STUDY TO ASSESS PULMONARY FUNCTION TESTS IN ELDERLY POPULATION.

Hemendra Suthar[1] ,Prakash Chaudhari[1] ,

[1] Tutor, Department of Physiology, GMERS Medical College, Vadnagar, Gujarat, INDIA , 384355

Background and Objectives: Ageing is associated with progressive declining in pulmonary function. Awareness of the basic changes in respiratory physiology associated with aging is important for for diagnosis as well as for follow up of pulmonary diseases. Numerous studies observed that FEV1 and FVC remain stable for 5-10 years after 25 years and decline in later adulthood. The aim of the present study was thus to evaluate pulmonary function tests in elderly persons. **Methodology**: The present study was conducted on 168 elderly healthy, non-smoker subjects (60 years and above) of three old age home located at Asarwa. PFTs were performed with the help of Medspiror (RMS). Three readings were obtained at same time of the day between 11:00 AM to 1:00 PM after a light breakfast in the morning and best one was selected for the final analysis as per ATS guideline. The data was entered in "Microsoft Excel" and analyzed using the Epi info 7. **Result:** Out of which 96 (57.1%) subjects were males and 72 (42.5%) subjects were females. The mean age for male population (72.4 ± 5.8 years) was higher than the female group (66.2 ± 7.2 years). The mean value of FVC, FEV1, FEV3 and PEFR in elderly subjects were 1.8 liters, 1.4 liters, 1.8 liters and 3.3 liters respectively. All parameter were significantly correlated with both height and age of the subjects. There was significant decline in mean values of FVC, FEV1, FEV3 with advancing age in both males and females. The values of FVC and FEV3 in male were lower than the values derived from previous prediction equations. In females, FEV1, FEV3 and PEFR were lower than prediction equations. **Discussion**: In our study, All the lung function parameters (FVC, FEV1, FEV3 and PEFR) were higher in male subjects as compared to females. The mean value of FVC, FEV1, FEV3 and PEFR in both gender were significantly correlated with both height and age of the subjects. Similarly Bala et al observed positive correlation of FVC, FEV1, FEV3 with height and age.[8] There was significant decline with advancing age in mean values of FVC, FEV1, FEV3 in both males and females. Similar results were reported in other studies. [9-11]**Conclusion**: we conclude that all lung function indices of study subjects were significantly related to age and height and these value were higher in male population than females. All PFT parameters shows significant reduction with advancing age.

Key Words: Age, Pulmonary function test, FEV1, FVC.

Author for correspondence: Dr. Prakash Chaudhari, Tutor, Department of Physiology, GMERS Medical College, Vadnagar, Gujarat, INDIA, 384355, Mobile No.: +91-9712987068, email: drprakashchaudhari333@gmail.com

Abbreviation list: FEV1- Forced expiratory volume in first second, FEV3- Forced expiratory volume in third second, FVC- Forced vital capacity, PEFR- Peak expiratory flow rate, PFT- Pulmonary function test, RR- Respiratory rate

Introduction:

Ageing is associated with progressive declining in functional reserve of body organs. The most important physiological changes occurs in respiratory system like decrease in static elastic recoil of the lung, in respiratory muscle performance, and in compliance of the chest wall resulting in increased work of breathing.[1]

Life expectancy has risen during the past three decades and is expected to continue to rise in virtually all populations. In the India, life expectancy has risen from 41.17 years in 1960 to 67.03 in 2011. The proportion of the population over 65 years of age more than 5%. These demographic changes have a major impact on health care.[2]

Pulmonary function tests (PFTs) measures the functional status of respiratory system. Awareness of the basic changes in respiratory physiology associated with aging is important for clinicians. They are important for diagnosis as well as for follow up of pulmonary diseases.[3] Numerous studies observed that FEV1 and FVC keep increasing up to the age of 25 years, then remain stable for 5-10 years and decline in lung functions beginning in later adulthood.[4, 5] The aim of the present study was thus to evaluate pulmonary function tests in elderly persons.

Material and Methods:

The present study was conducted on 168 elderly healthy subjects (60 years and above) of three old age home located at Asarwa. Total 303 subjects

were screened and 168 subjects who fulfilled the eligibility criteria were included in the study. They were non smokers with no history of symptoms of cardiovascular or respiratory diseases. After written informed consent, subjects were asked to fill a performa which included information like age, gender and height. PFTs were performed with the help of Medspiror(RMS). After explanation of the test procedure, every subject was asked to perform the test. Three readings were obtained at same time of the day between 11:00 AM to 1:00 PM after a light breakfast in the morning and best one was selected for the final analysis as per ATS guideline. Following parameters were calculated: FVC, forced expiratory volume in 1 second (FEV_1), forced expiratory volume in 3 seconds (FEV_3), peak expiratory flow rate (PEFR).

