



A Comparative Study on Ventilatory Abnormalities between Asymptomatic Smokers and Healthy Males

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ABSTRACT

Objective : Cigarette smoking has extensive effects on respiratory function. Pulmonary function testing is a routine procedure for the assessment and monitoring of respiratory diseases. The present study was aimed to evaluate the influence of smoking on pulmonary functions and to study the differences in pulmonary function test values in smokers and non-smokers.

Methodology : In cross sectional study, spirometry data of health staff of Govt Siddhartha Medical College, Vijayawada was collected. Among these, 44 were smokers & 48 were non-smokers. Pulmonary function test procedure was explained to the subjects and best readings were taken on PC based Spirometer. Expiratory flow volume curves were recorded & FVC, FEF 50, FEF 75, PEFR, FEV 1, MVV, FEV /FVC ratio were obtained. The data were compared between smokers and non-smokers group.

Study results : PFT parameters FVC, FEV, PEFR, FEF and MVV were significantly reduced in smokers group when compared to non-smokers group. Further, in age group of 36-45 years and above 45 years, FEV 1, PEFR, FEF 50, FEF75, MVV are decreased; more in heavy smokers (0.01 P value) than in moderate smokers (0.05 P). The PFT parameters markedly decrease with increase no. of cigarette smoked per day as well as increased duration of smoking.

Conclusion : The present study brings out substantial variation in most of the parameters of PFTs between smokers and non-smokers confirming PFT values are less in smokers due to toxic effects of tobacco smoking on respiratory system & is the major cause of obstructive lung disease in Indian population.

Key Words : Pulmonary Function test, smokers, non smokers

I. INTRODUCTION :

Smoking is the leading single preventable cause of deaths worldwide. Each year an estimated seven million deaths are attributed to the use of tobacco. On an average, tobacco users lose 15 years of life. The economic costs of tobacco use are enormous, totaling more than US\$ 1.4 trillion in health care costs and resulting in lost productivity which is about 1.8 percent of the world's GDP and over 40 percent of what the world spends on school education. Yet tobacco remains the single most widely available and purchasable addictive substance whose purchase is legal everywhere.

Every tenth adult (10.7%; 99.5 million) in India currently smokes tobacco. The prevalence of smoking among men was 19.0 percent and among women it was 2.0 percent. The prevalence of smoking was 11.9 percent in rural areas and 8.3 percent in urban areas. The mean number of cigarettes smoked per day by a daily cigarette smoker was 6.8 and the mean number of bidis smoked per day by a daily bidi smoker was 15.1. A daily cigarette smoker spent on an average Rs. 1192.45 per month and daily bidi smokers spent on an average Rs. 284.12 per month on bidis.

Cigarette smoking is by far the most important risk factor for COPD and most important that tobacco contributes risk of COPD.

Cigarette smokers have higher prevalence of respiratory symptoms, pulmonary function abnormality and greater annual rate of decline in FEV1 and greater COPD mortality rate than non-smokers. The ratio of FEV to FVC is significantly reduced in smokers.

Smoking leads to rapid decline in pulmonary function test specially those indicating diameters of airways such as forced expiratory flow



in one second (FEV1). Even in teenagers who have smoked only for few years, maximum expiratory flow volume curves demonstrate decrease in flow rate at small lung volumes, yet another expression of airway obstruction

Decline in FVC is noted with age, at the rate of 30-40 ml/yr. Similarly PEF decreases at rate of 4ltrs/min. The declines of these parameters is accelerated in smokers, in a direct correlation to the duration and the number of cigarettes smoked.

II. AIMS AND OBJECTIVES :

The aim of my study is to do a comparison between ventilatory abnormalities in asymptomatic smokers and healthy males.

The objectives of my study are

1. To study the influence of smoking on pulmonary functions.
2. To study the differences in pulmonary function test values in smokers and non-smokers.
3. To improve the health status of community by inculcating the knowledge about hazards caused by smoking.

III. METHODOLOGY :

In a cross sectional study, spirometry data of 92 subjects [Siddhartha Medical College staff and workers] was collected for 2 months, from March 2022 to May 2022. Among these, 44 were smokers & 48 were non-smokers.

Inclusion criteria :

1. Asymptomatic male smokers
2. Age > 40 year
3. Healthy male non-smokers
4. >10 years of smoking history

Exclusion criteria :

- The following groups of persons were not included in the study.
 1. Females were not included in this study.
 2. The known cases of bronchial asthma and COPD.
 3. The person who were morbid or have chronic parenchymal diseases, PAH, heart diseases.

