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## ORIGINAL ARTICLES

# Determination of Predictors for Peak Expiratory Flow Rate (PEFR) in Normal Adults (18-45 Years)

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**Abstract**

*A cross sectional prospective study was conducted to find out the correlation of various anthropometric parameters with PEFR in different age and sex of Bangladeshi adult population. Peak expiratory flow rate (PEFR) is a lung function test which is easily measurable and reproducible but base line value of PEFR has not been studied in large scale among Bangladeshi adults.*

*A total of 3401(2515 men and 886 women, M F= 1: 0. 35) normal adults (18 to 45 years), were selected randomly to obtain peak expiratory flow rate (PEFR) from seven different areas of Dhaka city. The mini-Wright peak flow meter was used to measure peak flow rate in a standard way. The highest of three reading was taken as the correct value. Anthropometric parameters including body weight and height were recorded appropriately and body surface area was calculated. Data were analyzed by SPSS program.*

*Significant correlation was found between PEFR with height, weight, surface area and age. The regression equations for PEFR were determined for adult male and female considering height, weight, surface area and age separately as independent variables. Correlation of height with PEFR was the highest in comparison to other anthropometric parameters (weight, surface area and age). Men had significantly higher values of PEFR than women at any height. PEFR of Bangladeshi adult were nearly similar to Indian but lower than that of American and African adult.*

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### Introducdtion:

Pulmonary function testing has come to assume a central place in the practice of pulmonary medicine. Pulmonary function tests of various types are used clinically and epidemiologically to measure functional status in order to assess the disease[1]. Breathing tests have several important uses like to screen for the presence of respiratory impairment, to measure its magnitude, to look for diagnostic patterns of abnormality as part of the investigation of respiratory symptoms, as well as in epidemiological research. Good quality control and appropriate reference values are essential.

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The peak expiratory flow rate is the fastest flow rate that can be sustained for 10 milliseconds at the start of a maximal expiration after full inspiration. The measurement is simple and reproducible and reliable way of judging the degree of airway obstruction in various obstructive pulmonary diseases, specially asthma. Peak expiratory flow rate is easily measured by using a mini-Wrights peak flow meter (mWPFM)[2], which is easy to use, reliable and can be recorded even by the patients at home[3-6]. This instrument is cheap, portable, understandable and useful for physicians in managing patients with respiratory diseases.

PEFR measurement can reveal the diurnal variability of airflow obstruction of patient has been suffering from reactive airway diseases[7,8] that provides early clue to the diagnosis and management. Fall of peak expiratory flow rate in a child with asthma is an impending sign of acute asthma. The response to treatment can be monitored by using serial PEFR measurement[9]. Peak expiratory flow rate measurement gives the idea of status of airway caliber of respiratory system and regulatory function of respiration which some times are affected by certain progressive neurological diseases. As no physician can understand the status of progress and treatment of diabetes mellitus without doing simple blood sugar test, no clinician could manage a patient with potential renal failure without an estimation of blood urea level; PEFR can be used as pulmonary function test in the same way[10],[11]. The occurrence of diurnal variation of symptoms and airway resistance in asthmatics are well perceived, thereby early intervention of treatment pattern and efficacy of drug can be documented by measurement of peak flow rate[12,14]. PEFR can be used not only to evaluate the airway obstruction, can also be used to classify the severity of airway obstruction and its management and as a guide line of admission and discharge of asthma patients[14]. It can also be used to categorize and asses the treatment response of the COPD patients.

Normal lung function values serve as important references for diagnosis of respiratory disorders. These values vary with race and human settlements and are affected by environmental, nutritional, genetic and anthropometric factors. They are hardly the same for any two populations or communities. Hence, the need for each community or population to have its own reference values. There is no such reference values for Bangladesh. The absence of such data encourage reliance on foreign and most times western standards even when those may not correctly represent the normal local values and could lead to misreading of the degree of respiratory dysfunction in indigenous patients. It is also important to know which one of the anthropometric factor has got maximum representation of peak expiratory flow so that a simple reference table can be prepared.

This study examined the PEFR values in normal healthy adults of Dhaka city with a view to highlighting the need for a comprehensive national study to develop a reference table which will help in diagnosis and proper monitoring of obstructive airway diseases specially bronchial asthma, to find out the correlation of PEFR with various anthropometric parameters in different age and sex.

