

## Original Research Article

# Pulmonary function tests: a study among healthy individuals of different age groups in Akhnoor Tehsil

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### ABSTRACT

**Background:** Pulmonary function tests may be affected by many factors like age, gender, race and body surface area of an individual. Lung functions decline throughout adult life, and healthy people are no exception. Aging is a universal progressive decline, but it is not a disease. The present study was done with an aim to establish the age effect on lung function test of healthy non-smoking people belonging to the rural belt of Jammu region.

**Methods:** A prospective study was conducted on 180 patients attending the OPD of department of medicine, sub-district hospital Akhnoor. With age ranging from 11 to 70 years, healthy individuals, non-smokers were selected for the study. Pulmonary tests like forced vital capacity (FVC), forced expiratory volume in 1<sup>st</sup> second (FEV<sub>1</sub>) and peak expiratory flow rates (PEFR) were conducted.

**Results:** Younger population had a high value for FEV<sub>1</sub> and PEFR showed a rise among age groups: 11-20, 21-30 and 31-40 years, reaching up to 7.23±1.75 (L/sec), and then declining to reach 3.93±0.98 (L/sec) for the age group: >60 years. Almost all parameters showed a resembling ascends and decline with ageing. Lung function has further variability in older people, depending upon lung capacity at maturation time. This study was quite in line with the most of the research findings in the field, but done under a different social set up.

**Conclusions:** Considerable differences in the respiratory patterns of healthy individuals with ageing suggest that pulmonary function tests have to become a part of routine health examinations in elderly population.

**Keywords:** Pulmonary function test, Lung functions, Forced vital capacity, Forced expiratory volume, Peak expiratory flow rates

### INTRODUCTION

Population aging is a universal phenomenon, but in the present times, the world has witnessed an increase in life expectancy.<sup>1</sup> Ageing represents a kind of accumulation of changes in a human being over time and it is said to include physical, psychological, and social changes also. Aging can also be termed as a universal progressive decline: first in functional reserve, and then in function that occurs in organisms over time. It is not a disease in itself; however, the risk of developing disease gets increased.<sup>2</sup>

Respiratory muscle strength decreases with age as the lung matures by age 20-25 years, and thereafter ageing-related digression, like decline in lung-function is set off. Differences in pulmonary function or function of the lungs, in normal people may be due to ethnic origin, physical activity, environmental conditions, altitude, tobacco smoking, age, height, gender and socioeconomic status. Studies in India have shown associations with regional differences in lung function in healthy individuals.<sup>3</sup>

The respiratory system changes with age and understanding these changes helps to detect and prevent

respiratory dysfunction in the elderly. Lung functions decline throughout adult life, and healthy people are no exception. Normal aging has shown results corresponding to significant changes in pulmonary, mechanics, respiratory muscle strength, gas exchange and ventilator control.<sup>4</sup> Ventilator function tests provide a better understanding of functional changes in the lungs and their significance from the view point of diagnosis. The knowledge of pulmonary function tests is a basic requirement to understand the respiratory physiology for all medical physiologist and clinicians.<sup>5</sup> Pulmonary function tests are an important tool for the diagnosis of pulmonary diseases and in assessing the effect of drug and follow-up of the disease prognosis. It may be affected by many factors like age, gender, race and body surface area of an individual.<sup>6</sup> No such data on Pulmonary functions with comparative analysis of data to ascertain their significance and relation to ageing is available in public domain, therefore the present study was done with an aim to establish the age effect on lung function test of healthy non-smoking people belonging to the rural belt of Jammu region.

**METHODS**

A prospective study was conducted on 180 patients attending the OPD of department of medicine, sub-district hospital Akhnoor, from October 2019 to March 2020. Both male and female subjects with age ranging from 11 to 60 years (and above), non-smoking individuals with normal cardiac and respiratory functions, meeting the inclusion criteria and completing the pulmonary function tests (PFT), were selected. Subjects were recruited from various aspects of life, either students or employees of organization and were divided in six groups depending on their age: 11-20, 21-30, 31-40, 41-50, 51-60 and >60 years of age. 30 subjects were included in each group.

**Inclusion criteria**

Inclusion criteria for the study included the participants didn't have any acute illness like upper/lower respiratory tract infection, Healthy, asymptomatic, non-obese, with moderate built individuals with non-sedentary life style, Non-smokers having normal cardiac and respiratory functions (as assessed by clinical examination), the participants who didn't have any acute illnesses like upper respiratory tract infection, lower respiratory tract infection, etc. were included. Only the participants who gave proper consent were included.