4. Recent surgery and Acute Illnesses.

Non/Never Smoker : An adult who has never smoked or smoked less than 100 cigarettes in his/her life time

- Rest of the subjects were considered smokers {former/Ex/Current/Someday/Everyday }

PROCEDURE :

- All the tests were done between 10:00 to 17:00. Each person was allowed to rest for about five minutes before the actual test. The details of the test were explained and demonstrated to each of them. All the measurements were recorded with the subject in standing position and wearing nose clips. Expiratory flow volume curves were recorded by a spirometer and FVC, FEF, PEFR, FEV1, FEV/FVC ratio were obtained. The person was asked to take deep inspiration from outside and then to expire as forcefully and as fast as he can inside the mouthpiece. The value of forced vital capacity in litres was obtained from the graph.
 - Various pulmonary function test included in the assessment of
 - 1) Vital Capacity (forced vital capacity- FVC)
 - 2) Peak expiratory flow rate (PEFR)
 - 3) Forced expiratory flow (FEF)
 - 4) FEV1 (forced expiratory volume in first second)
 - 5) FEV/FVC ratio.

IV. RESULTS :

- 92 males, 44 smokers and 48 non-smokers matched for age, socioeconomic status and physical activity completed this study.
- The number of cigarette smoked per day among 44 smokers:
 - 17 smoked average 5 cigarettes per day, 17 smoked average 15 and 10 smoked average 25 cigarettes per day. Duration of smoking among 44 smokers was more than 10 years.
- The values of different parameters of pulmonary function tests in smokers were compared with non-smokers i.e. the control group.

COMPARISION OF VARIOUS PULMONARY FUNCTION TESTS BETWEEN SMOKERS AND NON SMOKERS

S NO	PULMONARY FUNCTION TEST	NON SMOKERS	SMOKERS	P VALUE
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1	FVC MEAN	[L]	2.85	1.71	P<0.05
	S.D		0.57	0.60	
2	FEF MEAN	25-75	2.77	1.27	P<0.05
	S.D		1.05	0.52	
3	PEFR MEAN		5.93	3.07	P<0.05
	S.D		1.92	1.68	
4	FEV1 MEAN		2.40	1.20	P<0.05
	S.D		0.51	0.39	
5	FEV1/FVC MEAN		84.64	72.15	P<0.05
	S.D		9.35	14.28	

The difference in values of FVC, FEF 25-75 , PEFR, FEV , FEV /FVC ratio observed in two groups was significant (P less than 0.05).

Effect of No. of cigarette smoked per day on Pulmonary function test

S.NO	PULMONARY FUNCTION TEST		CIGARETTES PER DAY			P VALUE
			1-10	11-20	21-30	
1.	FVC	MEAN S.D	1.97 0.63	1.61 0.56	1.33 0.33	P<0.05



2.	FEF 25-75	MEAN S.D	1.27 0.60	0.87 0.39	0.80 0.41	P<0.05
3.	PEFR	MEAN S.D	3.16 1.30	3.10 2.26	2.79 1.02	P<0.05
4.	FEV1	MEAN S.D	1.40 0.41	1.09 0.32	0.99 0.31	P<0.05
5.	FEV1/FVC	MEAN S.D	73.57 17.14	69.76 13.15	73.94 9.69	P<0.05

The values of FVC, FEF , PEFR, FEV were significantly reduced with increase no. of cigarette smoke per day (P less than 0.05) while FEV1/FVC ratio did not show much difference (P>0.05).

Effect of Duration since smoking on pulmonary function tests

S.NO	PULMONARY FUNCTION TEST		DURATION OF SMOKING (YEARS)			P VALUE
			11-20	21-30	>31	
1	FVC	MEAN	1.91	1.75	1.50	P<0.05
		S.D	0.40	0.71	0.53	
1	FEF25-75	MEAN	1.19	1.01	0.93	P<0.05
		S.D	0.45	0.44	0.65	
3	PEFR	MEAN	4.05	2.74	2.87	P<0.05
		S.D	2.00	1.46	1.58	
4	FEV1	MEAN	1.39	1.23	1.05	P<0.05
		S.D	0.26	0.42	0.38	



5	FEV1/FVC	MEAN	74.78	72.16	70.70	P<0.05
		S.D	15.14	12.76	16.05	

Significant decrease in pulmonary function test values was found with increased duration since smoking (P<0.05).

