

## A Comparative Study of Pulmonary Function Tests amongst Different Age Groups

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### ABSTRACT

**Background:** Functions of lungs continue to decline with age even in case of healthy adults. Studies have demonstrated that this rate of decline is faster after the age of 70 years. With aging there is alteration in the pulmonary functions, strength of respiratory muscles and gaseous and ventilator exchange. There have not been much studies that standardize the lung function at different age groups. The aim of the present study was to assess lung function at different age groups.

**Materials and Methods:** The present cross sectional study was conducted amongst 75 subjects of five different age groups ranging from 25-75 years. The results were expressed as Mean $\pm$  standard deviation. Subjects were assessed using spirometer, weighing machine and a stethoscope. Height of the subjects was measured using a measuring tape. The results were expressed as Mean $\pm$  standard deviation.

**Results:** The mean age group in Group I was 29.01 $\pm$ 3.39 years. The mean BMI in this group was 26.87 $\pm$ 3.17. The mean physical training level score was 5.15 $\pm$ 2.37. The mean age group in Group II was 41.34  $\pm$ 2.55 years. The mean age group in Group V was 69.01 $\pm$ 2.84 years. The mean BMI in this group was 25.11 $\pm$ 3.21. The mean physical training level score was 1.45 $\pm$ 1.07. The mean FVC amongst 25-35 years

was 4.46 $\pm$ 1.45 lit/min. The mean FEV1 was 3.60 $\pm$ 0.79 lit/min. The mean PEFr was 11.28 $\pm$ 2.48 lit/sec. The mean SVC was 5.30 $\pm$ 1.72 Lit/min. The mean MVV was 160.5 $\pm$ 2.5 lit/min.

**Conclusion:** With aging there is decrease in strength of respiratory muscles and gaseous and ventilator exchange. From the above study it can be concluded that there is reduction in the pulmonary function test with age.


**Keywords:** Lungs, Pulmonary, Spirometer.

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### Article History:

Received: 30-11-2017, Revised: 22-12-2017, Accepted: 24-01-2018

Access this article online	
Website: <a href="http://www.ijmrp.com">www.ijmrp.com</a>	Quick Response code 
DOI: 10.21276/ijmrp.2018.4.1.092	

### INTRODUCTION

With ageing there is constriction of the every organ's homeostatic reserve. Various physiological changes associated with respiratory system indicate that with time there is decrease in the elastic capacity of lungs, muscle performance and the compliance of chest wall also decreases. All this results in increased breathing work.<sup>1</sup> Functions of lungs continue to decline with age even in case of healthy adults. Studies have demonstrated that this rate of decline is faster after the age of 70 years. With aging there is alteration in the pulmonary functions, strength of respiratory muscles and gaseous and ventilator exchange. The rigidity of chest wall increases and strength of the muscles decreases with age and these results in increase in the closing capacity and reduction in forced expiratory volume.<sup>2</sup> In a study by Culver and Butler<sup>3</sup> in the year 1985, they found that decline in lung function is not in a linear fashion, it reaches its maximum capacity by late 20s and then begins to decline. The decline is also variable in older age depending on the lung maturation. Functioning of the lungs is routinely assessed by lung function tests in a clinical setting.<sup>4</sup>

There have not been much studies that standardize the lung function at different age groups. The aim of the present study was to assess lung function at different age groups.

### MATERIALS AND METHODS

The present cross sectional study was conducted amongst 75 subjects of five different age groups ranging from 25-75 years. There were 15 subjects in each group. The study was conducted in the Institute. The ethical committee clearance was obtained from the institute's ethical board. All the subjects were informed about the study and a written consent was obtained in their vernacular language. Random sampling was used for the selection of the subjects and the entire procedure was explained to all in detail. Males and females, smokers or non-smokers were included in the study. Subjects with any athletic training were excluded from the study. Patients with neurological impairment, cardiovascular problem, vocal cord injury or musculo-skeletal issues were also excluded from the study. Subjects were

assessed using spirometer, weighing machine and a stethoscope. Height of the subjects was measured using a measuring tape. Demographic detail of all the subjects was taken into

consideration. All the data was arranged in a tabulated form and analyzed using SPSS software. The results were expressed as Mean $\pm$  standard deviation.

