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# ASSESSMENT OF PEAK EXPIRATORY FLOW RATE IN TRIPURI CHILDREN OF SOUTH TRIPURA

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**ABSTRACT:** Background and Aim: To access the ventilatory functions of lungs Peak expiratory flow rate (PEFR) is considered to be a reliable index. Gender is one of the important independent variable that influences PEFR values. There is paucity of data regarding the gender differences in PEFR among tribal and non-tribal children. Therefore, the present study was undertaken to assess the effect of gender on PEFR in age-matched, preadolescent and adolescent tribal children in rural areas of South Tripura. Materials and Methods: The study was conducted on Healthy rural school going children, both boys and girls, between the age group of 8 – 14 years. For determination of PEFR we used Mini Wright Peak Flow Meter. Among three trials of measurements, the highest value of PEFR was recorded. The formula for predicting PEFR was estimated by linear regression analysis after the computing correlation of PEFR with age and height of both boys and girls. Results: Prediction equations were derived for PEFR with height in boys and girls. Significant linear correlation of PEFR with height was observed in boys ($P<0.001, r=0.875$) and in girls ($P<0.001, r=0.846$). Prediction equations for PEFR were PEFR (L/min) = 5.023 × Ht (cm) – 395.049 L/min in boys and PEFR (L/min) = 4.538 × Ht (cm) – 355.138 L/min in girls. Conclusion: Reference values of PEFR are affected by regional, environmental and anthropometric factors. Hence, it is necessary to have regional reference values for children. Among different factors affecting PEFR, height correlates better with PEFR than weight and sex. Hence prediction equation estimated can be used for this region.

**KEYWORDS:** Peak Expiratory Flow Rate (PEFR), Height, Weight, School Children

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## 1.INTRODUCTION

Respiratory disorders are major group of illness affecting children especially in India and are the important causes of childhood morbidity and mortality. In particular, obstructive airway diseases occur in children due to environmental pollution and other causes. So, assessment of pulmonary function test in such children is very important. The PEFR is one among the lung function tests which is helpful in evaluating obstructive lung diseases especially bronchial asthma. It is also helpful in monitoring the disease progression and response to treatment. The Peak Expiratory Flow Rate (PEFR) is an effort dependent parameter, emerging from the large airways within about 100-120 msec of the start of forced expiration. It remains at its peak for 10 msec (Dikshit et. al., 2005)[1]. It is well documented in literature that a wide range of geographical, climatic, nutritional, anthropometric and socio-economic conditions of India are associated with regional differences in lung function (Raju et. al.,2004)[2]. Besides anthropometric and socio-economic factors, altitude is an important determinant of lung function (Gupta et. al.,2013)[3].From various studies we know that the PEFR affected by age, sex, weight and height and also it may vary from urban to rural areas. Moreover, it varies from region to region also. So, it is important to have a normal reference values for each region.

## 2. MATERIALS AND METHODS

A cross-sectional study was conducted on 601 healthy tribal school children (314 Boys, 287 Girls) aged from 8 to 14 years living in rural areas of South district of Tripura. Children studying in class III to Class IX were recruited from four schools, randomly selected from the said district. Exclusion criteria included known cases of bronchial asthma, chronic cardiopulmonary disease, upper respiratory tract infection within the previous two weeks, history of smoking, history of any allergy and structural abnormalities of thoracic cage and spine. Children who were consistently unable to perform the procedure were also excluded. The study was carried out with written informed permission obtained from the Head of the Institution. The purpose and objective of the study was explained to the institutional head and teachers. Informed consent was obtained from the subjects and was as per the Helsinki declaration. Different anthropometric measurements of the subjects were taken under standardized condition. The height was measured to the nearest 0.5 cm without shoes using an anthropometer with head in Frankfort plane and weight was recorded using a mechanical beam balance, and was recorded to the nearest 0.1 Kg, using standard technique of Lee and Nieman (2003)[4]. The body mass index (BMI) of a subject was determined by dividing the weight (kg) by the squared value of height (meter). [BMI = weight / height$^2$]. Body mass index was calculated to assess whether they are obese, underweight or normal. Peak Expiratory Flow Rate (PEFR) was measured using a mini Wright's peak flow meter as per standard method of Wright and McKerrow (1959)[5]. Instruction and method of carrying out the test were demonstrated to all the subjects individually. After proper rest, the subjects were asked to inspire deeply, and then to blow into the instrument's mouthpiece with nostrils closed as hard and quickly as possible. The machine was returned to zero

after every measurement. It was ensured that a tight seal was maintained between lips and mouthpiece of the peak flow meter. The mouthpiece was washed and sterilized for each participant. The highest of the three values (L/min) was used in the analysis. Measurement of flow rate was carried out by single observer, so that inter observer variations was eliminated.

