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Effect of Increasing Age on Lung Functions of Sedentary Persons

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Abstract: *Aim: The aim of the study is to determine the relationship between age and pulmonary function test parameters (FEV_1 and FVC) in sedentary individuals.*
Materials and methods*: The present observational cross sectional study was performed at Sant Ishar Singh Memorial Public School and in Punjabi University campus, Patiala. For the study 142 subjects were divided in four groups with different age groups which were further divided as males and females within each group. Informed consent from the subjects was taken. International Physical Activity Questionnaire was filled for each subject to check the level of physical activity. Various other instruments used for the study are spirometer, weighing machine, Anthropometric rod and chair. All the subjects were assessed and findings were noted for FVC and FEV1 with spirometer. The Karl Pearson Correlation, ANOVA and The Post Hoc test were the tools for statistical analysis.*
Result: *The results of this study showed there was negative correlation between the increasing age and values of FVC and FEV_1.*
Conclusion: *There is significant decline in the lung functions with increasing age. The pulmonary functions were more impaired in females with increasing age as compared to males and sedentary females were more prone to develop cardio respiratory problems than males.*
Keywords: *Age, Pulmonary function test, FEV_1, FVC, Sedentary.*

I. Introduction

Ageing process is associated with progressive constriction of the homeostatic reserve of every organ. The most important physiological changes associated with ageing are of the respiratory system which is associated with decrease in static elastic recoil of the lung, in respiratory muscle performance and in compliance of the chest wall and respiratory system, resulting in the increased work of breathing.[1] Physiological reserve, especially for the alveolar gas exchange is reduced with ageing. This leaves elderly individuals vulnerable to stresses, diseases and injuries much more easily than in young. Even individuals who enjoy good health, there are measurable decrements in function of the respiratory system with age.[2] However studies have shown that higher physical activity is associated with a slower decline in pulmonary function.[3] Men and women who are physically active have the highest lung function in all age groups.[4] Physical activity is defined as any bodily movement produced by skeletal muscles those results in energy expenditure. Physical activity is known to improve physical fitness and is vital for prevention and treatment of conditions such as hypertension, diabetes, ischemic heart disease, depression and some cancers, among others.[5] Tremblay et al. 2010 stated that sedentary behaviour was associated with deleterious health outcomes.[6] Sedentary people are those with weekly physical activity below 150 minutes. The prevalence of sedentary lifestyle in general population is high especially during the leisure time.[7] Sedentary lifestyle is more in obese, older, less educated, smokers, widowed/divorced individuals.[8] According to study by Powell *et al.*, 1987 the crude prevalence of sedentary lifestyle increases steadily with age (54.6% for younger respondents aged 18-34 years, 58.9% for persons aged 35-54 years and 61.9% for old respondents aged ≥ 55 years).[9]

There is need for the exploration of the relation between physical activity and respiratory functions that will aid in understanding the mechanism of improving patients' quality of life and finding a better way to decrease if not undo the deleterious effects of age on the respiratory system. The present study has been necessitated as very few studies have been conducted in this part of the country to study the age related effects in the respiratory status in sedentary individuals. The aim of the study is to determine the relationship between age and pulmonary function test parameters (FEV1 and FVC) in sedentary individuals.

II. Materials And Methods

The present study is an observational cross sectional study and simple random method is used for sampling. The study was performed at Sant Ishar Singh Memorial Public School and in Punjabi University campus, Patiala. 150 subjects were screened. On the basis of inclusion and exclusion criteria, 142 subjects were chosen taken for the study. They were divided in four groups with different age groups and then subjects were divided as males and females within each group as shown in table 1. Informed consent from the subjects was taken. International Physical Activity Questionnaire was filled for each subject to check the level of physical activity. Various other instruments used for the study are spirometer, weighing machine, Anthropometric rod and chair.

Table 1: Division of subjects into age groups

AGE GROUPS	NO. OF INDIVIDUALS	MALES	FEMALES
20-29	45	18	27
30-39	31	14	17
40-49	34	15	19
50-59	32	20	12

SAMPLING CRITERIA

Inclusion criteria:

1. Both males and females of age group 20-60 years.
2. Sedentary individuals.
3. Weekly score of IPAQ less than 150.
4. Absence of any intensive athletic training.

Exclusion criteria:

1. Subjects with any cardiovascular, pulmonary, neurological or orthopaedic problem.
2. Subjects suffering from any vocal cord problem or chest deformity.
3. Non cooperative subjects and those who are unable to perform lung function test properly.
4. Subjects with upper respiratory tract infection and those on medical treatment at the time of study.
5. Subjects who were smokers were excluded from the study.

