Research Paper Medicine

Correlation Between Body Mass Index and Peak Expiratory Flow Rate of an Indigenous Brick Industry Labour on Bank of Kangsabati River, Paschim Medinipur, West Bengal

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ABSTRACT

This study establishes the relationship of PEFR with age and BMI in healthy adult males (N=200) of Brick industry labor on bank of Kangsabati river, Paschim Medinipur. Overall, the mean PEFR is 455.37±58.18. The age is significantly affecting the PEFR unlike BMI. Age as an independent predictor predicts the 69.3% variability (R^2 is 69.3%)in PEFR while BMI > 23 as an independent predictor predicts only 1.4% variability (R^2 is 0.014) .PEFR declines with advancing age due to degenerative changes in musculoskeletal system leading to decrease in respiratory muscle strength. PEFR shows some decline with high BMI in elderly age group. The association of higher BMI with lower PEF may indicate that obesity is an important risk factor for reduced airflow or lung function in labour. These findings emphasize the importance of the prevention of obesity in labour in order to avoid possible future respiratory problems.

KEYWORDS Age, Body Mass Index, Peak Expiratory Flow Rate

Introduction

Peak expiratory flow rate (PEFR) is a measure of ventilator capacity measured by peak flow meter. It is regarded as a basic physiological parameter for the diagnosis, follow up and treatment of patients with respiratory illnesses such as asthma, chronic bronchitis, and emphysema. Pulmonary functions are generally determined by respiratory muscle strength, compliance of the thoracic cavity, airway resistance and elastic recoil of the lungs (1). Narrowing of airways is expressed in terms of various expiratory flow rates. Peak expiratory flow rate (PEFR) is one such parameter that can be easily measured by a peak flow meter and is a conventional tool for measure lung functions in field study (2). It is a fairly good indicator of bronchial hyper-responsiveness and does not require body-temperature-pressure saturation correction (BTPS) (3). The primary aim of this study is to establish the effect of age and BMI on PEFR on adult males who live at the Brick industry on bank of Kangsabati River, Paschim Medinipur which comes in this region and considered as relatively pollution free in comparison to other surrounding places.

Peak flow readings are higher when patients are well and lower when the airways are constricted. From changes in recorded values, patients and doctors may determine lung functionality, severity of asthma symptoms, and treatment .First measure of precaution would be to check patient for signs and symptoms of asthmatic hypervolemia. This would indicate whether or not to even continue with the Peak Flow Meter procedure. Measurement of PEFR requires training to correctly use a meter and the normal expected value depends on a patient's sex, age and height. It is classically reduced in obstructive lung disorders such as asthma. Due to the wide range of 'normal' values and high degree of variability, peak flow is not the recommended test to identify asthma. However, it can be useful in some circumstances. A small portion of people with asthma may benefit from regular peak flow monitoring. When monitoring is recommended, it is usually done in addition to reviewing asthma symptoms and frequency of reliever medication use. When peak flow is being monitored regularly, the results may be recorded on a peak flow chart. It is important to use the same peak flow meter every time.

Materials and Methods

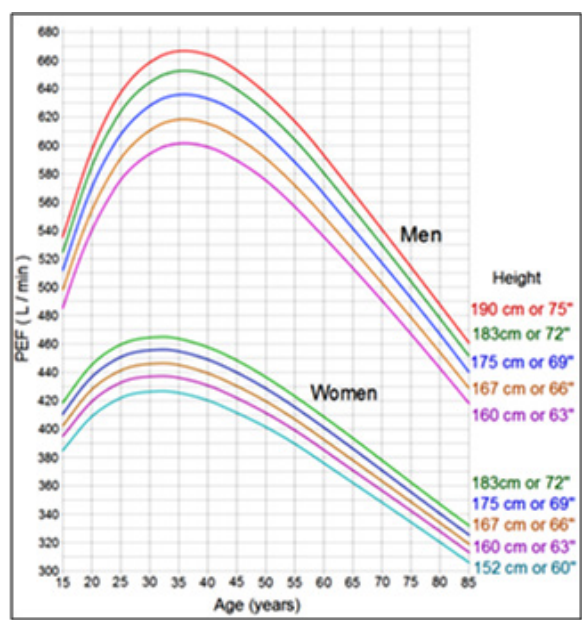

Figure1.Normal values for peak expiratory flow (PEF) EN 13826 or EU scale

The present study was undertaken in the Department of Human Physiology with Community Health, Vidyasagar University, Midnapore, West Bengal. Two hundred healthy, non-smoker males in the age range of 18–60 years volunteered have been considered for this study from Brick industry labor on bank of Kangsabati River, Paschim Medinipur, West Bengal for the period November 2013 to August 2014. Inclusion Criteria for selection of studysubjects:

- Non-smoker, physically and mentally fit.
- Free from any respiratory or cardiac disease.
- Co-operative and capable of understanding the procedure.

- Resident of Brick industry labor on bank of Kangsabati River, Paschim Medinipur for more than 5 years.