**Statistical Analysis**

Statistical analysis was done using MS-Excel software. The data were analysed separately for boys and girls with respect to age, weight, height and PEFR for all children. Linear regression analysis was done using PEFR as the dependent variable and height as the independent variable. The predictions equations for PEFR based on the height alone were determined for both sexes. Statistical evaluations were made using SPSS Package.

**Table1: Mean ± SD , Correlation and regression between Height and PEFR of boys**

| AGE (Years) | n | Height Mean±SD | PEFR Mean±SD | r | Regression equation for PEFR |
|---|---|---|---|---|---|
| 8 | 33 | 121.15±4.91 | 207.73±23.68 | 0.633 | -162.413+3.055x |
| 9 | 52 | 127.95±6.60 | 263.08±38.81 | 0.479 | -97.397+2.817x |
| 10 | 42 | 134.61±7.73 | 267.14±53.99 | 0.722 | -411.975+5.045x |
| 11 | 44 | 136.89±6.04 | 295.68±48.20 | 0.58 | -337.709+4.627x |
| 12 | 48 | 145.39±6.21 | 303.12±41.64 | 0.519 | -203.055+3.482x |
| 13 | 44 | 152.77±7.92 | 376.82±55.55 | 0.689 | -361.716+4.834x |
| 14 | 51 | 160.96±7.38 | 436.47±40.43 | 0.592 | -85.821+3.245x |

**Table: 2 Mean ± SD , Correlation and regression between Height and PEFR of girls**

| AGE (Years) | n | Height Mean±SD | PEFR Mean±SD | r | Regression equation for PEFR |
|---|---|---|---|---|---|
| 8 | 36 | 119.87±3.07 | 214.17±17.54 | 0.5 | -127.997+2.855x |
| 9 | 42 | 127.23±7.09 | 222.14±31.21 | 0.868 | -263.112+3.814x |
| 10 | 39 | 128.17±6.80 | 223.59±14.42 | 0.672 | 5.719+1.666x |
| 11 | 34 | 133.94±7.08 | 250.59±47.83 | 0.617 | -307.88+4.17x |
| 12 | 58 | 144.09±6.58 | 290.69±47.99 | 0.502 | -237.256+3.664x |
| 13 | 46 | 146.92±4.98 | 320±42.32 | 0.68 | -530.278+5.787x |
| 14 | 32 | 149.29±4.73 | 328.75±36.72 | 0.505 | -257.147+3.925x |

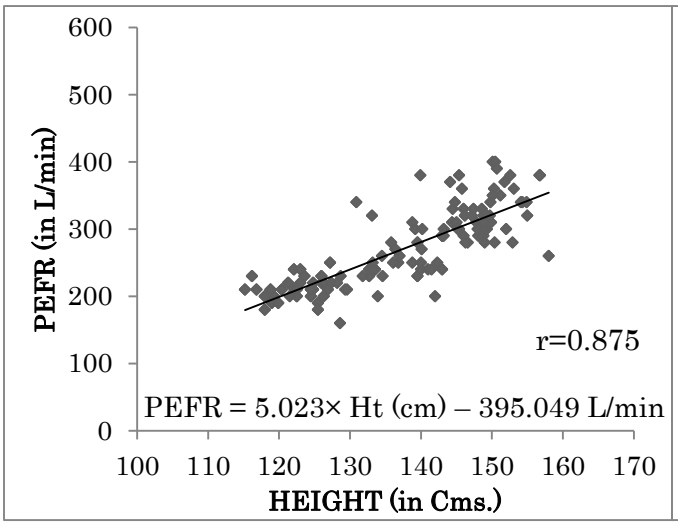


Figure 1: PEFR for various heights with regression equation in boys

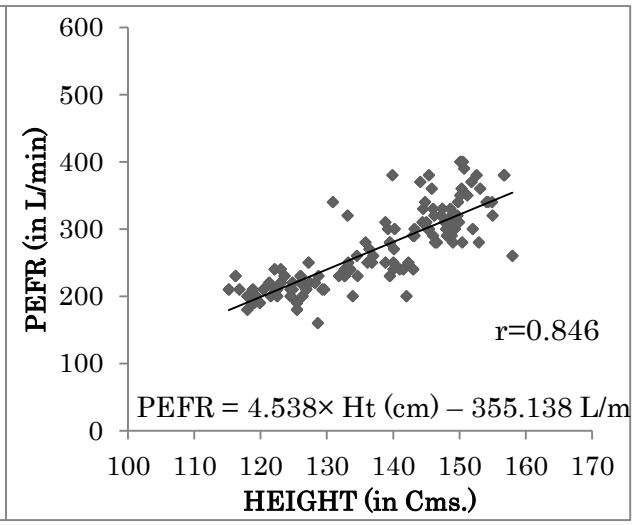


Figure 2: PEFR for various heights with regression equation in girls

## 3. RESULTS AND DISCUSSION

The PEFR values of six hundred one healthy children of both sexes between 8-14 years were analyzed. There were 314 boys and 287 girls. The PEFR values increased linearly in relation to age, weight and height. Table 1 showed that the mean age of boys was 11.33±2.02 years, mean height was 140.88±14.52 cm and mean weight was 34.33±10.57 kg and mean PEFR was 312.596±83.361 L/min . Table 2 showed that the mean age of girls was 11.26±1.96 years, mean height was 135.37±11.99 cm, mean weight was 33.15±9.351 kg and mean PEFR was 270.586±58.872 L/min. Figure 1 and 2 represent the PEFR values in relation to height for boys and girls respectively.