## Material and Methods:

The study was carried out from 1st July, 2000 to 30th June, 2002, for a period of twenty four months. Seven different areas in Dhaka city were included in this study namely Lalbag, Khilgaon, Gopibag, National Medical College, Shaheenbag, Arjat Para, and Nakhal Para. It was a prospective cross sectional study. Total 3401 volunteers of both sexes from all socioeconomic status were targeted and collected accordingly.

From 90 (ninety) wards of Dhaka city 7 (seven) were selected by lottery and from each ward 7 (seven) areas (mohalla) were included in the same way. From every selected area main road was chosen purposively. House holds situated on the right side of the main road were targeted purposively. Every alternate house of the selected side was included into the study. Informed consent was taken prior to the procedure. A detail history was taken from adults (both male & female) between the ages of 18-45 yrs before inclusion into the study. Adults who fulfilled the inclusion criteria were examined properly and questionnaire were filled up appropriately. Height was measured and weight was recorded on bare foot and wearing light clothes. Seven high range

(60-800 1/min) models well functioning mini Wright Peak flow Meter (mWPFM) were used to record PEFR (1,/min). Initially all the family members or group of adults were demonstrated how to use mWPFM correctly. For each determination the person was instructed to make a maximal inspiratory effort and then to make the maximum and most rapid expiratory effort possible in standing position. After initial demonstration of the procedure, majority of the subjects were asked to repeat the procedure 2-4 times on trial basis, to make the person familiar with the technique. Then serial 3 blows for PEFR were registered in individual sheet after the person had become familiar with the technique. Average 34 volunteers could participate in each day of total 100 days visits. Sample collection was started from the first week of July 2000 and completed by last week of June 2002. Before going to the locality a pilot programme was conducted to teach the investigators about the use of mWPFM, to demonstrate the reproducibility of PEFR. Piloting was done at Asthma Centre, NIDCH among the normal adults accompanying asthma patients who are not suffering from Respiratory diseases.

Normal healthy adults of both sexes aged 18 to 45 years were included in this study.

Adults that have been suffering from asthma or any obstructive airway diseases or history of ARI within two weeks or history of atopic conditions like eczema and hay fever were excluded.

Statistical Analysis

Statistical analysis was done using the statistical package for the social science (SPSS) program in computer. Linear and multiple regression analysis were performed by using age, weight, height and surface area as the independent variables and PEFR as the dependent variable. Independent sample test and group test statistics were also done.

**Results:**

The study population included 3401 normal healthy adults of both sexes from seven different areas of Dhaka city namely Lalbag, Khilgaon, Gopibag, National Medical College, Shantibag, Agat Para and Kalachadpur (Tble-1). Among them 2515 and 886 were male and female respectively. Male and female ratio was 1: 0.35 (Table-II). Distribution of study population according to age interval was analyzed and maximum male population was in 20-24 years of age and female was in less than 20 years of age (Table-III). Mean age, height, weight and surface area was calculated (Table-IV).

**Table-I**

*Study population accord in to locality (n=3401)*

| Locality | Male | Female |
|---|---|---|
| Lalbag | 591 (23.5%) | 211 (23.8%) |
| Khilgaon | 458 (18.2%) | 146(16.5%) |
| Gopibag | 197(7.8%) - | 78(8.8%) |
| National M College | 253 (10.5%) | 92(10.5%) |
| Shantibag | 289(11.5%) | 147(16.5%) |
| Ariat Para | 318(12.5%) | 105 (11.8%) |
| Kalachadpur | 409(16.0%) | 107(12.1%) |

**Table-II**

*Sex distribution (n=3401)*

| Sex | Number | Percentage | M:F ratio |
|---|---|---|---|
| Male | 2515 | 73.9 | |
| Female | 886 | 26.1 | 1:0.35 |
| Total | 3401 | 100 | |

**Table-III**

*Distribution of 3401 subjects according to age*

| Age (years) | Male | Female |
|---|---|---|
| <20 | 287(11.4%) | 214(24.2%) |
| 20-24 | 564(22.4%) | 212 (23.9%) |
| 25-29 | 481 (19.1%) | 127 (14.3%) |
| 30-34 | 496(19.7%) | 172(19.4%) |
| 35-39 | 377(15.0%) | 94(10.6%) |
| >39 | 311 (12.4%) | 67(7.6%) |

