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ORIGINAL ARTICLE

ASSOCIATION OF PEAK EXPIRATORY FLOW RATE WITH AGE AND HEIGHT AMONG MALAYSIAN ADULTS.

Jannathul Firdous[1*], Nur Nabila[2], Nur Haziqah[2], Nur Khairun Nisa[2], Nurhannah[2], Ravindran Jaganathan[2]

[1]Cluster for Integrative Physiology and Molecular Medicine (CIPMM), Faculty of Medicine, Universiti Kuala Lumpur Royal College of Medicine Perak, Jalan Greentown, 30450 Ipoh, Perak, Malaysia.

[2]Faculty of Medicine, Universiti Kuala Lumpur Royal College of Medicine Perak, Jalan Greentown, 30450 Ipoh, Perak, Malaysia.

Corresponding Author
Dr. Jannathul Firdous
Preclinical Department, Faculty of Medicine
UniKL Royal College of Medicine Perak (UniKL RCMP)
No. 3, Jalan Greentown, 30450 Ipoh, Malaysia.
Email: jannathul.firdous@unikl.edu.my

Abstract

Peak expiratory flow rate is a person's maximum flow produced during maximal force of expiration starting after a full inspiration. Subsequently, any respiratory disease such as asthma can be detected by comparing the readings with the normal. This study is aimed to determine the association between peak expiratory flow rate with age and height among normal adults in UniKL Royal College of Medicine Perak (UniKL RCMP). A cross-sectional study on association between peak expiratory flow rates was conducted among adults belonging to age group of 20-30 years and 40-50 years. All participants' heights were measured using the calibrated standard clinic scale without shoes. Peak flow meter was used to measure the PEFR. Results were analyzed using ANOVA test and the Independent Sample t test. Peak expiratory flow rate decreased as the age advanced (49%). However, the decrease of PEFR with increase age was not statistically significant. But for the height, the peak expiratory flow rate increased as the height increased and it was statistically significant (30.5%). The results of our study conclude that age and height have effects on the peak expiratory flow rate among normal adults. Peak expiratory flow rate decreases as age increases. Height has a positive association with peak expiratory flow rate in individuals.

Keywords: Age, Height, Peak flow meter rate, Normal adult.

Introduction

Peak expiratory flow rate (PEF) is defined as the maximum expiratory flow delivered with maximum force with maximal lung inflation.[1] It is an essential measure in monitoring lung function in patients with bronchial asthma. It is also used to check pulmonary function in estimating ventilator capacity. It's a crude measure of lung function in addition to spirometry. Peak flow meter is a simple instrument that is easily handled as well and also affordable, makes it suitable for self-measurement. The patient should know about the device handling in order to avoid errors in evaluating PEF readings[2]. Several factors such as age, sex, height and environmental factors like smoking and having pets can affect the readings of PEF.

When PEFR is associated with age, the highest peak flow reading occurs between the age of 30-40 years where a reading of 400- 600 l/min is considered normal.[3] The average height for Malaysian male and female was found to be 1.67 m and 1.50 m. According to the previous studies, based on average height, the PEF rate was 6.65 at the age of 25 years old and 5.40 at the age of 50 years old.[4] Past studies regarding gender differences on using the peak flow meter revealed that males gained faster correct techniques compared to females. Men scored higher than women for the steps of "inhale fully" and "exhale as hard and as fast as you can" in the first attempt. Percentage change in PEF improved from the second attempt to third attempt in women but not in men[5]. The study found out that men learned the correct technique for using peak flow meter and attained their best PEF more quickly than women. Taking all those factors into an account, the present study was carried out to examine the relationship of PEFR with age and height among Malaysian adults. Rationale of this study is aimed to determine the association between peak expiratory flow rate with age and height among normal adults.

Materials and Methods

Study population

We conducted the study among adults in UniKL RCMP. Both men and women between 20 to 30 years old and between 40 to 50 years old took part in the study.

Study type

This was a cross-sectional study on the association between peak expiratory flow rate with age and height. Convenient sampling method was used and healthy adults participated in the study. Adults with physical disabilities and respiratory diseases including asthma were excluded from the study.

Study variables

Study variables were age and height with its scale of measurement and PEFR.

Method of data collection

A written consent was obtained from all the participants as a proof of their willingness to participate in the study. All Participants' height was measured using the standard clinic skill without shoes. Each participant was required to sit and blow into the peak flow meter using the right technique (i.e., with maximal force after full inspiration) three times, and the PEFR values were noted and the mean of three values was calculated. The technique was personally supervised with standardized instructions. The confidentiality of participant's data was ensured to avoid any misuse of the data. Institutional ethical committee's approval was obtained prior to the conduct of study.

Data analysis

Data was collected and tabulated in Microsoft Excel. Data was analyzed with SPSS version 23 software. The software was used to tabulate the data. Student't'-test and Analysis of Variance (ANOVA) were used to analyze the data.

