A STUDY OF PEAK EXPIRATORY FLOW RATE IN HEALTHY ELDERLY PUNJABI FEMALES

Parminder Kaur Sandhu Gill*, Dimple Bajaj Arora*, Sukhjinder Kaur Dhillon, Ravneet Kaur Sandhu *****

*,** Department of Physiology, Sri Guru Ram Das Institute of Medical Sciences and Research, Amritsar, Punjab, India.
*** Department of Sports Medicine and Physiotherapy, Guru Nanak Dev University, Amritsar, Punjab, India. 143001

Abstract: Background: Age reduces the ventilatory capacity of lung/chest wall system and is thus expected to affect the PEFR. Peak expiratory flow rate (PEFR) is a relatively simple test to administer and is fairly repeatable. The present study was conducted to study the effect of various factors like age, height, weight, Body Surface area (BSA) and Body Mass Index (BMI) on PEFR in healthy elderly females and to determine the normal PEFR values to establish local reference standards. **Method:** The PEFR was measured in 50 healthy females in the age group of 65 - 94 years of rural areas of Patiala district using the mini Wright's peak flow meter in standing position. Best out of three trials were recorded. It's Correlation with age, anthropometric variables, BMI and BSA was calculated **Results:** The mean PEFR in the age group of 65-74 years for females was highest and it declined with increase in age. The correlation of PEFR with age was negative and highly significant. It has positive correlation with height and non-significant correlation with weight, Body Mass Index (BMI) and Body Surface Area (BSA). **Conclusion:** It was concluded that with advancing age, PEFR declines. Taller subjects have more PEFR in comparison to subjects having shorter height.

Key Words: PEFR, elderly, age, height, weight, BMI, BSA.

Author of correspondence: Dr Parminder Kaur Sandhu, E-mail: sandhugillp@rediffmail.com

Introduction:

PEFR is the largest expiratory flow rate achieved with a maximally forced effort from a position of maximal inspiration (American Thoracic Society, 1995) [1].One of the convenient methods of measuring lung functions is PEFR [2].The Wright peak flow meter[3] introduced in 1959 is widely used as a simple portable instrument for measurement of ventilatory function and has proved useful for diagnosis and follow up during management of asthma, chronic bronchitis and emphysema. The mini Wright peak flow meter, introduced later is particularly easy to handle[4]. The average PEFR of healthy young Indian males and females are around 500 and 350 litres/minute respectively[5]. Assessment of lung function in middle aged and elderly persons is important to study the effects of aging on the respiratory system and in clinical geriatric practice[6]. In a country like India that covers several latitudes, climatic zone, ethnic groups and dietary habits, lung function within the normal population would be expected to vary[7]. Lung function studies in elderly are as such sparse and envelope mostly the standard lung volumes and capacities and very little information is available on the PEFR of elderly[8] .There is a need to know the normal ranges of peak expiratory flow rates in the elderly for clinical use[9].

The present study was undertaken to establish normal PEFR values in elderly females in the age group of 65 – 94 years from rural regions in the Patiala district of Punjab and its reference value in relation to age and anthropometric parameters.

Material and methods:

The crossectional study was carried out in normal healthy ambulatory elderly females of age group of 65 – 94 years residing in rural areas of Patiala district. Subjects with co morbidities like diabetes mellitus were excluded from the study. The study design was approved by the ethics and research committee of the institute. Informed consent was taken from the subjects prior to the study. 50 females were included in this study. The subjects of this study were chosen at random irrespective of socioeconomic status and religion so that it can reflect an overall picture of PEFR status of study region.

All subjects included in the study were ambulatory, had no skeletal deformity, with no history of Chronic Obstructive Pulmonary Disease (COPD) , asthma,or serious respiratory complaints. They were also free from other significant illness. The subjects not performing properly, with neuromuscular disorder and history of smoking were excluded from the study.

The study subjects were explained about the purpose and procedure of the study and they were assured of keeping it confidential. A detailed history of the subjects was taken to rule out cardio-respiratory illness.

Anthropometric measurements of the study subjects were done to calculate the Body Mass Index (BMI) and Body Surface Area (BSA).

Age calculated in years to the nearest of 0.5 years. To measure height in centimetres subjects were made to stand barefoot on the floor against the wall, with their heels slightly separated and their buttocks in contact with the wall. Their weights were measured in kilograms with a subject standing on a portable weighing machine without wearing shoes.BMI was calculated using formula .BMI (kg/m^2) = Wt (kg)/ Ht (m^2)

Body Surface Area (BSA) was calculated by Du Bois formula[10].BSA (m^2) = 0.0071 * Wt (kg)/ ht (m^2)

PEFR was recorded by mini Wright's peak flow meter (Clement and Clarke) [11], an instrument to record PEFR from 60-800 lit/min. Before testing, the procedure was explained and demonstrated to each subject until full familiarity was achieved. Each subject was asked to take deep breath and then blow into peak flow meter as hard and fast as she could with nose clipped. Three trials were given and best of the three was chosen for analysis. In between each trial rest of two minutes was given. The same peak flow meter was used throughout this study. Recordings were taken in standing position.