**Table-IV**

*Anthropometric measurements (n=3401)*

| Sex | Male | Female |
|---|---|---|
| Mean age(±SD) | 29.28±9.36 | 26.57±7.77 |
| Mean height(±SD) | 159.8±5.9 | 153.5±4.6 |
| Mean weight(±SD) | 61.6±6.8 | 57.1±7.0 |
| Mean surface area(±SD) | 1.67±0.11 | 1.59±0.12 |

PEFR values were higher in the age group of 25-29 years in both the sexes in this study (Table-V). During analysis of height interval it was seen that PEFR (L/min) was maximum between 171-190 cm group (Table-10).

The regression equation (Table-VIII) was derived from the regression analysis and ANOVA test where PEFR of individual person was considered as dependent variable and other anthropometric parameters as independent variables. These regression equations enabled us to construct the nomogram.

**Table-V**

*PEFR (< / min) of Bangladeshi adult in relation to age interval (n=3401)*

| Age (years) | Male PEFR ± S.D. (L/min) | Female PEFR ± S.D. (L/min) |
|---|---|---|
| <20 | 472 ±65 | 370 ±38 |
| 20-24 | 508 ± 64 | 383 ±52 |
| 25-29 | 510 ± 49 | _ 391 ± 54 |
| 30-34 | 508 ± 49 | 387 ± 44 |
| 35-39 | 501 ± 51 | 384 ± 44 |
| >39 | 485 ± 50 | 348 ± 64 |

**Table-VI**

*PEFR (1 / min) of Bangladeshi adult in relation to height interval (n=3401)*

| | Male | | Female | |
|---|---|---|---|---|
| Height interval (cm) | N | PEFR (+/- SD) | n | PEFR (+/- SD) |
| 130-140 | 3 | 373.3(63.5) | 3 | 353.3(50.3) |
| 141-150 | 90 | 427.7(73.8) | 227 | 353.9(41.3) |
| 151-160 | 1365 | 489.9(51.1) | 596 | 385.1(42.7) |
| 161-170 | 945 | 518.8(48.71) | 58 | 420.6(81.2) |
| 171-190 | 112 | 524.65(78.2) | 2 | 460.0(14.1) |

PEFR values (both mean and range) were calculated. The values were found

**Table-VIII**

*PEFR I / min according to sex (n=3401)*

| Sex | PEFR (I/min) Best of 3 | | |
|---|---|---|---|
| | Mean | Standard Dev. | Range |
| Male | 500 | 57 | 250-800 |
| Female | 380 | 49 | 200-610 |

significantly lower in women than that of men (Table-VII).

**Table-VIII**

*Regression equation for prediction of PEFR (L / min) from different independent variables*

| Model Variable | Sex PEFR (1/min) | Independent | Regression equation | SEE* |
|---|---|---|---|---|
| Male | Ht (cm) | 3.51x Ht- 60.3 | 52.77 | |
| 1 | Female | Ht (em) | 3.75x Ht-195.4 | 45.91 |
| | Male | Wt (kg) | 2.89,\ Wt +321.9 | 53.18 |
| 2 | Female | Wt (kg) | 1.59x Wt +288.5 | 47.18 |
| | Male | S.Area(m.sq) | 188.8,\ SA+185.3 | 53.00 |
| 3 | Female | S.Area(m.sq) | 100.2x SA+219.7 | 47.60 |
| | Male | Ht & Wt | 2.63,\ Ht + 2.Ox Wt -44.8 | 51.20 |
| 4 | Female | Ht & Wt | 3.39x Ht +1.13x Wt- 204 | 45.30 |
| | Male | Ht,Wt & | 2.97x lit- 15.60xWt+1123.76x | 50.30 |
| 5 | S.Area | SA -887 | | |
| | Female | Ht,Wt & | 3.42x Ht- 11.72x Wt +768.90x | 44.60 |
| | | S.Area | SA -702 | |