Result:

A total of 168 elderly subjects were included in the study. Out of which 96 (57.1%) subjects were males and 72 (42.5%) subjects were females. The mean age for male population (72.4 ± 5.8 years) was higher than the female group (66.2 ± 7.2 years). The mean weight and height were higher in the male group as compared to those of female group. We divided subjects in four age groups. Mean values of height among subjects of the different age group were similar. Mean body weight of the subjects showed a significant (p-value < 0.05) decline with advancing age.

Table 1: Anthropometric data of the subjects.

		Group 1 (60–64 years) (n=54)	Group2 (65–69 years) (n=46)	Group3 (70–74 years) (n=41)	Group 4 (≥ 75 years) (n=27)	All subjects
All subjects (n=168)	Weight	70.9 ± 7.8	65.9 ± 7.3	58.3 ± 6.8	51.4 ± 8.1	63.4 ± 7.2
	Height	163.5 ± 5.3	164.4 ± 4.9	164.1 ± 6.1	163.1 ± 4.3	163.4 ± 5.1
Male (n=96)		(n=31)	(n=29)	(n=21)	(n=15)	(n=96)
	Weight	74.3 ± 6.8	68.2 ± 6.4	60.3 ± 5.4	53.2 ± 6.4	66.1 ± 6.3
	Height	165.2 ± 4.3	165.1 ± 4.4	163.9 ± 4.6	163.1 ± 4.3	164.6 ± 4.4
Female (n=72)		(n=23)	(n=17)	(n=20)	(n=12)	(n=72)
	Weight	66.4± 9.1	62.2± 8.9	56.2 ± 8.2	49.3 ± 8.7	59.7 ± 8.6
	Height	161.2 ± 6.6	163.1 ± 5.7	164.4 ± 7.6	163.1 ± 4.3	162.9 ± 6.2

The mean value of FVC, FEV1, FEV3 and PEFR in elderly subjects were 1.8 liters, 1.4 liters, 1.8 liters and 3.3 liters respectively. All parameter were significantly correlated with both height and age of the subjects but significant correlation was not found with weight. The mean value of FVC, FEV1, FEV3 and PEFR in both gender were significantly correlated with both height and age of the subjects. Respiratory rate was similar in the subjects (p > 0.05).

Table 2: Correlation of lung function data with age and height.

	Mean ± SD	Comparison with r value		
		Age	Height	Weight
FVC (L)	1.8 ± 1.1	- 0.6	0.6	0.1
FEV1 (L)	1.4 ± 0.5	- 07	0.6	0.1
FEV3 (L)	1.8 ± 0.4	- 0.6	0.6	0.2
PEFR (L/Sec)	3.0 ± 1.2	- 0.6	0.7	0.1
Male				
FVC (L)	2.0 ± 1.5	- 0.6	0.6	0.1
FEV1 (L)	1.5 ± 0.6	- 0.7	0.6	0.1
FEV3 (L)	2.0 ± 0.4	- 0.6	0.7	0.2
PEFR (L/Sec)	3.3 ± 1.0	- 0.6	0.6	0.1
Female				
FVC (L)	1.5 ± 0.7	- 0.6	0.7	0.1
FEV1 (L)	1.2 ± 0.4	- 0.7	0.7	0.1
FEV3 (L)	1.5± 0.5	- 0.7	0.8	0.2
PEFR (L/Sec)	2.6 ± 1.6	- 0.6	0.8	0.1

There was decline in mean values of FVC, FEV1, FEV3 from Group I to Group IV in both males and females and the difference was statistically significant (p < 0.05).

Table 3: Comparison of PFT parameter according to age.

	Group 1 (60–64 years) (n= 54)	Group 2 (65–69 years) (n= 46)	Group 3 (70–74 years) (n= 41)	Group 4 (≥ 75 years) (n= 27)
RR (/min)	16.2 ± 1.8	15.8 ± 1.6	16.9 ± 1.9	17.7 ± 1.4
FVC (L)	2.3 ± 1.3	1.9 ± 1.2	1.5 ± 1.1	1.2 ± 0.9
FEV1	1.8 ± 0.6	1.5 ± 0.6	1.1 ± 0.5	1.0 ± 0.3
FEV3	2.3 ± 0.3	1.9 ± 0.5	1.6 ± 0.4	1.3 ± 0.4
PEFR (L/sec)	4.4 ± 1.7	3.1 ± 1.4	2.2 ± 0.9	1.5 ± 0.9
Male				
RR (/min)	16.6 ± 1.8	16.8 ± 1.6	17.2 ± 1.9	17.6 ± 1.4
FVC (L)	2.6 ± 1.8	2.1 ± 1.4	1.7 ± 1.4	1.3 ± 1.1
FEV1	2.0 ± 0.7	1.6 ± 0.6	1.2 ± 0.5	1.0 ± 0.3
FEV3	2.6 ± 0.3	2.0 ± 0.5	1.8 ± 0.4	1.4 ± 0.4
PEFR (L/sec)	4.8 ± 1.7	3.2 ± 1.1	2.4 ± 0.4	1.8 ± 0.7
Female				
RR (/min)	15.6 ± 1.6	14.2 ± 1.4	16.6 ± 1.5	17.8 ± 1.4
FVC (L)	1.9 ± 0.7	1.5 ± 0.8	1.3 ± 0.7	1.1 ± 0.6
FEV1	1.6 ± 0.4	1.3 ± 0.6	0.9 ± 0.4	0.9 ± 0.3
FEV3	1.8 ± 0.4	1.6 ± 0.6	1.4 ± 0.5	1.2 ± 0.4
PEFR (L/sec)	3.8 ± 1.7	2.8 ± 1.8	2.0 ± 1.4	1.2 ± 1.2

