ORIGINAL RESEARCH ARTICLE

Establishment of Standard of Normal PEFR Value in Paediatrics Age-Group in Bihar, India.

Ashok Kumar Deo[1], Hari Kishore Rai[2] & Sushma Kumari[3]

[1]Associate Professor, Department of Physiology, [2]Assistant Professor, Department of Radiology [3]Assistant Professor, Department of Pharmacology, Narayan Medical College campus, Jamuhar, Rohtas (Bihar), India-821305.

Abstract:

Introduction: ***Peak Expiratory Flow Rate*** *[PEFR] is the easiest and most cost effective method to evaluate respirator functions. PEFR measurement is an important tool in asthma management by all international guidelines* ***Objectives:*** *To determine the PEFR values in healthy school children of Sasaram and to establish the influence of variables like age, sex, height and weight on these values.*

Methods: *PEFR was measured in 1535 school children of Sasaram city using mini wright's Peak flow meter. All PEFR measurements were obtained in standing position and the best out of three trials were recorded. Height and weight were recorded. Regression analysis was used to calculate the predicted normal values of PEFR and also to assess its relation to weight and height.*

Result: *Positive correlation was seen between age, height, weight and PEFR. The boys had higher values of PEFR than girls at all heights. The prediction equation based on height was PEFR=5.63(Ht)-474.43, r = +0.902 for boys and PEFR= 5.30 (Ht) -451, r = + 0.876 for girls.*

Conclusion: *PEFR values in this study were comparatively low to those of North Indian and western school children, high to those of south Indian children. This prediction equation can be used to detect PEFR values in Bihar.*

Keywords: *PEFR, Paediatric PEFR, standard PEFR*

Introduction:

Respiratory disease is a major cause of morbidity and mortality in our country. Now a day's bronchial asthma is most common chronic disease, apart from common cold, in children due to environmental factor and change in life style.

*Peak Expiratory Flow Rate [*PEFR] recording is an important non invasive respiratory function test for evaluation, monitoring, management and follow-up of patient with bronchial asthma [1].

PEFR is easily measured using peak expiratory flow meter and can be recorded by the patient at home by themselves to reflect the severity of outflow obstruction and was shown to anticipate early detection of asthmatic attacks [3].

Bronchial asthma is a common respiratory disease of childhood which is associated with fluctuation in airway caliber and one of the earliest sign of impending attack is fall in PEFR [2].

PEFR is an accepted index of pulmonary function. Personal best PEFR is a useful concept for asthma self management, Serial PEFR monitoring is a convenient method for investigation and diagnosis of asthma. A variation of greater than 20 percent of baseline may indicate airway reactivity [3].

Predictive normal values are essential for clinical interpretation of lung function tests. Normograms predicting PEFR from anthropometric measurements are available for various population groups [4].

Address for correspondence:
Dr. Ashok Kumar Deo
Associate Professor,
Department of Physiology,
Narayan Medical College,
Jamuhar, Rohtas (Bihar) India- 821305
Email: drashdeo@gmail.com

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Objectives:

1) To determine the standard value of PEFR in healthy school children from 8-18 years age for Bihar.
2) To establish the correlation of PEFR values with the variables like age, sex, height and weight.

Material and Methods:

A total of 1335 children of age group 8-18 years of both sexes (768 boys and 767 girls) were selected from various schools of Sasaram city. These children constitute a representative cross section of normal children of Sasaram. Schools were selected by systemic random sampling technique.

Proper consent was taken from the parents, school and college authorities before starting the study. The children were interviewed to rule out the following-

a) History of acute respiratory tract infection within preceding three weeks
b) History of chronic respiratory disease, asthma
c) History of skeletal deformity in thorax
d) History of cardiac and neurological disease
e) History of smoking in adolescence

Age was taken as completed years as on the school/ college record. The children were subjected to full clinical assessment with anthropometric measurement for height and weight. Weight was measured in kilograms using standard weighing machine without any footwear and with light clothes. Weighing machine was calibrated before taking measurements. Accuracy of the weighing machine was $\pm$ 50grams.

Standing height was measured by making the child to stand against a fixed calibrated rod with adjustable headrest. Height was measured without footwear, standing erect, looking forward with feet closed, back of head, and body touching the rod. The measured height was then corrected to nearest centimetre. Children who were found as malnourished as per IAP criteria were excluded from the study.

PEFR was measured by mini Wright's peak flow meter (60-800 L/min). All the measurement was taken in standing position.

The purpose of the test and procedure was explained to the children. Then procedure was demonstrated in detail so as to familiarize them with the procedure and to get their full cooperation.

Each child was told to take a deep breath and then blow into peak flow meter as hard and as fast as possible through mouth piece and was closely watched to ensure that she/he maintained an airtight seal between lungs and mouth piece of the instruments.

The procedure was repeated thrice, highest value of these three reading was taken as observed PEFR. Disposable mouth piece was used for recording of PEFR to prevent contamination and spread of any infection to other.