**Table 1: Demographics and baseline characteristics of the subjects**

VARIABLE	25-35 Years	35-45 Years	45-55 Years	55-65 Years	65-75 Years
AGE	29.01 $\pm$ 3.39	41.34 $\pm$ 2.55	51.62 $\pm$ 2.52	58.73 $\pm$ 2.98	69.01 $\pm$ 2.84
BMI	26.87 $\pm$ 3.17	27.98 $\pm$ 0.51	26.88 $\pm$ 2.80	25.18 $\pm$ 2.74	25.11 $\pm$ 3.21
Physical activity level	5.15 $\pm$ 2.37	4.55 $\pm$ 2.73	5.42 $\pm$ 2.41	1.73 $\pm$ 1.27	1.45 $\pm$ 1.07

**Table 2: Lung function tests amongst different age groups**

VARIABLE	25-35 Years	35-45 Years	45-55 Years	55-65 Years	65-75 Years
FVC (lt/min)	4.46 $\pm$ 1.45	3.50 $\pm$ 0.33	3.30 $\pm$ 0.66	3.18 $\pm$ 0.71	3.27 $\pm$ 1.02
FEV1 (lt/min)	3.60 $\pm$ 0.79	2.86 $\pm$ 0.26	2.81 $\pm$ 0.68	2.56 $\pm$ 0.47	2.71 $\pm$ 0.56
PEFR (lt/sec)	11.28 $\pm$ 2.48	8.44 $\pm$ 1.17	7.55 $\pm$ 0.99	7.21 $\pm$ 1.37	7.70 $\pm$ 1.22
SVC (lt/min)	5.30 $\pm$ 1.72	3.79 $\pm$ 0.55	4.52 $\pm$ 1.21	3.30 $\pm$ 0.58	3.72 $\pm$ 1.20
MVV (lt/min)	160.5 $\pm$ 2.5	155.8 $\pm$ 2.7	145.8 $\pm$ 1.6	136.5 $\pm$ 2.3	103.6 $\pm$ 2.7

**RESULTS**

In the present study a total of 75 subjects were involved. Each age group had 15 subjects each. The mean age group of the study sample was 47.87 $\pm$  18.32 years.

Table 1 shows the baseline characteristics of subjects amongst different age groups. The mean age group in Group I was 29.01 $\pm$ 3.39 years. The mean BMI in this group was 26.87 $\pm$ 3.17. The mean physical training level score was 5.15 $\pm$ 2.37. The mean age group in Group II was 41.34  $\pm$ 2.55 years. The mean BMI in this group was 27.98  $\pm$  0.51. The mean physical training level score was 4.55 $\pm$ 2.73. The mean age group in Group III was 51.62  $\pm$ 2.52 years. The mean BMI in this group was 26.88 $\pm$ 2.80. The mean physical training level score was 5.42 $\pm$ 2.41. The mean age group in Group IV was 58.73 $\pm$ 2.98 years. The mean BMI in this group was 25.18  $\pm$ 2.74. The mean physical training level score was 1.73  $\pm$ 1.27. The mean age group in Group V was 69.01 $\pm$ 2.84 years. The mean BMI in this group was 25.11 $\pm$ 3.21. The mean physical training level score was 1.45 $\pm$ 1.07.

Table 2 shows the lung function tests amongst different age groups. The mean FVC amongst 25-35 years was 4.46 $\pm$ 1.45 lit/min. The mean FEV1 was 3.60 $\pm$ 0.79 lit/min. The mean PEFR was 11.28 $\pm$ 2.48 lit/sec. The mean SVC was 5.30 $\pm$ 1.72 Lit/min. The mean MVV was 160.5 $\pm$ 2.5 lit/min. The mean FVC amongst 35-45 years was 3.50 $\pm$ 0.33 lit/min. The mean FEV1 was 2.86 $\pm$ 0.26 lit/min. The mean PEFR was 8.44 $\pm$ 1.17 lit/sec. The mean SVC was 3.79 $\pm$ 0.55Lt/min. The mean MVV was 155.8 $\pm$ 2.7 lit/min. The mean FVC amongst 45-55 years was 3.30 $\pm$ 0.66 lit/min. The mean FEV1 was 2.81 $\pm$ 0.68 lit/min. The mean PEFR was 7.55 $\pm$ 0.99 lit/sec. The mean SVC was 4.52 $\pm$ 1.21 Lit/min. The mean MVV was 145.8 $\pm$ 1.6 lit/min. The mean FVC amongst 55-65 years was 3.18 $\pm$ 0.71 lit/min. The mean FEV1 was 2.56 $\pm$ 0.47 lit/min. The mean PEFR was 7.21 $\pm$ 1.37 lit/sec. The mean SVC was 3.30 $\pm$ 0.58 Lit/min. The mean MVV was 136.5 $\pm$ 2.3 lit/min. The mean FVC amongst 65-75 years was 3.27 $\pm$ 1.02 lit/min. The mean FEV1 was 2.71 $\pm$ 0.56 lit/min. The mean PEFR was 7.70 $\pm$ 1.22 lit/sec. The mean SVC was 3.72 $\pm$ 1.20 lit/min. The mean MVV was 103.6  $\pm$ 2.7 lit/min.