Statistical Analysis:

Data obtained from the study were given as mean ± SD. After the data was recorded, the parameter stated above was analyzed statistically by applying the student's `t' test and p value < 0.05 was considered as significant, while p values of <0.01 and < 0.001 were considered highly significant statistically.

Results:

A total of fifty ambulatory healthy female subjects of rural areas of Patiala district were studied. The age of subjects ranged from 65-94 yrs.

Table 1: Mean and standard deviation values of physical measurements and PEFR

Age group (years)	No. of subjects	Weight Mean± SD (kg)	Height Mean±SD (kg)	BMI Mean ± SD (kg/m^2)	BSA Mean ±SD (m^2)	PEFR (litres/ min)
65-74	23	63.11± 11.92	159.44 ± 5.91	24.86 ± 5.04	1.62 ± 0.13	248.33 ± 47.92
75-84	20	57.42± 7.92	155.39 ± 5.22	23.69 ± 2.29	1.53 ± 0.12	167.89 ± 32.92
85-94	7	52.71± 11.89	152.14 ± 3.23	22.67 ± 4.59	1.45 ± 0.15	105.71 ± 27.60

Table no.1 shows mean and standard deviation values of physical measurements & PEFR. Mean PEFR in the age group of 65-74 yrs was 248.33 +_ 47.92 and it declined with increase in age. Females in the age group 65-74 years are slightly overweight with BMI of 24.86 ± 5.04. The correlation of PEFR with different parameters under study is shown in table 2.

Table 2: Correlation of PEFR with age, weight, height, body mass index (BMI) and body surface area (BSA) among females

Parameter	Co-efficient of correlation (r)	'p' value
PEFR	-	-
Age (years)	-0.87	<0.001
Weight (kg)	+ 0.17	>0.05
Height(cm)	+0.62	<0.01
BMI (Kg/m^2)	-0.08	>0.05
BSA (m^2)	+0.18	>0.05

'p' value < 0.001 and < 0.01- highly significant , 'p' value > 0.05 - Not significant.

It was negative, highly significant (HS) with age (p< 0.001), while it was positive and highly significant with height (p< 0.01). The correlation of PEFR with weight and BSA was found to be positive but statistically non-significant (NS). Correlation of PEFR with BMI was negative and non significant. The regression equations of PFER with different parameters under study are shown in table 3;

Table 3: Regression equation of PEFR in relation to age, weight, height, BMI and BSA

Independent Variable	Equation (y)	R(Multiple Correlation coefficient)	SEE(Standard error of estimate)	p value
Age (years)	-7.48(Age) + 763.56	0.87	32.16	< 0.05
Weight (Kg)	2.35(Wt) + 50.68	0.38	60.48	> 0.05
Height (cm)	7.06(Ht) - 921.97	0.62	51.31	> 0.05
BMI (kg/m^2)	2.45 (BMI) ± 132.95	0.15	64.65	> 0.05
BSA(M^2)	248.67 (BSA) - 201.16	0.52	55.60	> 0.05

'p' value < 0.05 - significant , 'p' value > 0.05 - Not significant.

table shows that best suited regression equation for PEFR is one with age.

Discussion:

Although a number of studies have been carried out in India, subjects in most of them have been professionals, hospital attendants and students. Present study is a rural based study of peak expiratory flow rate measurement in ostensibly normal subjects.

In our study increasing age appears to be negatively correlated with PEFR. With increase in age, the PEFR declines. This finding is in agreement with various authors [7,12,13,14]. Decline in PEFR with age is probably due to degenerative changes in the musculoskeletal system of thoraco-abdominal compartment leading to decrease in respiratory muscle strength and lung compliance with associated decrease in airway size.

In our study it was observed that correlation of PEFR with height was positive, hence the taller subjects had more PEFR than shorter ones. Similar observations were made by other authors [15,16,17,18]. Similar findings were found in younger age group.[25] This is probably due to better muscular effort and more chest volume in taller subjects.

In our study there was a non significant correlation of PEFR with weight and BMI which is in collaboration with the report of other authors [19, 20, 21, 22, 23, 24].

In our study there was statistically non significant positive **c**orrelation of PEFR with BSA. Similar observation was made by other author [21].

Conclusion: This study shows that among elderly Punjabi females, increasing age was associated with decline in PEFR. Taller subjects had more PEFR than shorter ones. The normal ranges and simple regression equation of PEFR with age constructed as a result of this study can be put to use in public health and clinical work. The regression equations derived from local population samples may be of assistance in assessing the observed to expected normal values of PEFR among older females in Punjab.