**Exclusion criteria**

The participants having respiratory problems such as bronchial asthma, Chronic obstructive lung disease, Tuberculosis, Post tuberculosis sequelae, etc. The subjects with history of or evidence of respiratory and cardiovascular disease, alcohol and drug abuse and thoracic, spinal and muscular deformity, the participants

having valvular heart disease, the participants who had undergone any abdominal surgery and the female participants with pregnancy were excluded. All smokers, BMI not ranging between 17 and 25. All such subjects who were not able to perform the PFT correctly.

Due consent was taken from all the participants before conducting the study. Body measurements of all participating individuals were taken, including the standing height and weight.

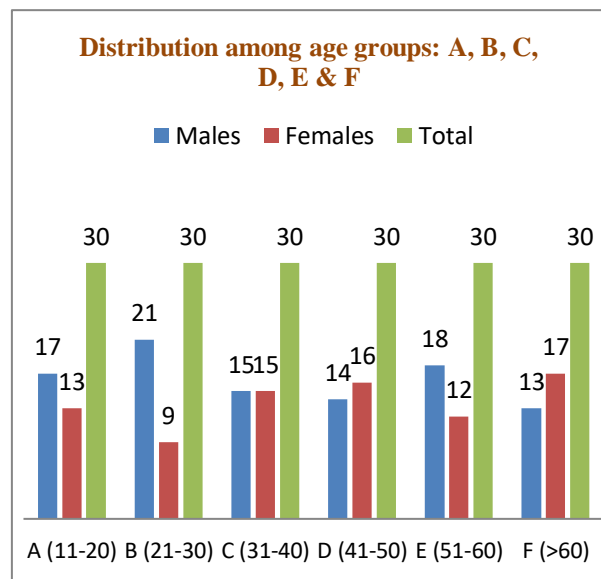
**Pulmonary function tests**

Following pulmonary function tests conducted: Forced vital capacity (FVC), forced expiratory volume in 1<sup>st</sup> second (FEV1), ratio of FEV1 to FVC expressed in percentage (FEV1/FVC), peak expiratory flow rates (PEFR), Forced expiratory flow rates during 25-75% of expiration (FEF25-75%), and were measured using computerized spirometer (Spiro excel, Medicare systems).

The test was applied at least three times and highest values were recorded. The data was analyzed on MS excel 2010 software to ascertain mean, standard deviation, p value and f value. One-way ANOVA was used to determine the statistical difference among various parameters. A p value of <0.01 was considered significant.

**RESULTS**

It is very evident from the earlier studies done in this regard that forced vital capacity decreases with age and its values are significantly lowered with increasing age and inversely related to it. Out of the total subjects studied, 98 were males and 82 females, with group B having maximum number of males (21) (Figure 1).



**Figure 1: Demographic distribution of subjects.**

**Table 1: Mean values of PFT by ANOVA test.**

Group	A	B	C	D	E	F	P value
<b>Respiratory Parameters</b>	<b>Mean±SD</b>	<b>Mean±SD</b>	<b>Mean±SD</b>	<b>Mean±SD</b>	<b>Mean±SD</b>	<b>Mean±SD</b>	
<b>FVC (L)</b>	3.29±0.85	3.35±0.56	3.18±0.58	2.87±0.63	2.26±0.74	2.24±0.45	<0.01
<b>FEV<sub>1</sub> (L)</b>	3.03±0.73	3.09±0.86	2.92±0.44	2.51±0.81	2.01±0.65	1.9±0.77	<0.01
<b>FEV<sub>1</sub>/FVC (as %)</b>	92.10	92.24	91.82	87.46	88.94	84.82	<0.01
<b>PEFR (L/sec)</b>	5.52±1.24	6.94±1.53	7.23±1.75	6.06±1.64	5.85±1.46	3.93±0.98	<0.01
<b>FEF<sub>25-75%</sub> (L/sec)</b>	3.65±0.84	4.68±1.01	4.77±1.22	4.01±1.16	3.78±0.87	2.39±0.73	<0.01

df= 5 in each case; p<0.01 is statistically significant.

Younger group, i.e., group A has a high value for FEV<sub>1</sub>. As is evident from data analysis, the mean values of FEV<sub>1</sub> showed almost a linear relation with ageing, with a small bending of curve between group A and group B. PEFR showed a rise among group A and B (11-20; 21-30), reaching 7.23±1.75 (L/sec) for group C (31-40 years), and then showed a significant decline reaching to 3.93±0.98 (L/sec) for the age group F, i.e., >60 years. Almost all parameters showed a resembling ascends and decline with ageing (Table 1).

## DISCUSSION

Pulmonary function tests have greatly evolved over time to now be considered as important tools for assessing the respiratory status of the healthy as well as that of patients worldwide. They are now an important part of the routine during respiratory examinations and other such examinations in sports medicine, etc. As due care was taken to keep a uniform distribution of subjects among all age groups, there was however quite a varied mix of male and female subjects within the groups.