III. Procedure

Electro diagnostic machine: ISO (9001:2000) certified SPIROEXCEL Medicaid system was used, giving thorough consideration to the factors enhancing accuracy of spirometric analysis and minimizing sources of error and providing accurate information to confirm clinical diagnosis.Instructions were given to the subjects about the spirometer. The demographic data of the participant i.e. name, age, height and weight was recorded in the data base of the spirometer. The height of the subject was recorded barefooted with the help of anthropometric rod in centimetres. The weight in kilograms was recorded through weighing machine. Subjects were made to sit comfortably on the chair in the upright posture with head slightly elevated. Nose clip was attached to the nose to hold it. Then the subject was asked to inhale fully and maximally. Then mouthpiece was placed in the mouth between the teeth and subject was instructed to close lips around the mouthpiece. Subject was asked to expel air sharply, forcefully and maximally for as long as possible until no more air can be expelled, while maintaining an upright position through the mouthpiece. This process was repeated for a minimum of three technically acceptable manoeuvres, to meet acceptability criteria i.e. two best FEV_1 should be within 5%. Sufficient test time was allowed to the subject between the manoeuvres. All the subjects were assessed and findings were noted for FVC and FEV1 with spirometer.

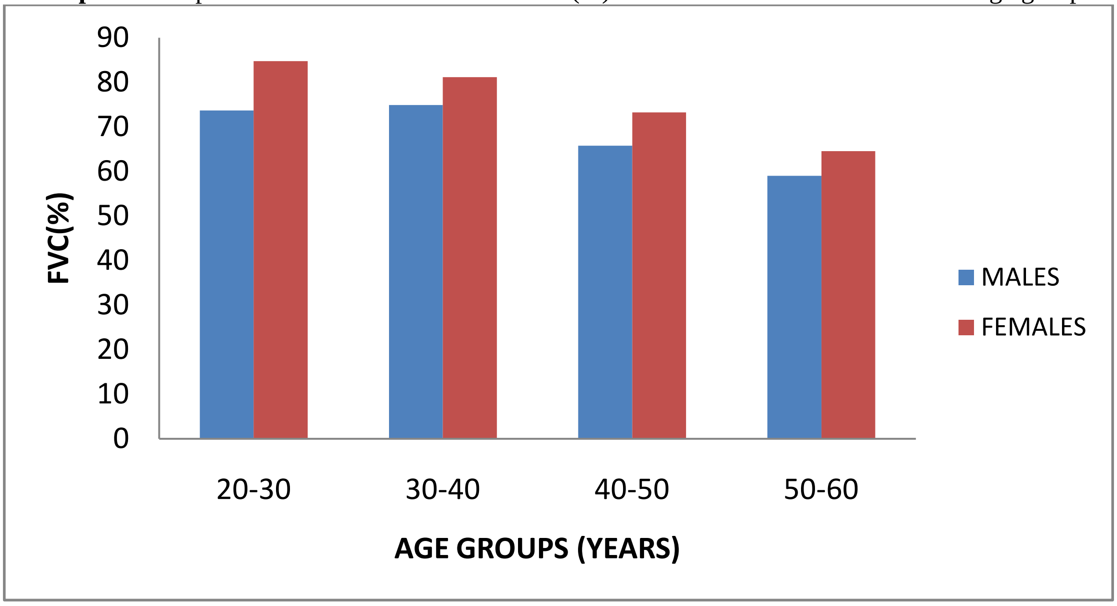
The data was analyzed using Microsoft Excel and Stats Direct. Mean, standard deviation and standard error was derived to prepare summary statisics. The Karl Pearson Correlation, ANOVA and The Post Hoc test were the tools for statistical analysis. The level of significance was set at $p<0.01$.

IV. Results

Table 2: Values of FVC and FEV_1 of males and females of different age groups

AGE	MALES		FEMALES	
	MEAN FVC(%)	MEAN FEV_1(%)	MEAN FVC(%)	MEAN FEV_1(%)
20-30	**73.68**	**79.93**	**84.77**	**87.51**
30-40	**74.89**	**78.04**	**81.13**	**84.86**
40-50	**65.77**	**71.22**	**73.26**	**76.29**
50-60	**59.05**	**62.76**	**64.57**	**68.68**

Graph 1: Comparison between the values of FVC(%) of males and females of different age group



Graph 2: Comparison between the values of FEV_1(%) of males and females of different age group

