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Research Article

Study of PEFR in urban lower and middle class high school children at Bangalore, India

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ABSTRACT

Background: Peak expiratory flow rate (PEFR) recording is an essential measure in the management and evaluation of asthmatic children. The PEFR can be measured by a simple instrument-peak expiratory flow meter. The aim of this study was to determine the normal PEFR in Urban lower and middle class high school children at Bangalore, India.
Methods: The PEFR was measured in 1000 healthy urban school children living in Bangalore, India using the mini-wright peak flow meter. All measurements were obtained in a standing position and the best out of three trials was recorded. Anthropometric measurements, weight, height, and mid-upper-arm circumference (MAC) were recorded, and body surface area (BSA) and body mass index (BMI) were calculated.
Results: Positive correlation was seen between age, height, weight and PEFR. The regression equations for PEFR were determined for boys and girls separately. The boys had higher values than the girls at all heights. The prediction equation for PEFR based on height was PEFR = 3.64 height (cm)-257.86 (R=0.47, R^2=0.22) for female; PEFR = 4.7 height (cm)-346.51 (R=0.62, R^2 =0.38) for male.
Conclusions: PEFR is a reliable measurement, which can be used routinely and regularly in urban areas for assessment of airway obstruction and prediction formula derived for use in this population.

Keywords: Asthma, Peak expiratory flow rate, Respiratory function tests

INTRODUCTION

The peak flow meter is a useful instrument for routine monitoring of the peak expiratory flow rate (PEFR) in healthy and asthmatic children.[1-3] Ventilation function studies in adult population from different parts of India are well documented, but the similar data in children are limited.[4-7] The measured PEFR is compared with the predicted PEFR of the subjects which is matched to the same sex, age, body size and ethnic group. This parameter is used to screen and monitor the severity of asthma in the community, particularly when the prevalence of asthma and asthma-related hospital admissions are rising.[5,6] Studies relating to PEFR and anthropometry among growing children are necessary in India as the mosaic of Indian population spreading over such a differing geography is varied and complex. The present study was designed to measure the PEFR in urban school children.

METHODS

The schools situated in Bangalore district, India selected randomly were included in the present study. Children with major medical illness and those having acute respiratory infections within 7 days of the study were excluded. The children with asthma were excluded. The exclusion criteria for recurrent cough or chest infection; a

family history of asthma or any person taking bronchodilator metered- dose inhaler (MDI) in the family; rhonchi or wheeze on auscultation. The anthropometric indices such as height, weight, mid-upper arm circumference and head circumference were recorded. The height nearest to 0.1 cm and weight nearest to 0.1 kg with minimal clothing were measured using the height and weight scale. Mid- upper-arm circumference (MAC) was measured in an extended arm, midway between the tip of the acromion process of the scapula and the olecranon process of the ulna. Body surface area (BSA) and body mass index (BMI) were derived using the height and weight of the children.[2,8] All of the children were examined thoroughly to exclude any underlying heart, lung or systemic disease. At rest and in a standing position, each child blew three times, without nose clip, into a standard mini-wright peak flow meter (60-800 L/min). The highest of the three results obtained was taken as the final PEFR for each subject. Prior to recording the PEFR of students, the use of the instrument was repeatedly demonstrated and explained.

Statistical analysis

The data were analyzed using SPSS 10.0 statistical package. An unpaired Student's t test was used to test the differences between the means. Pearson's correlation coefficients, r, r^2, R and R^2 were calculated. Linear regression equations for PEFR (dependent variable) in relation to height and weight (independent variable) were determined for boys and girls separately. A P value <0.05 was considered statistically significant.

RESULTS

A total of 451 boys and 549 girls, aged 8-15 years, came mostly (80%) from a lower socioeconomic group. The anthropometric data of the urban school children are shown in Table 1. The measured PEFR ranged from 100 to 600 L/min. Figure 2 illustrates the PEFR values in relation to height.

Table 1: Anthropometric data of the study group.

Study group	No. of cases	Age (months)	Height (cm)	Weight (kg)	MAC (cm)	BMI (cm)
		Mean±SD	Mean±SD	Mean±SD	Mean±SD	Mean±SD
Boys	451	162.74±18.72	148.09±11.91	34.15±8.27	19.30±3.44	15.36±2.10
Girls	549	160.09±20.87	144.65±11.15	33.87±7.69	20.07±3.82	16.01±2.14
Combined	1000	161.29±18.68	146.21±12.01	33.82±7.91	19.72±5.33	15.72±2.05

MAC: Mid-upper-arm circumference; BMI: body mass index; BSA: Body surface area.

