BRIEF COMMUNICATION
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Normal Values of Peak Expiratory Flow Rate in Children from the Town of Babol, Iran

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ABSTRACT

In the management and evaluation of asthma, simple instruments for measurements of peak expiratory flow rate (PEFR) are necessary. The aim of this study was to determine normal PEFR of the healthy children in Babol, Iran.

This study was randomly done on 1050 students (primary and secondary schools) in Babol. Mini-Wright peak flow meter was used for measurement of PEFR. The range of age, weight and height were defined. Information was statistically analyzed by SPSS, T- Test and R2 and due to formula with regression.

Mean age of 1050 students (525 male and 525 female) who participated in this study was 10.26 years. The mean of PEFR was 262.35±71.97 L/Min. Obtained PEFR with all anthropometrics variants indicate a high correlation. Correlation between PEFR and height was more significant and between PEFR and weight was lower, and according to importance of height and age, formulas suggested for prediction of PEFR in females {(age×4/8)+ (height×0/6)-25)} and in males ({(age×1/7)+ (height×2/1)-208)}.

The results of this study can determine normal PEFR and it can be useful for treatment and monitoring of children with asthma who live in this region.

Key words: Anthropometrics; Children; Peak expiratory flow rate; PEFR

INTRODUCTION

Peak expiratory flow rate (PEFR) is a simple and reliable way of following patients with bronchial asthma and other obstructive airway diseases,[1] response to a bronchodilator in the assessment of asthmatic subjects even in the specific forms such as occupational asthma.[2-4] The peak flow meter is a useful instrument for monitoring PEFR in children and adults.[5]

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An observed PEFR compared with the patient's predicted value, which is taken as the mean PEFR attainable by normal people of the same ethnic origin, gender, age and body build.[6] Normal values and prediction formula have been established for different children of European, America, African and Asian countries.[7-12]

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.[13]

MATERIALS AND METHODS

In this cross-sectional study which was carried out in spring of 2oo2 by four trained pediatric residents, 1050 students participated from six primary and four secondary schools. The schools were chosen randomly. Permission was obtained from school authorities. Peak flow meter apparatus was Mini-Wright type. In schools, students stratified randomly and the highest of the three results obtained was recorded. Exclusion criteria were based on suggestion of American Health National, including: cough, chronic or recurrent respiratory illnesses, asthma history, heart disease and tuberculosis. The age, sex, height (without shoes), and weight (with usual school uniform) were recoded. The surface area was calculated using

$$\sqrt{\frac{\text{weight kg} * \text{height cm}}{3600}}$$

Then the data were analyzed by SPSS. T test, Pearson correlation coefficients and multiple linear regressions were used for data analysis.

RESULTS

In this research project 1050 (525 male and 525 female) primary and secondary school's students were studied. PEFR average was 262.35 ± 7.97 L/min (in girls 248.46 ± 66.06 and in boys 276.25 ± 74.96 (P=0.000)). PEFR average in elementary students was 244.21± 59.56 L/min and in secondary school's students 307.93± 79.96 L/min (P=0.000). The mean age was 10.25 years. The PEFR values for girls and boys in relation to age are presented in table 1. Body surface average of all students was 1.08 m^2.

Table 2 shows the PEFR values in relation to sex and height. The PEFR were evaluated with increasing height, rate of increase in boys was higher than girls. The male children showed significantly higher values of PEFR ($P<0.05$) in comparison to female children, except in height range of 110-119.

The PEFR value in relation to sex and weight is presented in table 3. It was observed, after performing multivariate regression analysis, that age, height and weight were significant predictors of PEFR (P=0.000). The coefficient of determination between PEFR and height (R^2=0.413) was more relevant, and between PEFR and weight (R^2=0.299) was lower.

Table 1. PEFR (L/min) values for girls and boys in relation to age.

Age (year)	Boys		Girls		P-value
	Number	Mean±SD	Number	Mean±SD	
6	59	207±44.6	68	186.4±32.1	0.003
7	79	228.5±48.5	70	212.6±41.3	0.035
8	77	246.1±46.9	77	241.8±36.5	0.528
9	79	265.9±45.5	62	240.6±52.6	0.003
10	76	309±56.7	87	265.3±64.1	0.000
11	59	294.4±55.8	50	261.5±66.3	0.007
12	51	311.6±75.2	61	305.4±74	0.665
13	39	367.1±75.5	39	303.8±77.2	0.000
14	6	417.2±88.3	11	330±58.3	0.047

Table 2. PEFR (L/min) values for girls and boys by height range.

Height range	Boys		Girls		P-value
(cm)	Number	Mean±SD	Number	Mean±SD	
110-119	37	190.5±40.6	24	184.1±35.8	0.534
120-129	122	224.1±45	132	206.8±42.8	0.002
130-139	149	271±49.4	139	240±45.5	0.000
140-149	114	289.2±49.7	102	268.8±66.2	0.012
150-159	55	329.2±62.2	95	290±68.3	0.001
160-169	26	384.2±76.1	32	313.1±71.3	0.001
>=170	22	417.2±76.3	1	360	-

Table 3. PEFR (L/min) values for girls and boys by weight range.

Weight range (Kg)	Boys		Girls		P-value
	Number	Mean±SD	Number	Mean±SD	
10-19	13	181.5±25.4	8	196.2±29.7	0.242
20-29	229	238.2±51.8	224	213.6±46.3	0.000
30-39	152	288.1±53.3	132	260.6±58.4	0.000
40-49	77	313.6±66.6	97	284.4±71.3	0.006
50-59	33	359.7±82.8	40	292.7±61.5	0.000
>=60	21	395.2±107.6	24	304.1±74	0.002

Prediction equations for each sex were: Male children: PEFR (L/min) = ({(age×1/7)+ (height $_{cm}$ ×2/1)-208)} and Female children: PEFR (L/min) = {(age×4/8)+ (height $_{cm}$ ×0/6)-25)}.

DISCUSSION

The PEFR is an accepted index of pulmonary function and is widely used in respiratory medicine.[14] Serial PEFR monitoring is a convenient method in investigation and diagnosis of occupational asthma[15] and often is used alone in the assessment of asthmatic patients.[2, 16, 17] Recent studies showed that personal best PEFR is a useful concept for asthma self management plans when determined as the highest PEFR over the previous 2 weeks. There are many biologic sources of variation in pulmonary function. Intra individual variation may be attributed to body position, head position, effort dependency of maximum flow and circadian rhythm. Intra individual variability may be due to a variety of host factors, including size (height, weight), age, race, past and present health. Geographic factors, exposure to environmental and occupational pollution and socioeconomic status also may influence intra individual variation.[18] Therefore it would be more appropriate for each region to have its own value. The results of this study can be useful for treatment and diagnosis of children who live in this region. In this study, we found that the PEFR values of the children from the town of Babol were similar to other Iranian children[19] and also similar to those of some Europeans, Americans and Asians, but lower than those of Australians and Sri lankans.[10,11,20-22] The differences between the PEFR value of the Iranian children and those of other countries can be explained by factors like genetic factors, lifestyle, diet, and anthropometrical measurements as well as environmental conditions.

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