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Received: 24 Jul 2010  
Revised: 30 Jul 2010  
Accepted: 16 Aug 2010

## Normal measurement of peak expiratory Flow rate in the high school children in Babol, north of Iran

### Abstract

**Background:** Peak Expiratory Flow Rate (PEFR) is recommended as a tool for control of asthma. The purpose of this study was to determine the normal value of PEFR in the healthy high school children in Babol, Iran.

**Methods:** This study was conducted on 470 healthy high school children (285 girls, 185 boys with the age between 14-18 years). For the determination of PEFR we used Mini Wright Peak Flow Meter. At a three time measurement, the highest value of PEFR is recorded. Formula for prediction of PEFR was estimated by linear regression analysis after the correlation of PEFR with the age, height and weight.

**Results:** The mean PEFR in the boys was  $546.57 \pm 74.92$  and in the girls was  $424.48 \pm 52.29$  L/m. The amount of PEFR was increased regarding age, height and weight. The formula for prediction of PEFR was estimated:

For boys:  $\text{weight} \times 1.59 + \text{height} \times 2.24 + \text{age} \times 1.47 - 135$ ,

For girls:  $\text{weight} \times 0.86 + \text{height} \times 1.46 + 143.17$

**Conclusion:** The results show that the normal range of PEF is different from that reported to the other countries.

**Key words:** Peak Expiratory Flow Rate, (PEFR), High school children, Normal value.

*Casp J Intern Med 2010; 1(3):98-101.*

Peak Expiratory Flow Rate (PEFR) is an acceptable index for pulmonary functioning and is used in lung disorders. PEFR provides a simple, quantitative measure of airway obstruction. Daily monitoring of PEFR can be used to detect the worsening of lung function in the absence of symptoms, to assess variations in lung function throughout the day, to identify triggers, to make appropriate medication decisions, and to monitor the patient's response to therapy. A patient can take PEFR measurements at home, enter the information in a daily diary, and then share the information with the clinician (1).

Serial PEFR is a simple and appropriate method for the diagnosis of occupational asthma and this test can be used for monitoring these patients (2). PEFR is measured by Peak Flow Meter which was discovered by Wright in the 1950s. After that Mini Wright Peak Flow Meter was planned this was easily used for adults and children for more than five years and was able to guide the physician for the diagnosis of airway obstruction (3).

For measurement of PEFR, the individual puts the peak flow meter in her/his mouth after deep inspiration and then blows rapidly and forcefully to the mouth piece, With this maneuver, the pointer is moved forward and stopped in degrees which is depended to expiratory flow. PEFR is the highest flow of expiration that an individual can make. When obstructive events are present in the lung, this index was reduced and increased with the progress of obstruction, For example, in process such as exacerbation and treatment of asthma. The normal range of PEF is related to factors such as age, gender, height, race, weight, cigarette smoking, and environmental conditions (4-8).

Due to the effect of these factors, normal mean value and predictive formula, in various studies differed and several scales were recommended for this purpose (American Thoracic Society, Wright scale, EN13826 or EU scale) (9-11). In Iran, two studies were published regarding normal limit of PEF in the children (12, 13). Since the prevalence of asthma is relatively high especially in our region and its effect on general health and quality of life and other socioeconomic effects (13), we attempted to conduct this study to determine the normal value of PEF in high school children.

## Methods

This cross-sectional study was carried out in spring, 2010 on 470 subjects from 6 high schools for girls and 5 high schools for boys. The participants randomly were distributed in these schools. Peak flow meter apparatus used was Mini Wright. After instruction to all students, at least three PEF were taken by each person and the highest results were recorded. Inclusion criteria include babol residence, and their grades were either first, second or third high school.

Exclusion criteria were history of coughing, wheezing, history of asthma, pulmonary infection during last two weeks, cigarette smoking or hobbler bubble. The age, sex, height, weight were recorded as well. The data were gathered and analyzed with SPSS. T- test, Pearson correlation coefficient test while multiple linear regressions were used when appropriate.

## Results

Among the studied subjects, 285 were girls and 185 were boys. The mean age for boys was  $16.39 \pm 0.75$  and for girls was  $15.74 \pm 0.85$  years ( $p=0.0001$ ). The mean height for the boys was  $175.12 \pm 6.04$  and for the girls was  $160.78 \pm 5.44$  cm ( $p=0.0001$ ). The mean body weight for boys was  $66.94 \pm 12.83$  and for girls  $55.68 \pm 11$  kg ( $p=0.0001$ ). The mean PEF in the boys was  $546.57 \pm 74.92$  and the girls was  $424.48 \pm 52.29$  L/min ( $p=0.0001$ ). PEF was correlated with age, height and weight. Regarding height, the mean PEF for boys and girls are shown in (table 1, Figure 1,2). The mean PEF in boys and girls regarding weight is shown in table 2. In the model of linear regression by backward method, age, height and weight were entered in the model and were used in the following formula for prediction of PEF.

For boys:  $\text{weight} \times 1.59 + \text{height} \times 2.24 + \text{age} \times 1.47 - 135$

For girls:  $\text{weight} \times 0.86 + \text{height} \times 1.46 + 143.17$

In our study, the PEF in both boys and girls was not significantly different to EU scale ( $p=0.235$  and  $p=0.147$ , respectively) but was lower than that in the USA.