For FVC (L), the estimated prediction equation was: for females = 3.668 + 0.01 (height) − 0.059 (age) and for males was = 0.643 - 0.0458 (age) + 0.029 (height); for FEV1 (L) was: for females = 3.644 − 0.055 (age) + 0.0086 (ht) and for males was = 0.836 − 0.037 (age) + 0.020 (height).; for the FEV3 (L) in females was 1.637 − 0.056 (age) + 0.024 (height) and in males 1.085 − 0.045 (age) + 0.026 (height). for PEFR (L/s) was: for female = 9.249 − 0.175 (age) + 0.035 (height) and for males= 12.73 − 0.137 (age) + 0.002 (height).

Table 4: Calculated value of PFT parameters from prediction equations.

Parameters	Male	Female
FVC (L)	2.10	1.38
FEV1	1.46	1.40
FEV3	2.10	1.83
PEFR (L/sec)	3.14	3.99

The values of FVC and FEV3 in male were lower than the values derived from previous prediction equations. In females, FEV1, FEV3 and PEFR were lower than prediction equations.

Discussion:

The present study was conducted among 168 elderly (60 years and above) healthy, non-smoker subjects screened from Old Age Homes located in Asarwa. More than half of subjects (96, 57.1%) were males. Mean body weight of the subjects showed a significant (*p*-value < 0.0001) decline with advancing age. The lung matures at age of 20–25 years, and thereafter progressive decline with advance age.[6] There was larger decrements of FEV1 associated with greater age.[7]

In our study, All the lung function parameters (FVC, FEV1, FEV3 and PEFR) were higher in male subjects as compared to females. The mean value of FVC, FEV1, FEV3 and PEFR in both gender were significantly correlated with both height and age of the subjects. Similarly Bala et al observed positive correlation of FVC, FEV1, FEV3 with height and age.[8] There was significant decline with advancing age in mean values of FVC, FEV1, FEV3 in both males and females. Similar results were reported in other studies.[9-11]

In present study, FVC and FEV3 in male were lower than the values derived from previous prediction equations. In females, FEV1, FEV3 and PEFR were lower than prediction equations.

Conclusion:

From this study, we conclude that all lung function indices of study subjects were significantly related to age and height and these value were higher in male population than females. All PFT parameters shows significant reduction with advancing age.

Acknowledgment:

I express my sincere gratitude to Dr. Rajesh Desai, Assistant Professor to sharing her wisdom with us during the course of this research. I am thankful to Dr. Anup Patel, Assistant Professor for their

valuable suggestions. Last but not the least I want to thank whole heartedly to the elderly subjects without whom this study would have been impossible.

References:

1. Pruthi N, Multani NK. Influence of Age on Lung Function Tests. Journal of Exercise Science and Physiotherapy 2012; 8: 1-6.
2. Census INDIA 2011. Life expectancy. Retrieved, July 01, 2018, from http://www.censusindia.gov.in/2011census/population_enumeration.html.
3. Nussbaum RL, Ellis CE. Alzheimer's disease and Parkinson's disease. N Engl J Med2003; 348: 1356-1364.
4. Ostrowski S, Barud W. Factors influencing lung function: are the predicted values for spirometry reliable enough? Journal of Physiology and Pharmacology 2006 57: 263-271
5. Ostrowski S, Gorzywa A, Mieczkowska J, Rychlik M, Lachowska P, et al. Pulmonary functions between 40 and 80 years of age. Journal of Physiology and Pharmacology 2005; 4: 127-133.
6. Sharma G, Goodwin J. Effect of aging on respiratory system physiology and immunology. Clin Interv Aging 2006;1(3):253–60.
7. Mannino DM, Davis KJ. Lung function decline and outcomes in an elderly population. Thorax 2006;61(6):472–7.
8. Bala S, Dhar RJK, Sachdev S. An Epidemiological Study to Assess Pulmonary Function Tests in a Cohort of Elderly Population.Anat Physiol 2017; 7: 271.
9. Singh HD, Abraham DL, Antony NJ. Expiratory flow rates and timed expiratory capacities in South Indian men. J Indian Med Assoc 1970;412–416.
10. Higgins MW, Keller JB. Seven measures of ventilatory lung function. Am Rev Respir Dis 1973;108:258.
11. Burr ML, Phillips KM, Hurst DM. Lung function in the elderly. Thorax 1985; 40:54–59.

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