Comparison of various pulmonary function tests among smokers and non-smokers in relation to different age groups

S NO.	VARIABLE	AGE GROUP (IN YEARS)	NON-SMOKERS		SMOKERS		P VALUE
			MEAN	S.D	MEAN	S.D	
1	FVL	41 - 50	2.87	0.47	1.70	0.46	<0.05
		51 - 60	2.86	0.43	1.66	0.43	
		61 - 70	2.87	0.47	1.71	0.46	
2	FEF 25-75	41 – 50	2.80	0.89	1.04	0.43	<0.05
		51 – 60	2.75	0.86	1.03	0.42	
		61 – 70	2.78	0.86	1.03	0.40	
3	PEFR	41 – 50	5.97	1.59	3.05	1.22	<0.05
		51 – 60	5.90	1.52	3.04	1.20	
		61 – 70	5.54	1.61	3.07	1.24	
4	FEV1	41 – 50	2.42	0.38	1.20	0.33	<0.05
		51 – 60	2.41	0.36	1.18	0.33	

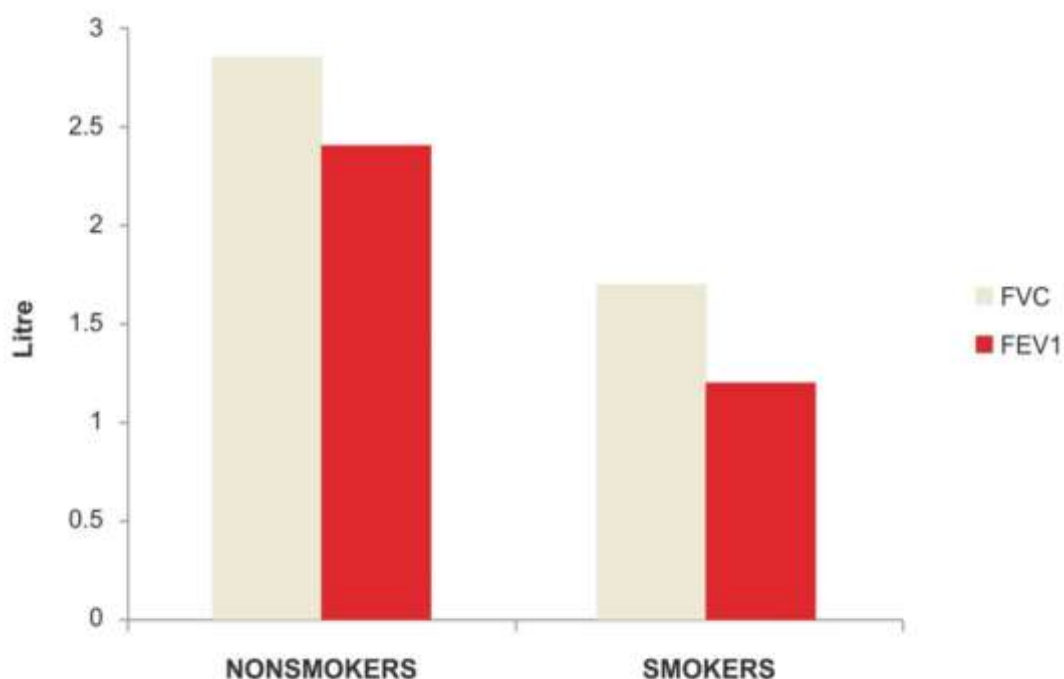


		61 – 70	2.42	0.38	1.20	0.33	
5	FEV1/FVC	41 - 50	84.78	8.08	72.31	11.76	<0.05
		51 – 60	84.46	8.03	72.73	11.39	
		61 - 70	84.67	7.76	72.15	11.36	