*Standard error of the estimate

To explain and predict the changes in the magnitude of a given variable (PEFR) in terms of one or more variables (Height, Weight, Surface area, age, Smoking Habit etc) regression analysis can be conducted. The most well known method of estimation procedure is the ordinary least square (OLS) method. In regression analysis we express the relationship between the dependent variables and the independent variables by means of an equation. The OLS regression model for estimating PEFR in terms of explanatory variables may be expressed in the following form.

$$PEFR = \beta_0 + \beta_1 H + \beta_2 W + \beta_3 SA + \beta_4 A + \Sigma$$

In this máodel the dependent variable is PEFR and independent variables are Height (H), Weight (W), Surface Area (SA), and Age (A). $â_0$ $â_1$, $â_2$, $â_3$, $â_4$, $â_1$ are regression coefficient and å is error term in the model. An OLS regression will be run to find out the principal determinant of PEFR. By statistical significance test we shall determine whether the explanatory variables have any significant relationship or not.

Now we can discuss the estimate of the parameters for the PEFR OLS regression model. The level of significance for all the tests is considered to be 0.05. The estimated values for the PEFR model along with their t-values, model F values, coefficient of determination, adjusted coefficient of determination and p-values are given in the table-13.

OLS PEFR regression model revealed that the intercept was significant for the PEFR model. Height, Weight, and Surface area were highly significant and age was also significant at .5% level of significance. Model F was highly significant. Multiple and adjusted multiple coefficient of determination were .601 and .524, showing explanatory power of the model was good.

Simple regression model of PEFR for different independent variables can be considered. In that model Height was considered as an independent variable.

$$PEFR = \beta_0 + \beta_1 H + \beta$$

The intercept was significant for the PEFR model (Table-X). Height was highly significant. Multiple and adjusted multiple coefficient of determination were .371 and .363.

When weight was considered as an independent variable and set up a simple regression model of PEFR as follows.

$$PEFR = \beta O + \beta 2W + \Sigma$$

**Table-IX**

*Estimation Results of OLS PEFR regression model*

| Variable | Parameter | Estimate value | $t_{cal}$ | P-value | $F_{mode\ el}$ | $R^2$ | $R^2$ |
|---|---|---|---|---|---|---|---|
| Intercept | $\beta_0$ | - | 15.899 | .000 | | | |
| | | | 1351.495 | | | | |
| Height | $\beta_1$ | 5.698 | 30.562 | .000 | | | |
| Weight | $\beta_2$ | -15.518 | -8.636 | .000 | 474.478 | .601 | .524 |
| Surface area | $\beta_3$ | 1134.225 | 10.182 | .000 | | | |
| Age | $\beta_4$ | -.428 | -2.783 | .005 | | | |

**Table-IX**

*Estimation Results of Simple OLS PEFR regression model (Height)*

| Variable | Parameter | Estimate | $t_{cal}$ | P-value | $F_{mode\ el}$ | $R^2$ | $R^2$ |
|---|---|---|---|---|---|---|---|
| Intercept | $\beta_0$ | -571.793 | -20.644 | .000 | 810.2 | .371 | .363 |
| Height | $\beta_1$ | 6.579 | 37.591 | .000 | | | |

**Table-XI**

*Estimation Results of Simple OLS PEFR regression model (Weight)*

| Variable | Parameter | Estimate | $t_{cal}$ | P-value | $F_{mode\ el}$ | $R^2$ | $R^2$ |
|---|---|---|---|---|---|---|---|
| Intercept | $\beta_0$ | 204.175 | 20.215 | .000 | 670.4 | .251 | .233 |
| Height | $\beta_1$ | 4.379 | 26.361 | .000 | | | |

**Table-XII**

*Estimation Results of Simple OLS PEFR regression model (Surface area)*

| Variable | Parameter | Estimate | $t_{cal}$ | P-value | $F_{mode\ el}$ | $R^2$ | $R^2$ |
|---|---|---|---|---|---|---|---|
| Intercept | $\hat{a}_0$ | 11.084 | 0.646 | .000 | 715.01 | .261 | .257 |
| Height | $\hat{a}_1$ | 277.739 | 26.747 | .000 | | | |