Results and Discussion

This study was aimed to determine the association between peak expiratory flow rate with age and height among adults and to learn how age and height reflects the lung function through peak flow meter. Distribution of study population by age and height is shown in Table 2.

When comparing the age, the distribution was 50.80% participants were in between 20 to 30 years old and 49.20% participants were between 40 to 50 years. The distribution according to the height was found as 5.1% participants below 149 cm, 32.20% participants in between the height of 150 cm to 159 cm, 32.20% participants in between the height of 160 cm to 169 cm, and 30.50% participants more than 170 cm. The peak expiratory flow rate (PEFR) was taken in three readings for each participant and average of expiratory flow rate was calculated. On calculation, the mean and standard deviation of the average peak expiratory flow rate was found to be 387.34±125.31. Based on the average value, peak expiratory flow rate was associated with age and height. Association of PEFR with age was shown in Figure 1.

Average peak expiratory flow rate for 20 to 30-years-old of participants was found to be 403±123 whereas for 40 to 50-years-old, average peak expiratory flow rate was 371±128 as shown in Figure 1. The peak expiratory flow rate would decrease as the age advance. However, the age factor did not significantly affect the peak expiratory flow rate. Based on the data from the Mann Whitney test, the average peak expiratory flow rate ($p = 0.275$) in 20 to 30 years age group (mean rank = 32.40) was not significantly higher than in 40 to 50 years age group (mean rank = 27.52). Association between average peak expiratory flow rate and height categories were shown in Table 3.

Peak expiratory flow rate increased as the height increased as shown in Table 3. A turkey post hoc test revealed that the peak expiratory flow rate was significantly higher at the height category of more than 170 cm compared to the other height categories, below than 149 cm (291.11±75, $p = 0.01$), between 150 cm – 159 cm (316.14±80, $p=0.00$) and between 160 cm – 169 cm (364.56±105, $p=0.00$). However, there was no significant difference between the height categories below 149 cm with 150 cm – 159 cm ($p=0.98$) and 160 cm – 169 cm ($p=0.63$). The height category of 160 cm – 169 cm did not have significant difference with 150 cm – 159 cm ($p=0.44$).

While testing the respiratory function, there will be a normal decline in the flow rate as the age increases, as part of aging process. There will be degeneration in thoracic-abdominal compartment with decreased muscle strength followed by decrease in lung elasticity and joint mobility[6]. This reduced PEFR reflects of tightening airways and can be used to verify the clinical status. In case of children, with increase in age, PEFR increases and reverse happens in adults, as the PEFR decreases after 30 years[7]. This fact was proved in the present study, as PEFR declined with increased age. However, this decline was not statistically significant in the two age groups we studied i.e. 20 to 30 years and 40 to 50 years. Similar findings were observed in a study done by Sagher *et al*. showed increased PEFR with both age and height[8]. In older people, PEFR predicts important outcomes. It was found that in order to report pulmonary function in the older people, standardized residual percentage method is better.[9]

Association between PEFR and height was significant, with mean PEFR values of taller participants were more than the shorter participants. With this correlation of height with PEFR, it can be used to predict the flow rate in children. But in another study, there was no significant difference between the height and age of adults with PEFR[10]. Our results are in accordance with the previous study done by Jayanti *et al.* where similar results are noted and

is due to high muscular effort with more chest volume. [11] Most significant correlations between height and PEFR was noted similarly in other experiment done by Malik *et al.* where the relation between PEFR and other parameters such as weight, arm span, body surface area and body mass index were also studied. [12]

Conclusion

Peak flow meter is a simple test to assess the airway obstruction and also to find the response of patient towards the therapy which helps in the management of the patient. It can also be used in the field studies. In this study, there was a significant relation between PEFR and height was observed with increased PEFR in taller participants. But there was no association between age and PEFR. However, further study with large sample size is needed to determine the association of PEFR with age. This study is considered as a baseline for larger studies in the future.

Acknowledgement

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Conflict of interest

None

Table 1: Study variables used in the study

Conceptual definition of the variables	Operational definition of the variables
1. Peak Expiratory Flow Rate (l)	The participant's PEFR measured by peak flow meter.
2. Height ~~(cm)~~	The participant's measured by height scale
3. Current age from birth	The participant's age based on their Identification Card (IC)

Table 2. Distribution of study population by age and height

Factor	size	Percentage
Age		
20 – 30	30	50.80
40 – 50	29	49.20
Total	59	100.00
Height (cm)		
Below than 149	3	5.10
150 – 159	19	32.20
160 – 169	19	32.20
More than 170	18	30.50
Total	59	100.00

Table 3. Average peak expiratory flow rate in relation with height

Height (I)	Height Category (J)	Mean Difference (I-J)	Std Error	Sig.	Mean ± SD
below 149	between 150 to 159	-25.03	61.42	0.98	291.11±75
	between 160 to 169	-73.45	61.42	0.63	
	more than 170	-211.48*	61.66	0.01	
between 150 to 159	below 149	25.03	61.42	0.98	316.14±80
	between 160 to 169	-48.42	32.08	0.44	
	more than 170	-186.45*	32.52	0.00	
between 160 to 169	below 149	73.45	61.42	0.63	364.56±105
	between 150 to 159	48.42	32.08	0.44	
	more than 170	-138.03*	32.52	0.00	
more than 170	below 149	211.48*	61.66	0.01	502.59±112
	between 150 to 159	186.45*	32.52	0.00	
	between 160 to 169	138.03*	32.52	0.00	

*The mean difference is significant at the 0.05 level.

