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*Original Research Article.*

# Making Norms of Peak Expiratory Flow Rate in Adolescent: A Cross Sectional Study At Bhopal

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## ABSTRACT

**Background:** Peak expiratory flow rate (PEFR) recording is an essential measure in the management and evaluation of asthmatic subjects.

**Objective:** The present study was undertaken to establish normal reference values for PEFR in normal healthy adolescent of Bhopal and to study the influence of height, age, weight and gender on PEFR.

**Methods:** The study was carried out at various schools in the Bhopal, Madhya Pradesh. A total number of 988 adolescent aged between 10-19 yrs were taken. The study included information about the sociodemographic characteristics and General Physical Examination was done along with Systemic Examination. PEFR was measured with Mini-Wright Peak Flow Meter.

**Results:** PEFR had highly significant positive co-relation with age, height and weight both in male and female adolescent. PEFR increased with increasing age with highest at the age range of 17-19 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 10-13 yrs ($p>0.05$), significant ($p<0.05$) in the age group 14-16 yrs and highly significant ($p<0.01$) in the age group of 17-19 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.

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## 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.[3-5] 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.[9-12]

## MATERIALS AND METHODS

Nine hundred eighty eight normal healthy adolescent (504 male and 484 female) of age group 10-19 years were selected from various schools of Bhopal. Ethical approval was taken from institute's ethical committee and informed consent was taken from subjects. Thorough general physical and systemic examination was done. Study subjects 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's correlation was used for determining significance and significant relationship between PEFR and anthropometric parameters.

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**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 Mean±SD (cm) | PEFR Mean±SD (L/min) |
|---|---|---|---|---|
| **10-13** | 176 | 18.03 + 3.69 | 116.82 + 8.23 | 147.78 + 39.57 |
| **14-16** | 110 | 33.80 + 9.83 | 145.23 + 11.25 | 286.53 + 56.91 |
| **17-19** | 218 | 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) |
|---|---|---|---|---|
| **10-13** | 162 | 16.42± 3.76 | 112.05± 8.03 | 144.21±43.78 |
| **14-16** | 112 | 35.00±8.23 | 146.92±8.86 | 274.63± 51.04 |
| **17-19** | 210 | 48.30± 10.28 | 159.19±6.61 | 337.17±54.59 |

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

| Parameters | Co-efficient of Correlation (r) | 'P' Value | Significance |
|---|---|---|---|
| **PEFR** | | | |
| **Age (yrs)** | + 0.90 | < 0.001 | HS |
| **Weight (Kg)** | + 0.85 | < 0.001 | HS |
| **Height (Cm)** | + 0.95 | < 0.001 | HS |

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

| Parameters | Co-efficient of Correlation (r) | 'P' Value | Significance |
|---|---|---|---|
| **PEFR** | | | |
| **Age (yrs)** | + 0.87 | < 0.001 | HS |
| **Weight (Kg)** | + 0.73 | < 0.001 | HS |
| **Height (Cm)** | + 0.84 | < 0.001 | HS |

**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. |
|---|---|---|---|---|---|---|
| **10-13** | **Male** | 176 | 150.16±41.15 | 1.24 | >0.05 | NS |
| | **Female** | 162 | 142.31±42.14 | | | |
| **14-16** | **Male** | 110 | 272.83±60.92 | 2.38 | <0.05 | S |
| | **Female** | 112 | 248.09±61.80 | | | |
| **17-19** | **Male** | 218 | 387.11±70.81 | 7.64 | <0.01 | HS |
| | **Female** | 210 | 309.28±65.19 | | | |

## RESULTS

Mean PEFR, weight, height, increases with increasing age and reaches the maximum values at 17-19 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 and female 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 than female but the difference is non-significant in 10-13 years of age group (p>0.05) significant in 14-16 years of age group (p<0.05) and highly significant in 17-19 years of age group (p<0.01). (Table 5) Table 2 shows mean and SD values of weight, height and PEFR for female adolescent in three age groups. Mean PEFR, weight, height increases with increasing age and reaches the maximum values at 17-19 years. In both male and female the highest value of PEFR is at the age of 17-19 years, with value being higher in males 408.51±61.67 L/min and lower in female 337.17±54.59 L/min. Table 3 shows correlation of PEFR with age, weight, height among male. The results show that PEFR has highly significant correlation 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 correlation of PEFR with age, weight, height, among females. The results show that PEFR has highly significant correlation 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 than female but the difference is non-significant in 10-13 years of age group, (p>0.05) significant in 14-16 years of age group (p<0.05) and highly significant in 17-19 years of age group (p<0.01).

## DISCUSSION

The present study revealed that both in male and female 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 17-19 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 while carrying a study on Eihiopian children recorded a sharp increase in PEFR with age, reaching a peak at 17-18 years in males and somewhat 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 observation could possibly be due to rapid growth of airway passages and increase in muscularity as the age advances.

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 females. This observation was similar to the observation of the authors of earlier studies Nairn et al, 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, Behera et al,[19] Carson et al,[20] However Wille and Sevensson found that weight did not have any important influence on PEFR both in males and females.

Mean PEFR values have been compared among male and female adolescent in different age groups. In the present study, mean PEFR in male was higher than that of female at all the 3 age groups and the difference was statistically non-significant in age group of 10-13 years ($p>0.05$), significant ($p<0.05$) in age group of 14-16 years and highly significant with age group of 17-19 years ($p<0.01$). This finding was consistent with all their previous studies i.e. Chiang et al, Hameed et al, Kashyap et al,[21] Host et al,[22] Pande et al.[23] Though Paramesh and Primhak found that the values of PEFR were similar both in males and females also. Male adolescent 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 sane ethnic origin, gender, age, and body build.

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