**Table-XIII**

*Estimation Results of Simple OLS PEFR regression model (age)*

| Variable | Parameter | Estimate | $t_{cal}$ | P-value | $F_{mode\ el}$ | $R^2$ | $R^2$ |
|---|---|---|---|---|---|---|---|
| Intercept | $\hat{a}_0$ | 439.492 | 87.114 | .000 | 35.579 | .101 | .101 |
| Height | $\hat{a}_1$ | 1.020 | 5.965 | .000 | | | |

**Table-XIV**

*Estimation Results of Multiple (Height & Weight) OLS PEFR regression model*

| Variable | Parameter | Estimate | $t_{cal}$ | P-value | $F_{mode\ el}$ | $R^2$ | $R^2$ |
|---|---|---|---|---|---|---|---|
| Intercept | $\beta_0$ | -537.695 | -19.953 | .000 | 861.495 | 0.336 | 0.336 |
| Height | $\beta_1$ | 5.442 | 29.219 | .000 | | | |
| Weight | $\beta_3$ | 2.414 | 14.806 | .000 | | | |

Intercept was found significant for the PEFR model (Table-XV). Weight was highly significant. Multiple and adjusted multiple coefficient of determination were about .251 and .233.

When surface area was considered as an independent variable, the intercept was significant for the PEFR model. S.Area was highly significant. Multiple and adjusted multiple coefficient of determination were about .261 and .257 (Table-XVI).

In case of Age the intercept was significant for the PEFR model. Age was highly significant. Multiple and adjusted multiple coefficient of determination were about .101.

From above findings it was obvious that the Multiple and adjusted multiple coefficient of determination of height is more (.371 and .363) than other independent variables like weight, surface area and age.

When Height and Weight were considered as independent variables and set up a multiple regression model of PEFR as follows.

$$PEFR = \beta_0 + \beta_2 H + \beta_3 H + \Sigma$$

There we saw the intercept, height and weight were highly significant for PEFR model (Table-XIV). Similar findings were seen in case of height, age and height, surface area.

**Table-XV**

*Estimation Results of Multiple (Height and Age) OLS PEFR regression model*

| Variable | Parameter | Estimate | $t_{cal}$ | P-value | $F_{mode\ el}$ | $R^2$ | $R^2$ |
|---|---|---|---|---|---|---|---|
| Intercept | $\beta_0$ | 575.316 | -20.778 | .000 | 712.905 | 0.296 | 0.295 |
| Height | $\beta_1$ | 6.522 | 36.092 | .000 | | | |
| Age | $\beta_3$ | 0.443 | 3.050 | .002 | | | |

**Table-XVI**

*Estimation Results of Multiple (Height and S. Area) OLS PEFR regression model*

| Variable | Parameter | Estimate | $t_{cal}$ | P-value | $F_{mode\ el}$ | $R^2$ | $R^2$ |
|---|---|---|---|---|---|---|---|
| Intercept | $\beta_0$ | -650.871 | -23.917 | .000 | 881.475 | 0.342 | 0.342 |
| Height | $\beta_1$ | 5.423 | 29.421 | .000 | | | |
| S. Area | $\beta_3$ | 159.052 | 15.730 | .000 | | | |

But the value of R' was highest (0.342) in multiple (height and s. area) OLS PEFR regression model.

Nomogram of normal PEFR (L/min) were constructed from regression equation to show relationship with height weight and surface area in both the adult male and female.