The PEFR values increased in linear relation to age, weight, height, MAC, BMI and BSA. The coefficients of correlation for age, weight, height, MAC, BMI and BSA variables were significant (P<0.001). The highest correlation was obtained between PEFR and height. Statistically significant correlation was found in both sexes between PEFR and standing height (male, r=0.62, r^2=0.38, P<0.001; female, r=0.42, r^2=0.17, P<0.001), weight (male, r=0.51, r^2=0.26, P<0.001; female, r=0.45, r^2=0.20, P<0.001), BSA (male, r=0.51, r^2=0.26, P<0.001; female, r=0.43, r^2=0.18, P<0.001), BMI (male, r=0.19, r^2=0.03, P<0.001; female, r=0.24, r^2=0.05, P<0.001), and MAC (male, r=0.29, r^2=0.08, P<0.001, Peak expiratory flow rate of urban school children female, r=0.15, r^2=0.02, P<0.001).

The prediction equations for PEFR based on height and weight alone are given below for boys and girls separately: (1) PEFR (female) = 3.64 height (cm)-257.86 (R=0.47, R^2=0.22), PEFR (male) = 4.7 height (cm)-346.51 (R=0.62, R^2=0.38); (2) PEFR (female) = 4.27 weight (kg) + 124.42 (R=0.43, R^2=0.18), PEFR (male) =5.6 weight (kg) + 159.37 (R=0.51, R^2=0.26). The predicted PEFR values from our data were also compared with published values (Table 2).[6,7,9-13]

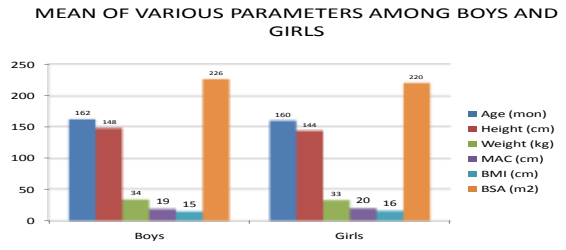

Figure 1: Mean of various parameters among boys and girls.

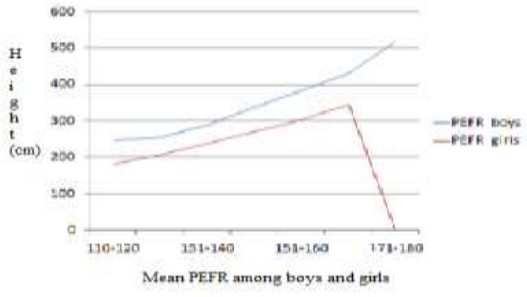

Figure 2: PEFR (L/min) in relation to height in boys and girls.

Table 2: Comparison of PEFR (L/min) predicted from the present series with those of previous studies in children of other states in India.

	Height					
Source of data	120 cm		140 cm		160 cm	
	Boys	Girls	Boys	Girls	Boys	Girls
Parmar [9]	198.29	228.51	299.45	312.17	400.61	395.83
Singh ,Peri[10]	179.60	169.20	279.60	269.80	379.60	370.40
Malik[6]	222	216	320	314	418	412
Mahajan et al[11]	196.70	-	296.70	-	396.70	-
Kashyap et al[12]	202.33	175.10	303.73	263.30	405.13	351.50
Swaminathan [7]	205	193	286	272	368	350
Sharma R[13]	199.20	186.70	285.88	273.90	372.50	361
Present study	217.49	178.94	311.49	251.74	405.49	324.54

PEFR: peak expiratory flow rate.

DISCUSSION

PEFR is a simple and reliable way of monitoring the severity of bronchial asthma and assessing the response to treatment. 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.[14-16] This study aimed to establish normal values of PEFR for healthy urban children of in urban Bangalore, so that local reference standards are available when this measurement is used for the assessment of asthmatic children. A standardized comparison of predicted PEFR values from the present study for 3 different heights was made with the PEFR values for the same height from 8 previous studies. Parmar et al studied PEFR values in healthy north Indian school children, which were similar to the findings from the western countries.[9] Singh et al found that PEFR in south Indian school children was lower than that observed in western and north Indian children.[10] Malik et al observed the PEFR from Punjab, north Indian school children and found that the height standarized value of PEFR showed no urban-urban differences.[6] Mahajan et al reported higher predicted values of PEFR than those in children of other Indian states.[11] Kashyap et al 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.[12] Sharma et al studied PEFR measurements in urban children of Rajasthan and found that they were lower than those reported for Caucasian and urban Indian children of the same height.[13] Comparing our data with previously published values showed that PEFR measurements in urban girls are lower than those reported for urban Indian girls of the same height, it may be best explained by low levels of physical activity. Whereas the PEFR values in boys were similar to the findings from western countries and from north Indian children. Age, height, weight and BSA have all been used either alone, or, in combination to predict PEFR in various studies.[17-20] 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 urban area in many instances is not possible and accurate weight measurement in field studies may sometimes pose a problem. Physicians usually refer to common international references for obtaining different normal values, but it has been shown that PEFR values vary with racial, socioeconomic and genetic features, and with lifestyle. Therefore, it would be more appropriate for each country to have its own region reference values.

CONCLUSION

PEFR is a reliable measurement, which can be used routinely and regularly in urban areas for assessment of airway obstruction and prediction formula derived for use in this population.

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Ethical approval: The study was approved by the Institutional Ethics Committee

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