**DISCUSSION**

Aging is a natural process and is associated with various physiological changes in the body. There is homostenosis of each and every organ of the body during the process of aging. According to the present study, the mean age group in Group I was 29.01 $\pm$ 3.39 years. The mean BMI in this group was 26.87 $\pm$ 3.17. The mean physical training level score was 5.15 $\pm$ 2.37. The mean age group in Group II was 41.34  $\pm$ 2.55 years. The mean BMI in this group was 27.98  $\pm$  0.51. The mean physical training level score was 4.55 $\pm$ 2.73. The mean age group in Group III was 51.62  $\pm$ 2.52 years. The mean BMI in this group was 26.88 $\pm$ 2.80. The mean physical training level score was 5.42 $\pm$ 2.41. The mean age group in Group IV was 58.73 $\pm$ 2.98 years. The mean BMI in this group was 25.18  $\pm$ 2.74. The mean physical training level score was 1.73  $\pm$ 1.27. The mean age group in Group V was 69.01 $\pm$ 2.84 years. The mean BMI in this group was 25.11 $\pm$ 3.21. The mean physical training level score was 1.45 $\pm$ 1.07. The results of the present study were similar to the results obtained by Woo & Pang amongst Chinese subjects.<sup>5</sup> The only difference from our study was that only there were age related changes in FVC only in case of women. In a study conducted by Rio et al amongst European males and females there was a decline in lung function with age.<sup>6</sup> In a study conducted by Wu & Yang et al<sup>7</sup>, amongst Chinese subjects aged more than 60 years. The study involved 102 women and 78 men residing in Taiwan. FEV1/FVC declined with age in case of men. There are two basic changes that occur in pulmonary system with age. According to the present study, the mean FVC amongst 25-35 years was 4.46 $\pm$ 1.45 lit/min. The mean FEV1 was 3.60 $\pm$ 0.79 lit/min. The mean PEFR was 11.28 $\pm$ 2.48 lit/sec. The mean SVC was 5.30 $\pm$ 1.72 Lit/min. The mean MVV was 160.5 $\pm$ 2.5 lit/min. The mean FVC amongst 35-45 years was 3.50 $\pm$ 0.33 lit/min. The mean FEV1 was 2.86 $\pm$ 0.26 lit/min. The mean PEFR was 8.44 $\pm$ 1.17 lit/sec. The mean SVC was 3.79 $\pm$ 0.55Lt/min. The mean MVV was 155.8 $\pm$ 2.7 lit/min. The mean FVC amongst 45-55 years was 3.30 $\pm$ 0.66 lit/min. The mean FEV1 was 2.81 $\pm$ 0.68 lit/min. The mean PEFR was 7.55 $\pm$ 0.99 lit/sec. The mean SVC was 4.52 $\pm$ 1.21 Lit/min. The mean

MVV was 145.8±1.6 lit/min. The mean FVC amongst 55-65 years was 3.18±0.71 lit/min. The mean FEV1 was 2.56±0.47 lit/min. The mean PEFr was 7.21±1.37 lit/sec. The mean SVC was 3.30±0.58 Lit/min. The mean MVV was 136.5±2.3 lit/min. The mean FVC amongst 65-75 years was 3.27±1.02 lit/min. The mean FEV1 was 2.71±0.56 lit/min. The mean PEFr was 7.70±1.22 lit/sec. The mean SVC was 3.72±1.20 Lit/min. The mean MVV was 103.6 ±2.7 lit/min. With ageing the elastic recoil of lung decreases and there is chest wall stiffening.<sup>8</sup> This elastic recoil of lungs is dependent on the composition of connective tissue and the surface tension produced by alveolar surfactant.<sup>9</sup> Even in case of healthy adults there is measurable deterioration in the respiratory system with age.<sup>10</sup> With the possibility to know how these changes occur with age, it is possible to improve life as the person ages.<sup>11</sup> Along with this there is decrease in the surface area of the lung parenchyma, capillary surface area and septal surface area.<sup>12</sup> This decreases the area for gaseous exchange and increases the volume of dead space.<sup>8</sup> All this shows that with age there are measurable changes amongst the subjects with age.

### CONCLUSION

There is a gradual decline in the lung function with age. Both men and women undergo decrease in the pulmonary function test with age. With aging there is decrease in strength of respiratory muscles and gaseous and ventilator exchange. From the above study it can be concluded that there is reduction in the pulmonary function test with age.

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**Source of Support:** Nil. **Conflict of Interest:** None Declared.

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**Cite this article as:** Shailesh Kumar Singh, Prem Praksh Dubey. A Comparative Study of Pulmonary Function Tests amongst Different Age Groups. *Int J Med Res Prof.* 2018 Jan; 4(1): 446-48. DOI:10.21276/ijmrp.2018.4.1.092