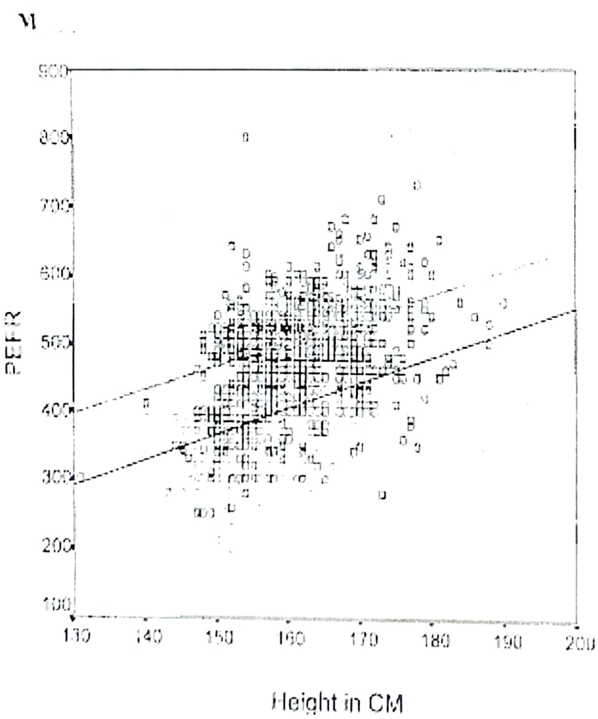


**Fig.-1 :** *Peak expiratory flow (L/min) in relation to height (male & female).*

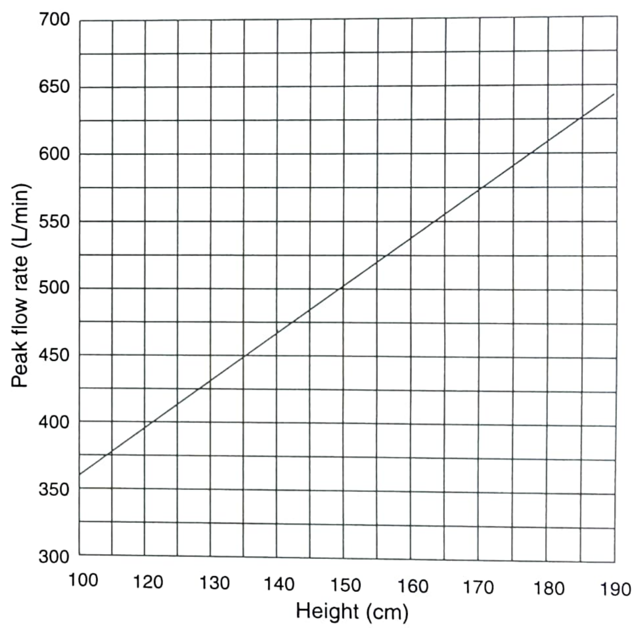


**Fig.-2:** *Nomogram of normal PEER (L/min) in relation to height (Bangladeshi male).*

It was observed that the Pearsons correlation co-efficient between PEFR and height was 0.642 (highest) which means strong positive relationship height and PEFR. Again surface area and weight had also positive relation with PEFR but age had very weak positive relationship with PEFR (Table-XVII).

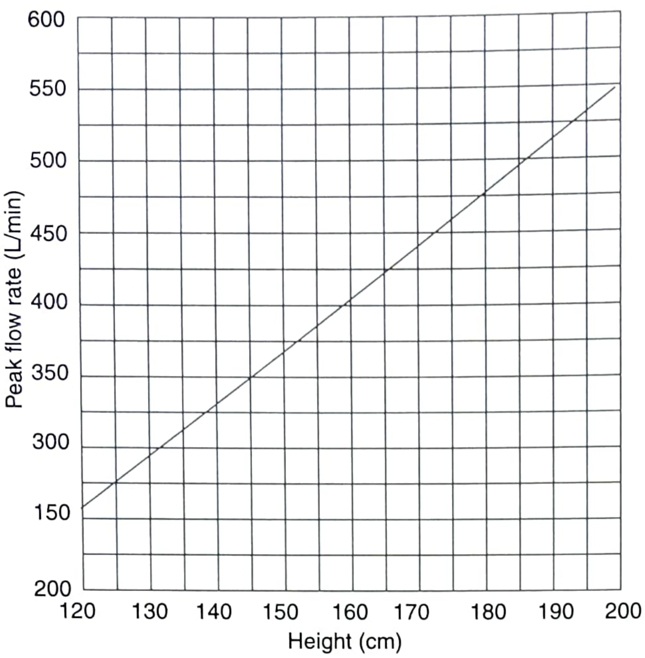


**Fig.-3:** *Nomogram of normal PEFR (L/min) in relation to height (adult female).*

**Table-XVII**

*Pearson's correlation coefficient (r) between PEFR and other variables:*

| | Height | S. Area | Weight | Age |
|---|---|---|---|---|
| PEFR | 0.642 | 0.487 | 0.482 | 0.172 |

Another observation from the simple regression model of PEFR and height (Table-X) was that the regression co-efficient of height was 6.579 (higher than that of other variables) which means one unit increase in height cause 6.579 unit increase in PEFR and the findings was concordant with the correlation co-efficient.