Regression analysis was used to calculate the predicted normal values of PEFR and also to assess its relation to weight and height.

Observation & Results:

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

Age (years)	Girls		Boys	
	Number	PEFR	Number	PEFR
6	96	210(4)	118	209(3)
7	123	229(3)	107	231(4)
8	111	256(3)	104	269(4)
9	83	258(4)	107	276(4)
10	89	291(4)	82	292(4)
11	44	350(6)	53	345(6)
12	103	361(4)	98	392(6)
13	83	378(5)	76	406(5)
14	35	391(10)	23	421(9)
Total	767		768	

The PEFRs in relation to age are presented in (Table 1) shows that PEFR values were higher in boys than in girls, and more significant during puberty. It is also, seen in Table 1, the difference in PEFR increased between the two sexes after the age of 11 due to a faster increase of PEFR in boys.

Table 2: PEFR (l/min) values in girls and boys by height intervals

Height interval (cm)	Girls		Boys	
	Number	PEFR	Number	PEFR
105-109	6	172(10)	7	194(13)
110-114	32	198(5)	34	203(3)
115-119	57	205(4)	81	209(4)
120-124	111	223(3)	79	233(4)
125-129	72	246(4)	87	250(3)
130-134	81	256(4)	90	267(3)
135-139	76	269(5)	81	300(5)
140-144	63	308(6)	66	319(6)
145-149	65	338(5)	37	323(8)
150-154	91	365(4)	57	350(6)
155-159	72	386(5)	25	380(6)
160-164	33	396(9)	65	397(5)
165-169	8	426(22)	15	436(13)
170-174	0	-	34	450(7)
175-179	0	-	10	460(23)
Total	767		768	

Table 2 shows the PEFR values in relation to sex and height. The PEFR elevated with increasing height. The rate of increase was similar in boys and girls until a height of 135 cm reached, with boys having values about 30 l/min higher than girls. But in girls, this difference was compensated soon at the height range of 140-144cm.

Table 3: PEFR (l/min) values in girls and boys by weight intervals

Weight interval (kg)	Girls		Boys	
	Number	PEFR	Number	PEFR
15-19	70	201(5)	41	204(4)
20-24	187	225(3)	172	224(3)
25-29	123	256(3)	179	264(3)
30-34	94	299(5)	87	295(5)
35-39	85	343(5)	87	342(5)
40-44	91	348(6)	49	355(7)
45-49	56	365(7)	48	363(9)
50-54	27	362(11)	26	415(13)
55-59	14	403(17)	30	401(9)
60-64	13	401(20)	20	443(15)
65-69	5	416(34)	8	409(17)
70-74	2	435(15)	9	48(22)
75-79	0	-	3	407(37)
≥80	0	-	9	438
Total	767		768	

Also, the male children showed significantly higher values ($P<0.01$) of PEFR in compare to girl. The relationship with height is more regular than other anthropometric measurements [Table-3].

The following regressive equation are derived-

For boys, PEFR = 20.7 (age) + 1.43 (height) + 0.95 (weight) - 158
For girls, PEFR = 11.6 (age) + 2.34 (height) + 0.31 (weight) - 189

Correlating HEIGHT alone as an independent predictor of PEFR, equation would be-
Boys: PEFR= 5.63(height) - 474.43
Girls: PEFR = 5.30 (height) – 451

Discussion:

As the lung in children is still growing no single value can be considered as normal for pediatrics age group. Predictive normal values correlates significantly with age height and weight [8]. Regression equations are therefore drawn from study of normal population.

In the present study we have selected children from 8-18 years of age who are considered as healthy by ruling out the systemic diseases. The values obtained are more sensitive and helps in diagnosis of obstructive lung disease especially bronchial asthma. The obtained PEFR results were analyzed as follows.

In our study, in boys the mean PEFR was 231.5 L/min, 359.6L/min, 460.3L/min, and in girls the mean PEFR was 218.4L/min, 324.2L/min and 374.9L/min at 9 years, 13 years and 16years of age respectively. This indicates boys have higher value of PEFR than girls at any given age.

The regression equation based on height for both sexes were-

Boys PEFR= 5.63 (Height) – 474.43

Girls PEFR= 5.30 (Height) – 451

It was seen that the regression equation for PEFR with height as the independent variable was the best predictor of PEFR [8]. This observation from our study correlates with the studies done by other researchers [15].

Sharma et al, showed PEFR has significant correlation with height (r = +0.85 for boys, r = +0.87 for girls)[6]. Studies done by Kashyap et al, showed PEFR has significant correlation with height. (r = +0.893 for boys, r = +0.883 for girls)[7]. Present study showed increase in PEFR levels with increasing age. Boys had higher levels of PEFR than girls except 8 years of age where both sexes have same PEFR level of 208.5L/min. It was noticed that difference in PEFR values of boys and girls was increasing more widely as age increases from 14 years. In girls after 14 years of age there is no much increase in PEFR levels [14]. This can be explained by the fact that there is no much increase in height after puberty in girls.