The peak expiratory flow rate was determined using Wright's Peak flow meter in Figure 1. The subjects were asked to stand in upright position with the peak flow meter held horizontally in front of their mouth and take a deep breath in and close the lips firmly around the mouthpiece, making sure that no air leaks around the lips. The subjects were asked to breathe out as hard and as fast as possible and the number indicated by the cursor was noted. The above sequence was repeated thrice in each patient. The highest of the three measurements was taken in to consideration for the analysis. The BMI was calculated using the formula-body weight (kg)/height2(m).Statistical analysis was done using SPSS version 18 and MS Office excel 2007.Variables analyzed were age, BMI and PEFR. Student's 't' test and Linear regression analysis was done to find out the effect of age and BMI on PEFR. Pearson correlation analysis was also done between age and BMI.

Results and Discussion

The PEFR values of 200 subjects had been stratified according to age and BMI. The mean PEFR in different age groups showed a decreasing trend with advancement of age. The mean PEFR in age group of 25-40 years was found to be 493.58±44.56 L/min. whereas that in the age group of 41-60 years was 433.06±34.09 L/min. Similarly PEFR appeared to be higher in normal BMI subjects (mean PEFR 465±63.41 L/min.) than that in the higher BMI subjects (mean PEFR 467.05±64.87 L/min.). Further in-depth analysis using Student's 't' test after stratification of the high and normal BMI subjects in various age ranges showed that mean PEFR had been found to be lower in high BMI subjects in all age groups except in younger age range of 15-25 years but the differences were not significant statistically (p value <0.05) as evident in Table 1.

Table 1. Mutual effect of age & BMI on PEFR of the subjects in various age ranges

Age groups (years)	PEFR in normal BMI (<23)in lt./min±SD	PEFR in high BMI (>23)in lit./ min±SD	p value
15-25	563.0923.87±	587.0833.85±	0.05
26-40	498.0846.09±	489.0843.03±	0.05
41-60	420.56±+29.09	445.5639.09±	0.05

Linear regression analysis model shows that the age significantly affects the PEFR unlike BMI. Age as an independent predictor predicts the 67.8% variability (R^2 is 67.8%) in PEFR while BMI > 23 as an independent predictor predicts only 1.9% variability (R^2 is 0.019). PEFR was found to be significantly decreased (p value <0.05) in the age range of 26-40 years and 41-60 years. The odds ratio for PEFR in different age groups i.e. 15-25 years, 26-40 years & 41-60 years are –0.569, –2.20 & –4.90 respectively. This means the decrease in PEFR in age group 41-60 years is more than that in the age group 26-40 years and the decrease in PEFR in the age group 26-40 years is more than in age group 15-25 years. Although with increase in BMI PEFR is decreasing but it is not significant (p value <0.05). Table 2 shows the correlation between the PEFR of normal and high BMI subjects in various age ranges. The only significant correlation was found to be in the age range of 41-60 years (p value <0.05) where high BMI was found to be negatively correlated with PEFR although the strength of association was poor (r=–0.287). In other age groups the correlation was not significant.

Table 2. Correlation between the PEFR of normal and high BMI subjects int various age ranges

Age groups (years)	Normal BMI (BMI<23)		High BMI (BMI>23)	
	r	p value	r	p value
15-25	0.210	0.05	0.110	0.05
26-40	-0.154	0.05	-0.054	0.05
41-60	0.045	0.05	-0.035	0.05

The interplay between age and BMI has been found to be very complex in context of its overall effect on PEFR values. PEFR, on the other hand, is an important diagnostic and prognostic tool in lung function studies for identifying airflow limitations, its severity and variations. Age has been found to be an important factor determining PEFR in healthy subjects. Increasing age appears to be negatively correlated with PEFR although the strength of association is poor. This finding is in agreement with various Indian and foreign authors like Mahajan et al (4), Jepegnanam et al (5), Yogesh Saxena et al (6), Joffa Paul et al (7). The reason for this decline could be related to various factors which plays important role in determining PEFR like expiratory muscle effort, elastic recoil and airway size etc. These factors are known to be affected significantly in old age or as the age advance after 40 years (8). The decline in PEFR per decade increase in age in previous Indian studies ranged between 20.3 to 33.1 L/min (9-13). In a study by Rajendra Prasad et al (14), the decline in PEFR per decade increase in age was 29.2 lit/min. Increase in BMI did not show any significant correlation with mean PEFR in younger age range. These findings show agreement with previous studies (3, 6, and 7). In elderly age group i.e. >40 years of age PEFR shows some significant declining trend with higher BMI. Besides decrease in the elastic recoil of the lungs and airway size and weakness of the respiratory muscles in older age group, it could further be explained through several possible mechanisms such as mechanical effects on the diaphragm and fat deposition between the muscles and the ribs that can lead to increase in the metabolic demands and work load of breathing (6).

Conclusion

Both age and BMI autonomously affects the PEFR in indigenous Brick industry labor but the effect of age on PEFR is much more significant than BMI. Thus, pulmonary functions vary according to the physical characteristics like age and BMI with regional differences in lung functions in healthy Indians. Because of resource limitations, this study has been done as a hospital based study; therefore the study population may not be the true representative of Indian population. There is a scope of population based epidemiological study with bigger sample size to further validate the findings of the study.

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