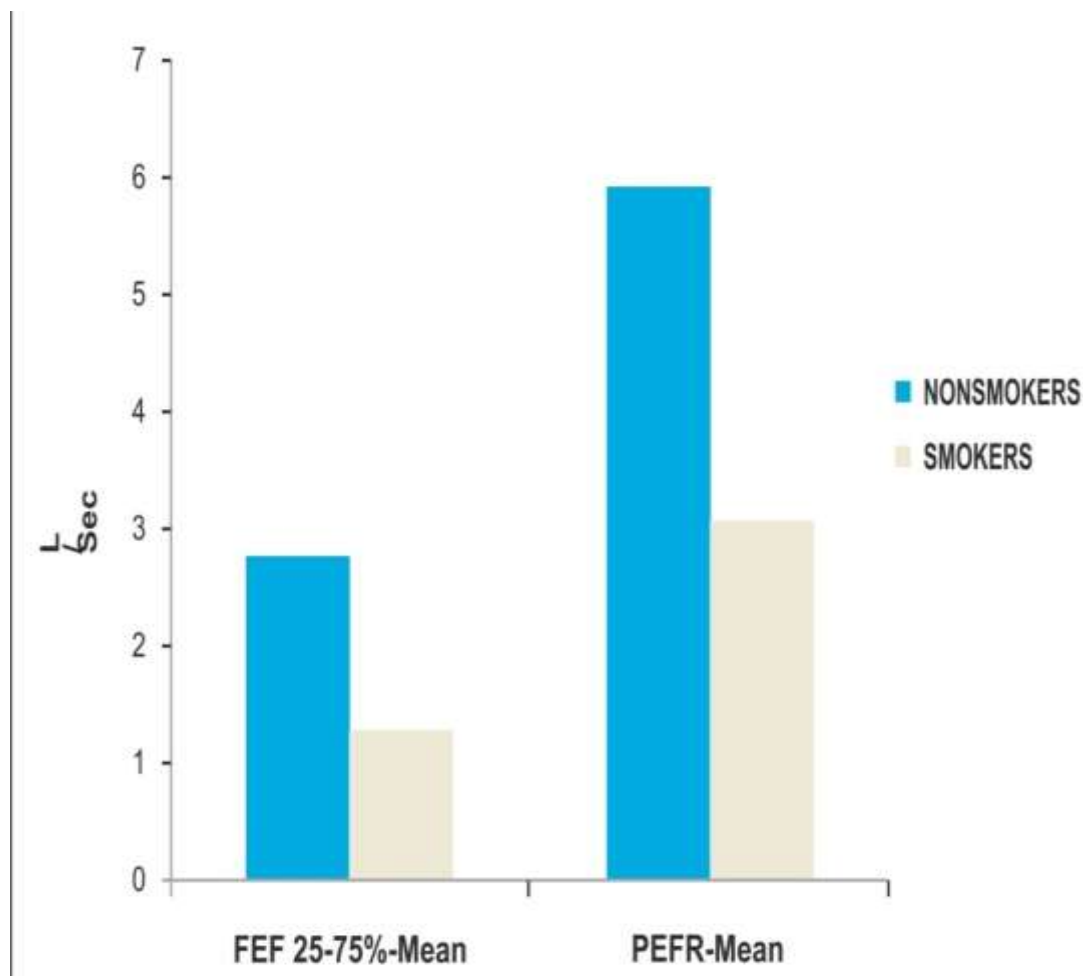
Comparing mean observed forced vital capacity, FEF , PEFR, FEV , FEV /FVC ratio of smokers and non-smokers in different age group , significant

difference in the values of all PFTs were observed in smokers (P<0.05).

Forced vital capacity and forced expiratory volume in first second in smokers and non smokers



Forced expiratory flow between 25% to 75% and peak expiratory flow rate in smokers and nonsmokers



V. DISCUSSION

- 92 males, 44 smokers and 48 non-smokers matched for age, socioeconomic status and physical activity completed this study. The number of cigarette smoked per day among 44 smokers, 17 smoked average 5 cigarettes per day, 17 smoked average 15 cigarettes per day and 10 smoked average 25 cigarettes per day. Duration of smoking among 44 smokers was more than 10 years.
- The values of different parameters of pulmonary function tests in smokers were compared with non-smokers i.e. the control group.
- The results showed statistically highly significant decrease in FVC, FEV1, FEV1/FVC ratio, PEFR, FEF among smokers compared to non-smokers. In the present study the effect of quantity and duration of smoking on various PFTs were also examined which showed strong correlation between impairment of pulmonary functions and duration since smoking and no. of cigarettes smoked per day.
- Wihelmensen and Tibblin have reported that the lung function tests show uniform tendency of deterioration with increasing tobacco consumption.
- MS Eslam et al studied changes of ventilator functions among smokers and nonsmokers and observed fall in FVC amongst the smokers. Also the FEF25-75% was markedly diminished amongst smokers.
- In recent time Anand kumar et al conducted study among smokers and non smokers and concluded that the actual values of FVC, FEV1, ratio of FEV1/ FVC, FEF25-75% and PEFR are decreased in smokers compared to non smokers and all the values are more decreased with increase in duration of smoking and increase in number of cigarettes smoked per day. These showed a dose response relationship.
- Hani A et al conclude in their study of pulmonary function test among smokers and non-smokers that mean FVC, FEV1 and PEFR were higher in non-smoker in each age group



and BMI was not significantly associated with the most of spirometric values.

VI. CONCLUSION :

- During last few decades pulmonary function tests evolved from tools for physiologic studies to clinical investigation in assessing respiratory status. They also become a part of routine health examination in respiratory, occupational, sports medicine and public health screening.
- FVC, FEF₂₅₋₇₅, PEFR, FEV₁, FEV₁/FVC ratio were the pulmonary function tests selected for the present study.
- FEF₂₅₋₇₅, PEFR and FEV₁ values were found to be significantly lower in smokers than in non-smokers. FVC and FEV₁/FVC ratio were also found to be decreased in smokers.
- Gradually with increasing age all parameters of pulmonary function tests were markedly lower in smokers compare to that in non-smokers.
- Decline in all parameters of pulmonary function tests were seen when there is an increase in no. of cigarette smoked per day as well as increase duration of smoking. This suggests that severity of COPD directly proportional to no. of cigarette smoked per day and duration of smoking .
- This pulmonary function test analysis proved that pulmonary function decrease in smokers with increasing age, no. of cigarette or bidis smoked per day and duration of smoking.

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