## Discussion

Peak expiratory flow rate (PEFR) of 3401 normal adult (18 to 45 years) from seven different areas in Dhaka city were measured to determine relation among different factors and between male and female populations and to understand the normal value (Table-IV). Male female ratio was 1:0.35 (Table-II). In this study significant difference of values of PEFR (litre/minute) in relation to height, weight, age, and body surface area was found specially in respect to height. PEFR values of women (in relation to height) were always lower than that of the men which was statistically significant. The difference of PEFR in male and female were observed by other investigators[15]. Same difference was also observed in different studies between boys and girls[16]. The factors that determine PEFR are predominantly expiratory muscle effort, lung elastic recoil pressure and air way size[17]. The muscle effort intern depends on the physical strength and physical activity. It is possible that these lower values in women were due to physiological reason.

The positive correlation of PEFR with height, age, weight and body surface area was observed in both the male and female which means that the value of PEFR increased with increase in those anthropometric parameters. The most significant correlation was observed between PEFR and height (Fig-3) similar to other studies[16] Thus the height had been found to provide a good basis for prediction of normal values of PEFR. Other investigators[18] also found the superiority of height as an independent parameter which correlated well with PEFR and other ventilatory functions. Pulmonary measurements such as forced vital capacity (FVC), forced expiratory volume in one second (FEV1 1) and peak expiratory flow rate (PEFR) are best correlated with height[17]. One study[19] observed that for clinical evaluation of child's lung function, height was the best independent parameter in comparison to age and weight. Several recent studies had also shown the highest correlation coefficient between PEFR with height. There was no disagreement regarding positive correlation of PEFR with height as an independent body parameter. Standing height is the best predictor of PEFR in children and height should have the first preference for prediction of PEFR because of more accuracy, easily measurable at any place and its highly significant relationship with PEFR.

Significant association was observed between PEFR with body surface area and with body weight. But the correlation of PEFR with body surface area was more significant than that of weight. On the other hand, the level of significance of correlation of PEFR with body surface area and with weight was less than that of height. Such variation may be due to wide variation in weight and height within same age group.

Age is the variable which has also positive correlation with peak flow rate (PEFR) in this study

(Table-XVII). But correlation coefficient values are less than that of the height, surface area and weight (Table-XVII). Another study[16] concluded that it is lower than height but higher than weight and surface area. It could be because his study population was children aged 5 to 15 years, where with increase age muscular development also increases causing better performance.

OLS PEFR regression model revealed that the intercept was significant for the PEFR model. Height, Weight, and Surface area were highly significant and age was also significant at .5% level of significance. Model F was highly significant. Multiple and adjusted multiple coefficient of determination were .601 and .524, showing explanatory power of the model was good.

When height was considered as an independent variable, the intercept was significant. for the PEFR model (Table-X). Height was highly significant. Multiple and adjusted multiple coefficient of determination were .371 and .363. When weight was considered as an independent variable, the intercept was round significant for the PEFR model (Table-XI). Weight was highly significant. Multiple and adjusted multiple coefficient of determination were about .251 and .233.

Similarly for surface area the intercept was significant for the PEFR model. S.Area was highly significant. Multiple and adjusted multiple coefficient of determination were about. 261and .257 (Table-XII).

In case of Age the intercept was significant for the PEFR model. Age was highly significant. Multiple and adjusted multiple coefficient of determination were about .101.

So it was obvious that the Multiple and adjusted multiple coefficient of determination of height is more (.371 and .363) than other independent variables like weight, surface area and age.

When Height and Weight were considered as independent variables it was seen that the intercept, height and weight were highly significant for PEFR model (Table-XIV). Similar findings were seen in case of height, age and height, surface area.

But the value of $R^2$ was highest (0.342) in multiple (height and s. area) OLS PEFR regression model.

Nomogram of normal PEFR (L/min) were constructed from regression equation to show relationship with height (Fig-2,3) in both the adult male and female.

Scatter diagrams were prepared which revealed maximum relation of height with PEFR than other variables (Fig-1).