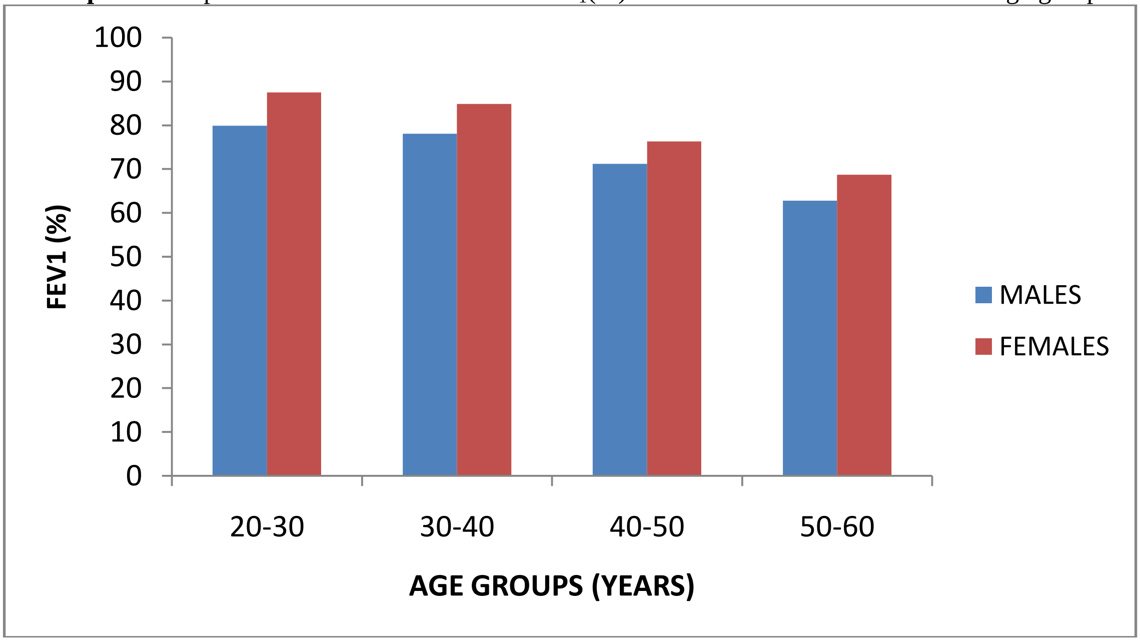


Table 3: Comparison between the values of FVC(%) of males and females of age group 20-30 years

	Mean square	Sum of square	Degree of freedom	F value	P Value
Between groups	1328.45	1328.45	1	9.80	Significant
Within groups	135.54	5828.22	43		

Table 4: Comparison between the values of FEV_1(%) of males and females of age group 20-30 years

	Mean square	Sum of square	Degree of freedom	F value	P Value
Between groups	620.77	620.77	1	6.82	Significant
Within groups	91.01	3913.43	43		

Table 5: Comparison between the values of FVC(%) of males and females of age group 30-40 years

	Mean square	Sum of square	Degree of freedom	F value	P Value
Between groups	298.61	298.61	1	3.27	Significant
Within groups	91.19	2644.44	29		

Table 6: Comparison between the values of FEV_1(%) of males and females of age group 30-40 years

	Mean square	Sum of square	Degree of freedom	F value	P Value
Between groups	358.04	358.04	1	2.89	Significant
Within groups	123.66	3586.17	29		

Table 7: Comparison between the values of FVC (%) of males and females of age group 40-50 years

	Mean square	Sum of square	Degree of freedom	F value	P Value
Between groups	471.06	471.06	1	10.44	Significant
Within groups	45.13	1444.16	32		

Table 8: Comparison between the values of FEV_1(%) of males and females of age group 40-50 years

	Mean square	Sum of square	Degree of freedom	F value	P Value
Between groups	215.42	215.42	1	4.19	Significant
Within groups	51.42	1645.54	32		

Table 9: Comparison between the values of FVC(%) of males and females of age group 50-60 years

	Mean square	Sum of square	Degree of freedom	F value	P Value
Between groups	228.25	228.25	1	2.19	Non Significant
Within groups	104.29	3128.64	30		

Table 10: Comparison between the values of FEV_1(%) of males and females of age group 50-60 years

	Mean square	Sum of square	Degree of freedom	F value	P Value
Between groups	263.14	263.14	1	1.74	Non Significant
Within groups	151.53	4545.76	30		

Table 11: Comparison between the values of FVC(%) and FEV_1(%) and different age groups of males