Acknowledgment

We express gratitude to all the subjects who committed themselves for participation in the study.

REFERENCES:

1. American Thoracic Society (1995): Standardization of Spirometry; (1994) update. Am J Respir Critical Care Med. 52: 1107-1136.
2. Badaruddin M, Uddin M B, Khatin M F and Ahmad K. Study of Peak Expiratory Flow Rate in Different Positions. Dinajpur Medical College Journal 2010; 3(1): 17-18.
3. Wright BM, Mckerrow CB. Maximum forced expiratory flow rate as a measure of ventilatory capacity. BMJ 1959; 2: 1041-1046.
4. Wright BM. A miniature Wright peak flow meter. BMJ 1978; 1627-1628.
5. Dikshit M B, Raje S, Agarawal M J. Lung functions with spirometry : An Indian perspective-I. Peak expiratory flow rates; Indian J Physiol Pharmacol 2005: 49 (1): 8-18.
6. Jain SK, Gupta CK. Lung function studies in healthy men and women over forty. Indian Journal of Medical Research 1967; 55(6): 612-619.
7. Ray D, Rajaratnam A, Richard J. Peak Expiratory Flow in rural residents of Tamil Nadu, India. Thorax 1993 Feb; 48(2):163-166.
8. Dikshit M B, Prasad B A and Jog N V. Peak flow rates in elderly Indians. Indian Journal of Physiology and Pharmacology 1991; 35(1): 39-43.
9. Srinivas P, Chia Y C, Poi P J and Ebrahim S. Peak expiratory flow rate in elderly Malaysians. Med Journal of Malaysia 1999; 54: 11- 21.
10. Dubios D, Dubios EF. Clinical Calorimetry: a formula to estimate the approximate surface area if height and weight be known. Arch Inter Med 1916; 17: 863-871
11. Perks W H, Tams I P, Thompson D A and Prowse K 1979. An evaluation of mini Wright peak flow meter. Thorax 1979; 34: 79-81.
12. Virani N, Shah B, Celly A. Pulmonary function studies in healthy non- smoking adults in Sri Aurobindo Ashram, Pondicherry. Indian Journal of Medical Research 2001; 114: 117-84.
13. Woo J, Pang J. Spirometry in healthy elderly Chinese. Thorax 1988 Aug; 43(8): 617-620.
14. Memon MA, Sandila MP, Ahmed ST. Spirometric reference values in healthy non- smoking urban Pakistani population. J Pak Med Assoc 2007 Apr; 57(4): 193-195.
15. Boskabady MH, Keshmiri M, Banihashemi B, Anvary K. Lung function values in healthy non-smoking urban adults in Iran.Respiration 2002; 69(4): 320-326.
16. Hameed MA, Khan SA. Peak expiratory flow rate in healthy Pakistani adults. Journal of Pakistan Medical Association 1984 Dec; 363-364.
17. Mishra J, Mishra S, Satpathy S, Manjareeka M, Nayak P K, Mohanty P. Variations in PEFR among males and females with respect to anthropometric parameters. Indian Journal of Dental and Medical Sciences 2013; 5(1): 47-50.
18. Orie N N. Comparison of normal respiratory function values in young Kenyans with those of other Africans and Caucasians. East African Medical Journal 1999; 76: 31-34.
19. Maiolo C, Mohamed EI, Carbonelli MG. Body composition and respiratory function. Acta Diabetologica 2003; 40(1): 32-38.

20. Amin SK, Pande RS. Peak expiratory flow rate in normal subjects. Indian Journal of Chest Diseases 1978; 20: 81-83.
21. Singh HD, Peri S. Peak flow rate in South Indian adults. Indian J Physiol Pharmacol 1979; 23: 315-20.
22. Wannamethee SG, Shaper AG, Whincup PH. Body fat distribution, body composition and respiratory function in elderly men. Am J Clin Nutr 2005; 82(5): 996-1003.
23. Das KK, Dhundasi SA. A study of predictors of Peak Expiratory Flow Rate in Muslim subjects (aged 18 to 20 years) of Karnataka. Indian J of Physiol and Pharmacol 2002 Jul; 46(3): 321-327.
24. Medarov BI, Strachan P, Cohen R. Effect of body mass index on pulmonary functions. Chest 2005; 128: 171Sb – 172Sb.
25. Kaur H, Singh J, Makkar M, Singh K, Garg R. Variations in the peak expiratory flow rate with various factors in a population of healthy women of the Malwa region of Punjab, India. J Clin Diagn Res 2013 Jun; 7(6): 1000-1003.

Disclosure: No conflicts of interest, financial, Or otherwise are declared by authors