthy children of Srinagar, so that local reference standards are available when this measurement is used for the assessment of asthmatic children.

Singh *et al*[6] found that PEFR in south Indian school children was lower than that observed in western and north Indian children. Mahajan *et al*[8] reported higher predicted values of PEFR than those in children of other Indian states. On comparing our data with previously published western values, we found that PEFR measurements are lower than that reported for Caucasian. The difference is marked when one compares recent western values as there has been a gradual increase in body size and presumably lung volumes. The lower PEFR values in Indian children could be an effect of lower lung volumes due to smaller chest size as has been reported previously in adults. Within India also, ethnic differences has been shown to account for difference in pulmonary function in adults and therefore it is important to establish reference values for each group. PEFR values increased in linear relation to age, weight and height. 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 .[12, 13] We used height for constructing the regression equation for predicting PEFR because it is a convenient measurement and its assessment is accurate, if proper technique is used. Assessment of correct age in rural area in many instances is not possible and accurate weight measurement in field studies may sometimes pose a problem. It has been shown that pulmonary function, especially lung volume show racial and ethnic differences. In conclusion, this study has generated preliminary reference values for PEFR in children of Srinagar, India.

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