Sample size of the study was reasonably large enough (n=3401). Four physicians working in the field of respiratory medicine were involved in the data collection procedure in every step. Seven peak flow meters of good quality were selected for the procedure. Each and everyday prior to data collection, the validity of the devices was checked. Intensive quality control measure was taken at every stage of the study. The investigators were provided extensive supervision. They were directly involved in data collection at field level. Filled up questionnaires were rechecked every night after completion of the days field work to find out any missing data. If any mistake was found, it was corrected at field on the next day. This type of study is for the first time in Bangladesh.

However, the study suffers from some limitations. Like, sample was not selected randomly, because it is not possible in Dhaka city. Though cluster sampling is a well accepted method in developing countries. During data collection female participants were less than that of male, because of' conservativeness. Even then required sample size was fulfilled. The required number of each age group could not be strictly followed because of limited time and fund. With all these the study can be regarded as representative.

Gregg, 1. & Nunn, I.J[20] carried out a study on peak expiratory flow on normal subject in South West London among 202 men and 199 women to show the relationship between peak expiratory flow, age and height. They found the relationship between PEFR & age as curvilinear. In this study it was also observed that PEFR values increase gradually up to certain age limit then do fall again. All the variables were initially included then eliminated in turn if their additional contribution to the regression sum of squares was not statistically significant. Their findings suggested that in both sexes PEF does not begin to decline until about the age of 35 years. They also found that small departure from the correct technique of performing the test may cause spuriously low value of PEF. And in general it is more difficult to persuade women to make a maximal effort than men.

In present study it was observed that PEFR values rises gradually with the increase of age and reaches maximum in the age group of 25-29 years in both the sexes. Similarly, it is difficult to persuade women to make a maximal effort than men and a small departure from the correct technique of performing the test causes spuriously low value of PEF. They also found relationship of PEFR with age and height which is consistent with present study.

Natarajan, S. and Radha, K. (1978) studied peak expiratory flow rate in normal south Indians (1850 men and 210 women). The highest readings for men were obtained in the age group of 21-25 years and for women in the age group of 17-20 years. In this study highest readings for both the sexes were in the age group of 25-29 years. In women the values were consistently lower than those in men of the same age and height. Similar lower values for women were observed in this study. The highest individual value recorded in their study was 720 L/min for a man aged 23 years weighing 63 kg and of a height of 175 cm. In present study the highest value is 800 L/min in a man aged 27 years weighing 65 kg with a height of 176 cm. Their another observation was that if height is eliminated for analysis of the data and all the value of a particular age group are pooled there is no appreciable difference in the PEFR of young women belonging to the age group 17-35 years, which shows height is one of the most important factor which determines the PEFR in an individual.

From the simple OLS PEFR regression model it is seen that the intercept was significant for the PEFR model. Height is highly significant, multiple and adjusted multiple co-efficient of determinations are .371 and .363, showing explanatory power of the model is not good. Explanatory power of height is more (.371) than that of any other variable like weight, surface area and age. Another observation is that combination of height and surface area represents more than combination of height and weight or height and age.

Nomogram for predicting normal values of PEF, derived from the data of this study, have been prepared.

In this study it is evident that mean expiratory flow for men is 500+/- 57 L/min and 380+/-49 L/min for women. A study conducted in India (Shah and Mehta, 1961) showed PEFR 500 L/min for adult male and 400L/min for female. So, it is almost similar to this study. It may be explained by same environment and identical build of the population. Though other study (SK Mallik et al. 1975) showed it 483+/-25 in India.

In Kenya Orie-NN (1999) in his study on Comparison of normal respiratory function values in young Kenyans with those of other Africans and Caucasians included 88 apparently healthy young Kenyans. The study revealed mean values of (male versus female) PEFR 586.30 ± 8.54 versus 438.30+/-8.55. The values for females were 25-26% lower than those for males. The FEV1, FVC and PEFR for both males and females correlated positively with heights. In present study the PEFR value is much lower (for male 550 + 57 and for female is 380 + 49). It could be due to increased height, better build and decreased environmental pollution. Similarly PEFR values were found always lower in female than male subjects and PEFR for both males and females correlated positively with heights.

Leiner et al, (1963) at New Jersey found the mean value of 600+/-70 for adult male; this higher value can be explained by same way.

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