

Original Article**A study of peak expiratory flow rate in normal healthy children of Punjab**Bedi U¹, Dang BK²¹Dr Upneet Bedi
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Received: 04-11-2015

Revised: 20-11-2015

Accepted: 02-12-2015

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Dr Upneet Bedi
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upneetbedi@rediffmail.com**ABSTRACT****Background:** Peak expiratory flow rate (PEFR) recording is an essential measure in the management and evaluation of asthmatic children.**Objective:** The present study was undertaken to establish normal reference values for PEFR in normal healthy children of Punjab and to study the influence of height, age, weight and gender on PEFR.**Method:** The study was carried out at various schools in the Patiala, Punjab. A total number of 250 children aged between 5-17 yrs were taken. The study included information about the socio demographic characteristics and General Physical Examination was done along with Systemic Examination. PEFR was measured with Mini-Wright Peak Flow Meter.**Result:** PEFR had highly significant positive co-relation with age, height and weight both in male and female children. PEFR increased with increasing age with highest at the age range of 14-17 yrs ($p < 0.001$). These findings were attributed to the rapid growth of airway passages and expiratory muscle effort. PEFR in males

was more than females, the difference was non significant in age group 5-9 yrs ($p > 0.05$), significant ($p < 0.05$) in the age group 10-13 yrs and highly significant ($p < 0.01$) in the age group of 14-17 yrs. These changes may be attributed in males to the better height, weight, and possibly because of more expiratory effort.

Key words: PEFR, male, female, age, height, weight**Introduction**

Lung function tests have been increasingly used in assessing the severity of obstructive airway disease, evaluating the effect of various therapeutic regimens and providing a better understanding of disordered pulmonary physiology. [1, 2] PEFR is an accepted index of pulmonary function and is widely used in respiratory medicine. Serial PEFR monitoring is a convenient method in investigation and diagnosis of asthma. [3, 4, 5]

Measurement of PEFR is simple, non-invasive, rapid and economical method to assess the strength and speed of expiration in L/min, through a forced expiration from total lung capacity. It is used to detect the reduction in pulmonary function associated

with narrowing of airways; to assess the efficacy of clinical treatment. PEFR can detect airway obstruction in children as soon as it starts. [6, 7] The peak flow meter is a useful instrument for routine monitoring of PEFR in healthy and asthmatic children. 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. [8]

Miniwright peak flow meter is robust, portable, and easy to use and does not require electrical connection. As with all the instruments, patient full co-operation is essential and is obtained without much difficulty from normal children aged 5 years and above. Normal values and prediction formula have been established for different

children of different ethnic origin and build. [9, 10, 11, 12]

Materials and methods

Two hundred fifty normal healthy children (125 male and 125 female) of age group 5-17 years were selected from various schools of Patiala. Ethical approval was taken from institutes ethical committee and informed consent was taken from subjects. Thorough general physical and systemic examination was done. Children having asthma, allergy, history of recurrent hospital admission or respiratory tract infection within 3 week period prior to commencement of testing, cardiac diseases and bony deformities of chest cage were excluded from the study. Age was calculated in years to the nearest of 0.5 years. Height was measured using a standard measuring tape by making the

child stand bare footed on floor against the wall, It was measured to the nearest cm. Body weight was measured (in Kg) with the subject standing on a portable weighing machine. PEFR was recorded with mini-wright peak flow meter. PEFR was recorded thrice. The highest of the three reading was taken. Procedure was explained to each child before taking the reading. For recording of PEFR child was asked to blow as hard as possible from a position of maximal inspiration in standing position. The highest of the three readings was taken. All the data obtained was given mean and standard deviation. Student's t test and pearson correlation was used for determining significance and significant relationship between PEFR and anthropometric paramaters.

Results

Table 1: Mean and standard deviation values of physical measurements and PEFR in male children

Age group (yrs)	No. of Subjects	Weight Mean±SD (kg)	Height (cm)	PEFR Mean±SD (L/min)
5-9	52	18.03 ±3.69	116.82 ±8.23	147.78 ±39.57
10-13	26	33.80 ±9.83	145.23 ±11.25	286.53 ±56.91
14-17	47	48.95 ±12.62	164.51 ±9.09	408.51 ±61.67

Table 2: Mean and standard deviation values of physical measurements and PEFR in female children

Age group (yrs)	No. of Subjects	Weight Mean±SD (kg)	Height Mean±SD (cm)	PEFR Mean±SD (L/min)
5-9	38	16.42 ±3.76	112.05 ±8.03	144.21 ±43.78
10-13	41	35.0 ±8.23	146.92 ±8.86	274.63 ±51.04
14-17	46	48.30 ±10.28	159.19 ±6.61	337.17 ±54.59

Table 3: Correlation of PEFR with age, weight, height, among male children

Parameters	Co-efficient of correlation (r)	'p' value	Significance	't'
PEFR	-	-	-	-
Age (yrs)	+ 0.90	<0.001	HS	24.37
Weight (kg)	+ 0.85	<0.001	HS	18.68
Height (cm)	+ 0.90	<0.001	HS	22.94

Table 4: Correlation of PEFR with age, weight, height, among female children

Parameters	Co-efficient of correlation (r)	'p' value	Significance	't'
PEFR	-	-	-	-
Age (yrs)	+ 0.87	<0.001	HS	13.84
Weight (kg)	+ 0.73	<0.001	HS	9.48
Height (cm)	+ 0.84	<0.001	HS	12.98