The PEFR values increased in linear relation to age, weight and height. The coefficient of correlation obtained for all the three variables was significant ($p<0.05$). The highest correlation was obtained between PEFR and height ($r=0.875$ for boys , $r=0.846$ for girls). The regression equation based on height for both sexes were

Boys: PEFR (L/min) = 5.023 × Ht (cm) – 395.049 L/min

Girls: PEFR (L/min) = 4.538 × Ht (cm) – 355.138 L/min

According to our study PEFR values in both male and female children increase with height and male children have higher PEFR values than female children. Using multiple regression analysis we can calculate the expected PEFR from height with >95% accuracy.

**Table 3. Comparative values of mean PEFR in different studies compared to the present study.**

| | Height | | | | | |
|---|---|---|---|---|---|---|
| | 120 cm | | 140 cm | | 160 cm | |
| | Boys | Girls | Boys | Girls | Boys | Girls |
| Singh & Peri (1978)[6] | 179.60 | 169.20 | 279.60 | 269.80 | 379.60 | 370.40 |
| Malik et. al.,(1981)[7] | 222 | 216 | 320 | 314 | 415 | 412 |
| Kashyap et.al.,(1992)[8] | 202 | 175 | 304 | 263 | 405 | 352 |
| Chowgule et. al., (1995)[9] | 293.73 | 292.47 | 458.33 | 433.27 | 622.93 | 574.07 |
| Taksande et.al.,(2008)[10] | 217.49 | 178.94 | 311.49 | 251.74 | 405.49 | 324.54 |
| Pramanik et.al.,(2013)[11] | 207.88 | 193.9 | 301.36 | 248.3 | 394.84 | 302.70 |
| Mittal et.al.,(2013)[12] | 205 | 193 | 286 | 272 | 368 | 350 |
| **Present Study (2016)** | **207.71** | **189.42** | **308.17** | **280.18** | **408.63** | **370.94** |

When we compared our study with other Indian studies, the results were fairly comparable with the studies of Kashyap et al.[8], Taksande et al.[10], Pramanik et. al.[11] and Mittal et. al.[12]. Further in comparison with North Indian children of Punjab (studies by Malik et. al.)[7], children of North east India (our study), tribal children living in high altitudes of Himalayas (Kashyap et.al.)[8], children of Eastern India (Purushottam Pramanik et. al.)[11], rural school children from Maharastra, India (Taksande A et.al.)[10] and Punjab(studies by Mittal et. al.)[12] showed lesser PEFR values. The probable reason would be larger body size and lung volumes of Northern Indian children in comparison to East, North Eastern and South Indian children. When the PEFR values between the sexes were compared the studies by Malik et. al.[7], Kashyapet. al.[8], Taksande A et.al.[10],Shallu Mittal et.al.[12] as well as the present study showed significant difference between the sexes. Male children showed higher values. The probable reason for lower PEFR values in females is the lesser lung volumes for the same height in comparison to that of males. PEFR values increased in linearly in relation to age, weight and height, out of which height has been maximally correlated with PEFR. It would also be possible to predict PEFR for a given height by calculating it from our equation. We used height for constructing the regression equation for predicting PEFR because it was a convenient measurement, if proper technique could be employed. Within India, ethnic differences have been shown to account for the variation in the pulmonary functions (Vijayan et al.,1990)[13]. Therefore, it is important to establish reference values for this region. The regression equations obtained in the present study can be used to calculate the expected value of PEFR, which can serve as reference value. Data from a few villages is not representative of characteristics tribe in a state. Therefore, the findings of the present study should be considered preliminary and call for future studies with large sample size based on random selection.

## 4. CONCLUSION

The mean PEFR of the tribal boys was higher than those of the tribal girls of South Tripura and it also correlated better with anthropometric parameters in the boys than those in girls. The anthropometric variables showed a positive correlation with PEFR in both the sexes. This study had generated preliminary reference values for PEFR for rural tribal children of South Tripura, India. We sincerely hope that more such studies will be done in future to generate more accurate reference values and that similar data would also be available with other tribes in Tripura as well as comparative studies on pulmonary functions with their non-tribal counterparts.

## CONFLICT OF INTEREST

The authors declare that no competing financial interests exist.

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