ORIGINAL RESEARCH ARTICLE

INTERNATIONAL JOURNAL OF ANATOMY PHYSIOLOGY AND BIOCHEMISTRY

http://www.eternalpublication.com

IJAPB: Volume: 2; Issue: 11; November 2015 *ISSN(Online):2394-3440*

Correlation of anthropometric parameters with Peak Expiratory Flow Rate

Published online on 02nd November 2015©www.eternalpublication.com

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Received: 17th October 2015; Accepted: 28th October 2015

How to cite this article: Bawaskar AS, Iyer N. Correlation of anthropometric parameters with peak expiratory flow rate. International Journal of Anatomy Physiology and Biochemistry 2015; 2(11):1-5.

Abstract:

Aims & Objectives: To know correlation between Peak Expiratory Flow Rate (PEFR) and height, weight & BMI in males and females.

Material & Method: The study has been carried out on 150 healthy females & males of 18 to 25 years of age. Informed consent was taken. Their PEFR was measured with the help of mini Wrights Peak Flow Meter. Three PEFR readings were taken from each individual and the best of the three readings was considered. Subjects were categorized into groups based on their differences in height, weight and BMI. The variations of PEFR with respect to height, weight and BMI were determined separately. Unpaired t-test and Pearson correlation was used for analysis.

Results: The values of PEFR obtained in this study were within the normal range. The mean values of height, weight, BMI and PEFR were higher for males than females. There is also positive anthropometric association with PEFR.

Conclusion: It was concluded that PEFR shows positive correlation with anthropometric determinants like height, weight and BMI.

Key Words: BMI, Height, Peak Expiratory Flow Rate, Weight

Introduction:

PEFR (Peak Expiratory Flow Rate) as a measurement of ventilatory function was introduced by Hadorn in 1942 and was accepted in 1949 as an index of spirometry.[1] By definition, it is "The largest expiratory flow rate achieved with a maximally forced effort from a position of maximal inspiration, expressed in liters/min (BTPS).[2]

PEFR is considered as the simplest index of pulmonary function to assess the ventilatory capacity. It is effort dependent and reflects mainly the caliber of the bronchi and larger bronchioles, which are subjected to reflex bronchoconstriction. The peak flow meter is a reliable and safe, bedside instrument that fulfils the need of assessing the ventilatory function and can be efficiently used without much specialized training. The portability and simplicity of the peak flow meter make it particularly suitable for studies of respiratory function. With Wright peak flow meter PEFR is perhaps the fastest and easiest single breath pulmonary function test available.[3,4]

In a subject whose lungs have not been affected by any pathological condition, the factors effecting PEFR are the dimensions of the large intra and extra thoracic airways, the force generated by the expiratory muscles, the speed with which maximal

alveolar pressure is reached and how the lung was stretched prior to the PEFR manoeuvre.[5,6] Structure and dimensions of the lung are influenced by age, sex, body mass.[7] Previously various scientific studies have been carried out to relate PEFR to height and weight of the subjects.[8-11]

The present study has been taken up to look into the relationship between PEFR and anthropometric parameters like height and weight in males and females and determining which factor has a stronger association with PEFR. The subjects were chosen around the age of 18-20years as during this age, PEFR is recorded at its peak levels and has least variations

Materials & Method

150 healthy adults (70 females & 80 Males) selected for this study with their prior consent were among the students of L. T. M. M. C. & G. H. The study was undertaken in the Department of Physiology L. T. M. M. C. & G.H. Sion, Mumbai. Permission from the Human Ethics Committee of the Institute was taken.

Subjects with history of cardiopulmonary disorders, psychiatric disorders, smoking, history of any drug intake which could possibly affect the lung functioning were excluded from the studies .They were then made to relax and vital parameters were recorded. Height in 'cm' was measured with subject standing erect on flat fleet, looking straight ahead and back in contact with the measuring bar. Body weight of every subject was recorded in 'Kg' with the help of weighing machine with a sensitive lever. Body mass index (BMI) was calculated by using Quetelet index, i.e. weight (kg)/ height (meter).[2]

PEFR was measured with Mini wrights Peak Flow Meter after prior demonstration in the subject during the same time of the day (i.e. from 3.00 pm to 4.00 pm.) to obtain uniformly maximum Peak Expiratory Flow Rate. It is determined in liters/ minute. The subjects were asked to inspire deeply, and then blow into the instrument's mouthpiece with nostrils closed. Each subject made three PEFR measurement maneuvers the highest value was considered.[12,13]