Table 5: Comparison of PEFR among males and female children in different age groups

Age groups (yrs)	Sex	No.	Mean±SD PEFR (L/min)	't' value	'p' value	Sig.
5-9	Male	52	150.16±41.15	1.24	>0.05	NS
	Female	38	142.31±42.14			
10-13	Male	26	272.83±60.92	2.38	<0.05	S
	Female	41	248.09±61.80			
14-17	Male	47	387.11±70.81	7.64	<0.01	HS
	Female	46	309.28±65.19			

Mean PEFR, weight, height, increases with increasing age and reaches the maximum values at 14-17 years in both males and females. (Table: 1,2) The results show that PEFR has highly significant co-relation between age, weight and height in male children and female children with maximum 'r' value for age ($r=0.90$) and height ($r=0.90$) in males and with maximum 'r' value for age ($r=0.87$) in females. (Table: 3,4) The results show that in all the three age groups mean values of PEFR is more in male children than female children but the difference is non-significant in 5-9 years of age group ($p>0.05$) significant in 10-13 years of age group ($p<0.05$) and highly significant in 14-17 years of age group ($p<0.01$). (Table: 5) Table 2 shows mean and SD values of weight, height and PEFR for female children in three age groups. Mean PEFR, weight, height increases with increasing age and reaches the maximum values at 14-17 years. In both male and female children the highest value of PEFR is at the age of 14-17 years, with value being higher in males 408.51 ± 61.67 L/min and lower in female children 337.17 ± 54.59 L/min. Table 3 shows co-rrelation of PEFR with age, weight, height among male children. The results show that PEFR has highly significant co-rrelation between age ($r=0.90$) ($p<0.001$), weight ($r=0.85$) ($p<0.001$), height ($r=0.90$) ($p<0.001$), (with maximum 'r' value for age ($r=0.90$) and height ($r=0.90$)). Table 4 shows co-rrelation of PEFR with age, weight, height, among female children. The results show that PEFR

has highly significant co-rrelation between age ($r=0.87$) ($p<0.001$), weight ($r=0.73$) ($p<0.001$), height ($r=0.84$) ($p<0.001$), with maximum 'r' value for age ($r=0.87$). The results show that in all the three age groups mean values of PEFR is more in male children than female children but the difference is non-significant in 5-9 years of age group, ($p>0.05$) significant in 10-13 years of age group ($p<0.05$) and highly significant in 14-17 years of age group ($p<0.01$).

Discussion

Co-rrelation of PEFR with age

The present study revealed that both in male and female children mean PEFR, weight and height increased with the increasing age, as seen from tables 2,3,4,5 and highest values of PEFR was at the age range of 14-17 years. This observation was consistent with other studies conducted by other workers, though the age at which the maximum mean PEFR was reached is different. Nairn et al ^[13] found maximum mean PEFR at 17 years in both males and females Bayu et al ^[10] while carrying a study on Eihopian children recorded a sharp increase in PEFR with age, reaching a peak at 17-18 years in males and some what earlier at 15-16 years in the female group. Rahman et al ^[14] while carrying a study of PEFR on Bangladeshi boys and girls found that PEFR continued to rise in boys after 15 years but PEFR in girls seemed to have attained maximum values by that age. This observtion could possibly be due to rapid

growth of airway passages and increase in muscularity as the age advances.

Correlation of PEFR with Height and weight

Height and weight correlated positively with PEFR i.e. as the height and weight increased there was an increase in the PEFR in both male and female children. This observation was similar to the observation of the authors of earlier studies Nairn et al, [13] Hameed et al, [15] Paramesh, [16] Primhak et al [17] Wille and Svensson. [18] This observation could possibly be due to rapid growth of airway passages and expiratory muscle effort as height and weight increases.

Weight- This finding was similar to the findings in earlier studies; Hameed et al, [15] Behera et al, [19] Carson et al, [20] However Wille and Svensson [18] found that weight did not have any important influence on PEFR both in males and females.

Comparison of PEFR values in Male and Female children

Mean PEFR values have been compared among male and female children in different age groups. In the present study, mean PEFR in male children was higher than that of female children at all the 3 age groups and the difference was statistically non-significant in age group of 5-9 years ($p>0.05$), significant ($p<0.05$) in age group of 10-13 years and highly significant with age group of 14-17 years ($p<0.01$). This finding was consistent with all their previous studies i.e. Chiang et al, Hameed et al, [15]

Kashyap et al, [21] Host et al, [22] Pande et al. [23] Though Paramesh [16] and Primhak [17] found that the values of PEFR were similar both in males and females also. Male children had higher PEFR values especially after the age of 10 years possibly because of better height, weight and rapid growth of airway passages as age advances and possibly due to the more expiratory muscle effort. The results of this study can be useful for comparing the asthmatic children PEFR value with normal children of the same ethnic origin, gender, age, and body build.

Acknowledgement

I want to thank the children and the staff of various schools, technicians, computer operator of Physiology department for their help and support. I want to thank statistician who carried out statistics work.

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Cite this article as: Singh GH, Mehta RJ, Shah ND, Mehta RY. Handwriting change as a psychiatric symptom. *Int J Med and Dent Sci* 2016; 5(1):1042-1047.

Source of Support: Nil