A study showed a significant correlation between PEFR and height, weight, and age [8,9]. PEFR levels were marginally higher in pre pubertal boys than girls [6]. The boys continue to show an increase in PEFR until at the age of 19 years [11].

Study revealed mean PEFR levels were higher in boys than girls and this was more significant during puberty [9]. Difference in PEFR increased between two sexes after the age of 11 years due to faster increase of PEFR in boys.

Study revealed that PEFR level reached a plateau effect after the age of 13 years in girls whereas boys did not showed a similar effect.

A study revealed there was significant increase in the slope of PEFR / age line at 12 years in girls which continued for 2 years. Change in the slope was significant ($P<0.001$) there was a little increase in PEFR after this among girls. Among boys this change occurred at 14 years, there was continued increase in PEFR among boys up to 19 years of age.

Thus, the finding of this study correlates well with other studies for a given age, sex, height and weight. Height and weight has strong correlation with PEFR. Therefore it is possible to derive predictive equation for PEFR from there independent variables.

For boys,

PEFR = 20.7 (age) + 1.43 (height) + 0.95 (weight) – 158

For girls,

PEFR = 11.6 (age) + 2.34 (height) + 0.31 (weight) - 189

Conclusion:

Peak expiratory flow rate measurement is a reliable, simple and inexpensive method of assessing the severity of airway obstruction in a child with obstructive airway disease like asthma. It is a considerable value in monitoring prediction of exacerbation and monitoring of therapeutic efficacy. PEFR increases progressively with age in both sexes. For a given age boys have high PEFR than girls. PEFR shows very good correlation with height and weight in both sexes. Predictive equation could be derived relating to PEFR to height and weight and to height alone for both sexes. It is important to have reference standards for detecting abnormal values. Reference values are affected by regional and environmental factors. Therefore it is necessary to have regional values for children. Present study found that observed PEFR values of different age groups of either sex correlate with both height and weight. However height correlates better with PEFR. Regression equations were formulated and a PEFR normogram was constructed for the age group of 8-18 years of this region. Since children are in dynamic process of variable growth, further studies of this nature are required to establish reference standard. PEFR values of children in our study were comparatively low to those of north Indian and western children but slightly higher when compared to south Indian.

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References:

1. *Mendoza GR: Peak flow monitoring. J Asthma 1991; 28(3):161-77.*
2. *Cross D, Nelson HS: The role of the peak flow meter in diagnosis and management of asthma. J Allergy Clinical Immunology 1991; 87(1 pt 1) : 120 – 8.*
3. *Twarog FJ: Home monitoring of asthma with peak expiratory flow rates. Ann Allergy 1991; 67(5) :457-60.*
4. *Wright BM, Mckerrow CB: Maximum forced expiratory flow rate as a measure of ventilatory capacity. BMJ 1959; 2: 1041-1047*

5. *Lebowitz MD: The use of peak expiratory flow rate measurements in respiratory disease. Paediatric Pulmonology 1991; 11(2): 166-74.*
6. Sharma R, Jain A, Arya A, Chowdhary BR. Peak Expiratory Flow Rate Of School Going Children Aged 5-14 Years From Ajmer District. Indian Peditr. 2002; 39 :75-78.
7. Kashyap S, Puri S, Bansal K. Peak Expiratory Flow Rate Of Healthy Trail Childrens Living At High Attitudes In The Himalayas. Indian Peditr 1992; 29:283-286.
8. *Host A, Host AH, Ibsen T: Peak expiratory flow rate in healthy children aged 6-17 years. Acta Paediatric 1994; 83(12) : 1255-7.*
9. *Herguner MO, Guneser SK, Altintas DU, et al: Peak expiratory flow in healthy Turkish children. Acta Paediatric 1997; 86 (5) : 454 – 5.*
10. *Dickman ML, Schmidt CD, Gardner RM: Spiro metric standards for normal children and adolescents (ages 5 years through 18 years). Am Rev Respiratory Disease 1971; 104(5) : 680 – 7.*
11. *Olanrewaju DM: Spirometric standards for healthy Nigerian children and adolescents. East Afr Med J 1991; 68(10) : 812 – 9.*
12. *Lam KK, Pang SC, Allen WGL, et al: Predictive nomograms for forced expiratory volume, forced vital capacity and peak expiratory flow rate in Chinese adults and children. Br J Dis chest 1983; 77(4) : 390 – 6.*
13. *Udupihille M: Peak expiratory flow rate in Sri Lankans schoolchildren of Sinhalese ethnic origin. Respir Med 1994; 88(3) : 219-27.*
14. *Standardization of spirometry – 1987 Up- date statement of the American thoracic society. Am Rev Resp Dis 1987; 136(5) : 1285 – 98.*
15. *Dugdale AE, Moeri M: Normal values of forced vital capacity (FVC), forced expiratory volume (FEV1) and peak flow rate (PFR) in children. Arch Dis Child 1968;43(228) :229-34.*

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