Major observations recorded including that of mean values of FVC varied significantly with age groups. For age group A (11-20 years) it stood at 3.29±0.85 L and for group B (21-30 years) it rose to 3.35±0.56 L showing stage of lung growth among these age groups. It showed significant decline with proceeding age groups. A similar trend or a similar graph could be observed for FEV<sub>1</sub> values as well. These findings/results were quite similar to the findings of Jagia, Knudson and Vidja et al.<sup>7-9</sup>

Lung function does not have a straight-line graphic association with age. It may keep rising from age of 11 years, reaching peak at the age: 20 and then start declining. It has further variability in older people, depending upon lung capacity at maturation time.<sup>10</sup>

Observation with respect to FEF<sub>25-75%</sub> values also showed significant decline with age of a person and more so in patients with age >40 years; and Girgla et al had also made similar findings in 2012.<sup>11</sup>

Generally speaking, our results showed a decline in all parameters, including that of: FVC, FEV<sub>1</sub>, FEF<sub>25-75%</sub>, PEFR after the age of 50, while studies like those of Behra and Bandyapadhyay et al had registered similar findings.<sup>12,13</sup> This also means that our study was quite in line with the most of the research findings in the field, but done under a different social set up.

However, the sample size being quite representative of the population being studied, it was found that a gender correlation was slightly missing in the data. It could be a limitation to an otherwise comprehensive study carried out with a big sample size and age groups. A proportionate gender ratio in all the groups, if not 50-50%, could have helped in even better understanding of the gender issued involved in the pulmonary functions of the body.

## CONCLUSION

Considerable differences in the respiratory patterns of healthy individuals and the elderly, suggest that age actually impacts the lung function. Understanding these changes helps detect and prevent the respiratory dysfunctions in the elderly. We can measure the pulmonary function tests by spirometry which is an important predictor of morbidity and mortality of elderly persons. In addition, these tests have to become a part of routine health examinations in elderly population, people under respiratory distress, occupational monitoring and essentials in sports medicine.

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*Ethical approval: The study was approved by the Institutional Ethics Committee*

## REFERENCES

1. Christensen K, Doblhammer G, Rau R, Vaupel W. Aging population: the challenges ahead. *Lancet*. 2019;374:1196-208.
2. Franceschi C, Gargnani P, Morsiani C, Conte M, Sontoro A, Grignolio A. The continuum of aging and

- age-related disease: common mechanism but different rates. *Front Med*. 2018;5:61.
3. Barboza L, Barbosa B, Spina G, Spornadio F, Arates R, Gagliardi T. Association between physical activity in daily life and pulmonary function in adult smokers. *J Bras Pneumol*. 2016;42:130-35.
  4. Sharma G, Grodwin J. Effect of aging on respiratory system physiology and immunology. *Clin Intern Aging*. 2006;3:253-60.
  5. Solanki S, Chaudhary R, Chaudhary K, Mirdha P, Kumar R. Study of pulmonary function tests in different age groups of healthy people in western Rajasthan. *Sch App Med Sci*. 2015;3:1871-5.
  6. Rance H, Wilde M, Madden B. pulmonary function test. *Ulster Med J*. 2011;80:84-90.
  7. Jagia GJ, Chandan L. Study of pulmonary function in different age groups. *Indian J Basic App Med Res*. 2013;8(2):1138-45.
  8. Knudson RJ, Slatin RC, Lebowitz MD. The maximal expiratory flow-volume curve: normal standards, variability, effects of age. *Am Rev Respir Dis*. 1976;113:587-9.
  9. Vidja K, Bhabhor M, Paramar D, Kathrotia R, Dodhia S, Mehta N. A comparative study of Pulmonary function in different age groups. *National J Integrated Res Med*. 2013;4(3):0975-9840.
  10. Culver BH, Butler J. Alterations in pulmonary function. In: *Principles of Geriatric Medicine* Ed Andes R, Bierman EL and Hazzard WR, McGraw Hill Book Co Ltd (London). 1985;26:280-7.
  11. Girgla KK, Kaur D, Kiran. Variation in lung function with age-A local study. *Int J Basic App Med Sci*. 2012;2(2):148-53.
  12. Behera AA, Behera BK, Dash S, Mishra S. Variation of pulmonary function tests with relation to increasing age in healthy adults. *Int J Health Sci Res*. 2014;4(3):136-41.
  13. Bandyopadhyay A. Pulmonary function studies in young healthy Malaysians of Kelantan, Malaysia. *Indian J Med*. 2011;134:653-7.

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