Considering the differences between the maximum and minimum value of height recorded, the subjects were grouped into different ranges of height. Similar procedure was followed for categorizing the subjects according to their weight. Unpaired t-test was used to determine the differences between the PEFR, height and weight of male and female subjects. P-value less than or equal to 0.05 ($p \leq 0.05$) was considered as statistically significant. Correlation coefficient (r) was calculated between PEFR and different parameters separately for male and female subjects. All statistical analysis was done using Graph Pad Prism 5 software.

Observation & Results

The male and female subjects grouped according to their height, weight and BMI .The mean PEFR value recorded in each group. We observe a gradual trend of increasing PEFR with respect to increasing height, weight and BMI in both male and female.

Table No. 1 shows the variation of peak expiratory flow rate with height, weight and BMI in male and female. The correlation between PEFR and height, weight, BMI is positive in both male and female and correlation is significant at 0.01 level.

Table No. 1 Variation of PEFR with Height, Weight and BMI in males and females.

Sr. no.	Sex	Variation of PEFR With	Correlation coefficient
1	Male N = 80	Height	**0.33***
		Weight	**0.26***
		BMI	**0.016***
2	Female N = 70	Height	**0.20***
		Weight	**0.24***
		BMI	**0.014***

* Positive Correlation & correlation is significant at 0.01 level.

We found that in case of males, a stronger association exists between PEFR and height as compared to PEFR and weight. In male and female both PEFR increases with increase in BMI in Physiological limits correlation is significant at 0.01 level.

Table No. 2 Anthropometry and PEFR in young adults.

Subjects	Height (cm) (mean±SD)	Weight (kg) (mean± SD)	BMI (kg/m^2) (mean± SD)	PEFR (L/min) (mean± SD)
Males (N=80)	167.46±7.79	65.66±15.06	23.56±5.40	514.29±58.274
Females (N=70)	153.24±7.66	55.32±11.99	23.54±4.79	375.14±51.940
T	10.881	4.494	4.349	14.913
P value	**< 0.001***	**< 0.001***	**< 0.05**	**< 0.001***

Table No. 2 summarizes the mean values of height, weight, BMI and PEFR of males and females which shows that mean values of height (167.46±7.79), weight (65.66±15.06) and BMI (23.56±5.40) are at higher side in males as compared to females having mean values of height (153.24±7.66), weight (55.32±11.99), BMI (23.54±4.79). Males also have higher mean value of PEFR (514.29±58.274) than females (375.14±51.940) and the difference is significant (<0.001).

Discussion

A number of factors influence PEFR in normal subjects. Weight and height are the common ones. PEFR is best correlated to height and weight, even though other physical factors such as age and body surface area may also correlate well.[14] Pulmonary function tests (PFT) are one of the indicators of the health status of the individuals and could be used as a tool in general health assessment.[15,16] The values of PEFR obtained in this study were within the normal ranges for the healthy adult male (360 –900 L/min) and female (168 –600 L/min) populations.[17]

The mean values of height, weight, BMI and PEFR were higher for males than females (P<0.05). This also points to positive anthropometric association with PEFR. Our study showed that in males, PEFR significantly increases with height (r =0.33), weight (r =0.26) and BMI (r =0.016) which is in agreement with the reports of certain other researchers[8-11] and in females also PEFR significantly increases with height (r =0.20), weight (r =0.24) and BMI (r =0.014) but the correlation of BMI with PEFR is less stronger than the height and weight. This was probably because of the greater chest volume in the taller subjects. The growth of the airway passages and the expiratory muscle effort also increase with an increase in the height.[18-22] The mean values of PEFR were lower in female than those in male of the same age and height similar findings are reported by this fact may be due to muscular component and genetic factors of men.[23,24]

Conclusion

1. The mean values of height, weight, BMI and PEFR were higher for males than females. This also points to positive anthropometric association with PEFR.
2. Our study showed that in males, PEFR significantly increases with height and weight.
3. It is concluded that PEFR shows positive correlation with anthropometric determinants like height, weight and BMI within physiological limits.

Acknowledgement

We would like to thank the medical students of LTMMC and LTMGH for their co-operation and support in the course of this study.

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