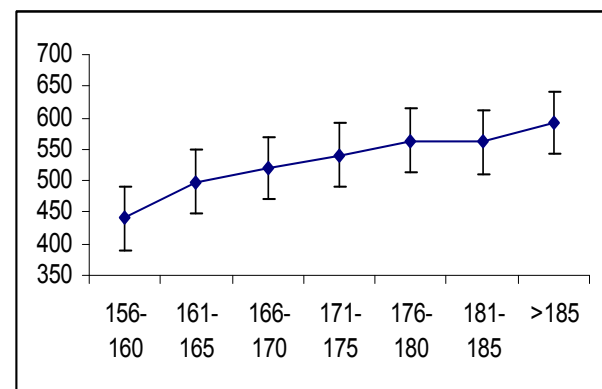


Figure 1. The mean PEF regarding height in boys

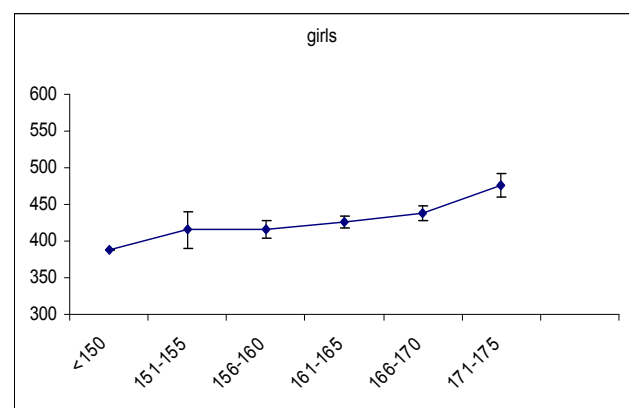


Figure 1. The mean PEF regarding height in Girls

Table 1. The mean amount of PEF regarding height in boys

| Height  | Boys PEF |              | Girl PEF |              |
|---------|----------|--------------|----------|--------------|
|         | N        | Mean±SD      | N        | Mean±SD      |
| <150    | -        | -            | 7        | 388.57±46.70 |
| 151-155 | -        | -            | 47       | 415.32±52.62 |
| 156-160 | 1        | 440          | 80       | 415.38±54.56 |
| 161-165 | 10       | 498±78.99    | 96       | 425.73±48.68 |
| 166-170 | 32       | 520.63±66.63 | 46       | 438.91±49.72 |
| 171-175 | 53       | 451/04±63.15 | 9        | 475.56±36.43 |
| 176-180 | 60       | 563/42±77.56 | -        | -            |
| 181-185 | 20       | 561.25±72.29 | -        | -            |
| >185    | 9        | 592.22±99.47 | -        | -            |

**Table 2. The mean amount of PEF regarding weight**

| Weight | Boys |                | Girl |               |
|--------|------|----------------|------|---------------|
|        | N    | Mean±SD        | N    | Mean±SD       |
| <50    | 12   | 452.58±143.717 | 85   | 412.82±47.274 |
| 51-60  | 55   | 487.4±148.957  | 85   | 424.59±54.392 |
| 61-70  | 60   | 530.83±109.587 | 32   | 443.44±46.114 |
| 71-80  | 35   | 557.31±152.074 | 18   | 437.22±39.676 |
| 81-90  | 13   | 564.62±69.446  | 2    | 475±7.071     |
| <90    | 10   | 583.50±106.928 | 4    | 475±52.599    |

## Discussion

The peak flow meter is a simple, easy, cheap and inexpensive device and PEF is a reliable and acceptable index in the evaluation and management of asthmatic patients. Many studies showed that PEF vary in age, sex, height, weight, race and geographic region. It is necessary for each country to have normal values for PEF. PEF in the boys was higher than the girls and may be related to higher rates of weight and height in the boys. Even in both sexes with similar pattern of weight and height, PEF in the boys was higher. Therefore, these findings emphasize the higher normal value of PEF in the male gender. Previous studies showed that the most correlation are in age and height in both sexes. In some other studies body surface and the measurement around the chest have relations to the value of PEF (4). In our study, PEF was related to age, weight and height, and perhaps its relation to weight is due to the higher height with increased weight. The rates of PEF in this study was similar to the EU scale but was lower than the white race in the USA (3, 4). Our findings were higher than those reported from Kashmir, Nigeria and India (6-8). These differences may be related to the socio-economic status, geographic situation and body shape. In some resources, the PEF in adolescents were similar to the children when the height and weight is similar, but the comparison of our study with the results of the study carried out by Mohammadzadeh et al. in school children under 15 years old. It showed the higher value of PEF in our study when the result was matched with height and weight in these two groups (13). This result may be related to the effect of age on the value of PEF. In conclusion, the results of our study showed that the normal range of PEF in adolescence and young adult are different from that reported to the other countries. We suggest that each region should determine the normal value of PEF in their population.

## Acknowledgement

The authors would like to thank the students, teachers and principals of the different schools for their participation and cooperation in this study.

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