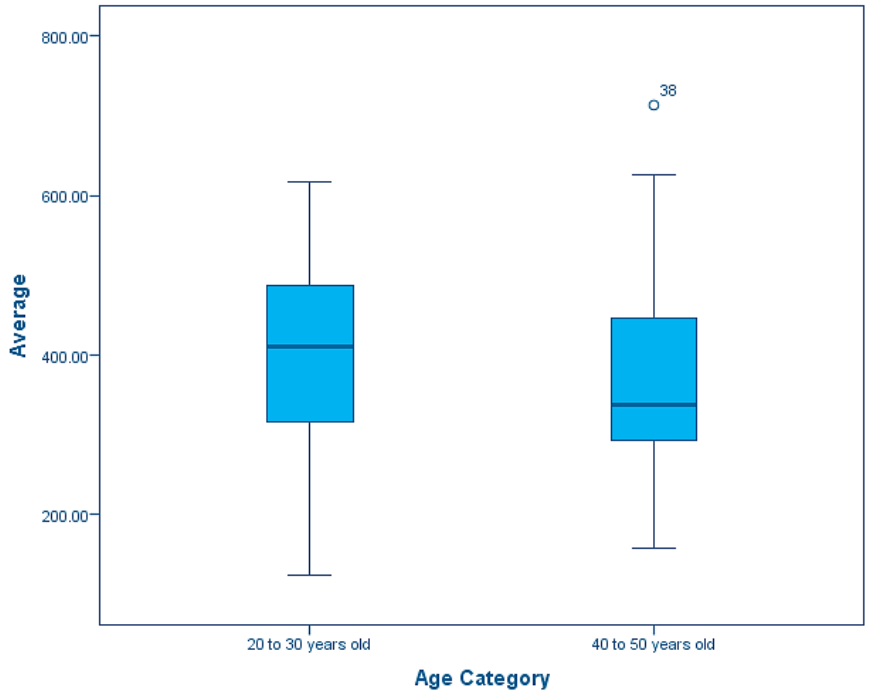

Figure 1. Average peak expiratory flow rate in relation with age.

References

1. Vaz Fragoso CA, Gahbauer EA, Van Ness PH, Gill TM. Reporting peak expiratory flow in older persons. The journals of gerontology Series A, Biological sciences and medical sciences. 2007; 62:1147-51.
2. Venkatesan EA, Walter S, Ray D. An evaluation of the assess peak flow meter on human volunteers. Indian J Physiol Pharmacol. 1999; 38:285-8.
3. Adeniyi B, Erhabor G. The peak flow meter and its use in clinical practice. African Journal of respiratory medicine. 2011; 11: 5-8.
4. Srinivas P, Chia YC, Poi PJ, Ebrahim S. Peak expiratory flow rate in elderly Malaysians. Med J Malaysia. 1999: 54:11-21.
5. Chafin CC, Tolley E, George C, Demirkan K, Kuhl D, Pugazhenthi M., et al., Are there gender differences in the use of peak flow meters? J Asthma. 2001; 38:541-3.
6. Ismail Y, Zurkurnain Y. Spirometry and flow-volume in Malay adults. Med J Malaysia. 1992; 47:261-6.
7. Gururaja S. Comparison of peak expiratory flow rate in healthy urban and rural school children in and around Bangalore: a cross sectional study. International journal of advances in medicine. 2016; 4: 77-82
8. Sagher FA, Roushdy MA, Hweta AM. Peak expiratory flow rate nomogram in Libyan schoolchildren. East Mediterr Health J. 1999; 5:560-4.

9. Quanjer PH, Tammeling GJ, Cotes JE, Pedersen OF, Peslin R, Yernault JC. Lung volumes and forced ventilatory flows. Report Working Party Standardization of Lung Function Tests, European Community for Steel and Coal. Official Statement of the European Respiratory Society. Eur Respir J Suppl. 1993; 16:5-40.
10. Radziavicius F, Martins L, Radziavicius C, Valenti V, Siqueira A, Souza C, et al. Peak expiratory flow values are higher in older and taller healthy male children: An observational study. Clin Invest Med. 2010; 33:E92.
11. Mishra J, Mishra S, Satpathy S, Manjareeka M, Nayak P, Mohanty P. Variations in PEFR among Males and Females With Respect To Anthropometric Parameters. IOSR Journal of dental and medical sciences. 2013; 5: 47-50
12. Malik SK, Jindal SK, Sharda PK, Banga N. Peak expiratory flow rate of healthy schoolboys from Punjab. Indian Pediatr. 1981; 18:517-21.