Age groups	**FVC(%)**		**FEV_1(%)**	
	Mean Square	**Significance**	**Mean square**	**Significance**
20-30 vs 30-40	-1.21	Significant	1.89	Significant
30-40 vs 40-50	9.17	Significant	15.28	Highly Significant
40-50 vs 50-60	6.72	Significant	8.46	Significant
20-30 vs 40-50	7.92	Significant	8.71	Significant
20-30 vs 50-60	14.63	Significant	17.17	Highly Significant
30-40 vs 50-60	15.84	Highly significant	15.28	Highly Significant

Table 12: Comparison between the values of FVC(%) and FEV_1(%) and different age groups of females

Age groups	**FVC(%)**		**FEV_1(%)**	
	Mean Square	**Significance**	**Mean square**	**Significance**
20-30 vs 30-40	3.64	Significant	2.65	Significant
30-40 vs 40-50	7.87	Significant	8.58	Significant
40-50 vs 50-60	8.69	Significant	7.61	Significant
20-30 vs 40-50	11.51	Highly Significant	11.23	Highly Significant
20-30 vs 50-60	20.21	Highly Significant	18.83	Highly Significant
30-40 vs 50-60	16.56	Significant	16.18	Significant

V. Discussion

This study was performed to establish the influence of age on the pulmonary function tests from a randomized sample of the sedentary urban population. Aging of the population is a significant product of demographic transition and pulmonary functions remain the major biologic variable affected by aging that shows great inter-individual variation.[10] Two major changes to the pulmonary system associated with aging are decreased elastic recoil and stiffening of the chest wall.[11] Loss of the elastic recoil with aging is directly associated with reduced forced expiratory flow.[12] Limitations in the exhalation were caused by the airway narrowing and thus reducing forced expiratory volume in 1 sec (FEV1).[13] Additionally early airway closure also produced early closing volume and relatively increased total residual volume. The combination of the reduced elastic coil and increased chest wall stiffness further increases the residual volume and lead to decrease in forced vital capacity in older individuals.[14]

The results of this study showed there was negative correlation between the increasing age and values of FVC and FEV_1. Similar results were shown by the study done by Cheng *et al.*, 2003.[15] The present study showed that there was significant difference in FVC and FEV_1 of males and females of 20-30, 30-40, 40-50 age groups and there is no significant difference in FVC and FEV_1 of males and females of 50-60 age group. In a study done by Verma *et al.*, 2002 they concluded that lung function tests were different in different age groups and changes take place in lung function parameters after the age of 40 years.[16] When FVC values were compared among different age groups of males the difference was significant except for age group 30-40 vs. 50-60 in which it was highly significant. In case of FEV_1 values significant difference was obtained between age groups of 20-30 vs. 30-40, 20-30 vs. 40-50 and 40-50 vs. 50-60 whereas highly significant difference was obtained between age groups of 30-40 vs. 40-50, 20-30 vs. 50-60 and 30-40 vs. 50-60.

When FVC values were compared among different age groups of females, the difference was significant except for age groups 20-30 vs. 40-50 and 20-30 vs. 50-60 in which it was highly significant. Similarly In case of FEV_1 values the difference was significant in all age groups except for 20-30 vs. 40-50 and 20-30 vs. 50-60 in which it was highly significant.

The study conducted in elderly Chinese showed similar values, but women not men showed an age related decline in FVC. Similar decline with age was obtained in studies conducted on the elderly European males and females[17]. The values of FVC obtained were higher than our present study in both sexes**.** Similarly in healthy elder blacks, higher values than the present study were observed.[18] In Italy, similar decline but with higher values was seen.[19] A study in eastern India showed similar results but had higher values as the subjects in their study were of lesser age.[20] The results were also consistent with the study done in Portugal.[21] Present study had values which were lesser than the values obtained by a study done by Neder *et al*.[22] in Brazil but had higher values as compared to a study conducted in India by Verma *et al*.[16]

Clinical Significance

This study shows that regular measurements of various lung function parameters like FEV_1 and FVC combined with informed evaluation of various respiratory signs and symptoms can lead to timely and accurate diagnosis of various respiratory disorders in old aged people thus leading to better management of these conditions in them.

VI. Conclusion

Results of the study indicate that there is significant decline in the lung functions with increasing age. The pulmonary functions were more impaired in females with increasing age as compared to males and sedentary females were more prone to develop cardio respiratory problems than males. If these aging changes could be minimized by various exercise programs etc it might be possible to improve on quantity as well as quality of life.

Future Scope

The study can be done on large sample size with equal number of male and female subjects. More lung function parameters can be included in the study. Various exercise programs can be designed to reduce the risk factors of sedentary lifestyle.

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