



ORIGINAL RESEARCH PAPER

Pulmonary Medicine

“EVALUATION OF PULMONARY FUNCTION TEST PARAMETERS IN HEALTHY ASYMPTOMATIC SMOKERS USING SPIROMETRY AT A TERTIARY CARE HOSPITAL.”

KEY WORDS: Chronic Obstructive Pulmonary Disease, Lung, Smoking, Cigarette, Bidi, Spirometry

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ABSTRACT

Background: Chronic Obstructive Pulmonary Disease (COPD) is a leading cause of morbidity and mortality worldwide. Tobacco smoking is the leading cause of preventable lung diseases. Present study aimed to evaluate the pulmonary function test parameters by spirometry in healthy asymptomatic smokers. **Material & Method:** This prospective observational study was conducted for duration of 1yr period among the healthy subjects with smoking history of 5yrs attending the OPD/admitted in the hospital for complaints other than respiratory symptoms. The individuals underwent the clinical examination and history collection. The pulmonary function testing was done as per the guidelines of American thoracic society. Participants performed PFT in seated position after a thorough calibration of spirometer. Three trials of testing was performed and the best of the trials was considered for analysis. **Result:** A total of 200 patients fulfilling inclusion criteria consenting to be part of study were included. The mean age of patients included in the study was found to be 47.22±9.85yrs. There is significant change in lung function in smokers, this was pronounced with the finding that the bidi smokers are at higher lung function derangement with the duration and number of pack years compared to cigarette smokers. **Conclusion:** Tobacco smoking in form of bidi or cigarette or both has a significant deleterious effect on the pulmonary function. The asymptomatic smokers should be educated for the risk of COPD and health benefits of cigarette cessation.

INTRODUCTION

Smoking has been labelled the most important preventable cause of disease and death. It is been a very old practice of the people all over the globe cutting across all the national and social barriers, and is one of the widely accepted social habits. The increase in the habit of cigarette smoking has led to high-incidence of diseases related to it in developed as well as developing nations. COPD is a leading cause of morbidity and mortality worldwide.¹ Globally there are around 3million deaths annually. Smoking is one of the most important major risk factor leading to the development of COPD. The risk of morbidity and mortality increases with both the quantum of smoking and duration in years.² The addictive effect of the nicotine accounts to most for persistent personal and public health dilemma. The compelling urge to smoke, gives an immense pleasurable alteration in mood and motivates chronic cigarette smoking seeking behaviour.

Smoking is one among the most important risk factor for developing chronic obstructive pulmonary disease (COPD).³ In India, an estimated 82.3% males with COPD are smokers.⁴ Once smoking has caused a disease, the disease is largely irreversible and progressive. With the increasing prevalence of smoking in developing countries, the prevalence of COPD is expected to rise and by 2060 there may be over 5.4 million deaths annually from COPD.⁵

Spirometry measures the pulmonary function by measuring the air flow rates, lung volumes in the form of measuring FEV1, FVC, FEV1/ FVC. It should be compared to their normal predicted values. If there is a decline in any of the above values, then the risk of occurrence of COPD in the near future can be assessed. Patient can be advised to quit smoking, as cessation of smoking can halt the incidence and progression of the disease. Hence it's a greater responsibility of the treating physicians to combat with the smoking habits, both through their strict advice to the patients and through the influence of the society/ community by health education for quitting the habit of cigarette smoking and creating awareness of its benefits. The present study aimed to evaluate the pulmonary function test parameters by spirometry in healthy asymptomatic smokers.

MATERIAL & METHOD

The present prospective observational study was conducted for duration of 1yr period among the healthy subjects with smoking history of 5yrs attending the OPD/admitted in the

hospital for complaints other than respiratory symptoms. Patients who were ex-smokers, history of tuberculosis, asthma, on treatment with corticosteroids, bronchodilators, vertebral deformities and patients not willing were excluded from the study.

The individuals underwent clinical examination and history collection. Pulmonary function testing was done as per guidelines of American thoracic society. Participants performed PFT in seated position after a thorough calibration of spirometer. Three trials of testing was performed and the best of the trials was considered for analysis.

Statistical analysis: The patient's data were collected in excel and analysed using SPSS v26.0 operating on windows 10. The mean difference between data were analysed using student t-test and categorical data using chi-square test. A p-value of <0.05 was considered statistically significant.

RESULT:

A total of 200 patients with mean age of 47.22±9.85yrs were included. Age-wise distribution, majority of patients were in age of 51-60yrs (40%) followed by 32% with 41-50yrs, 18.5% with 33-40yrs, 8.5% with 25-30yrs and 1% with more than 61yrs of age. Among the occupation, 21.5% were farmers, 20% were businessperson, 19% were mason, 12.5% were sweeper and 8% were carpenter. The smoking type was majority with cigarette in 60.5% and 39.5% with bidis.

Table 1: Showing the distribution of FEV1, FEV1/FVC and FVC results among study subjects

		Frequency	Percent
FEV1	Mild	104	52.0
	Moderate	8	4.0
	Normal	88	44.0
FEV1/FVC	Mild	104	52.0
	Moderate	8	4.0
	Normal	88	44.0
FVC	Mild	104	52.0
	Moderate	8	4.0
	Normal	88	44.0

In study FEV1 was mild grade in 52%, moderate grade in 4% and normal in 44% of patients.

FEV1/FVC ratio was found to be mild grade in 52% patients, moderate grade in 4% and normal in 44% of the patients. FVC

were found with mild grade in 52%, moderate in 4% and normal in 44% of the patients.

Table :2 Comparison of FEV1 changes in age-wise groups

Age group	FEV1					Chi-square (p-value)
	Mild	Moderate	Normal			
	Count	N %	Count	N %	Count	N %
25-30yrs	0	0.0%	0	0.0%	17	19.3%
31-40yrs	0	0.0%	0	0.0%	37	42.0%
41-50yrs	30	28.8%	0	0.0%	34	38.6%
51-60yrs	72	69.2%	8	100.0%	0	0.0%
>61yrs	2	1.9%	0	0.0%	0	0.0%

In present study, the mild changes in FEV1 was significantly seen in older age group individuals compared to the normal findings in younger age group. (p<0.05)

Table :3 Comparison of FVC changes in age-wise groups

Age group	FVC					Chi-square (p-value)
	Mild	Moderate	Normal			
	Count	N %	Count	N %	Count	N %
25-30yrs	0	0.0%	0	0.0%	17	19.3%
31-40yrs	0	0.0%	0	0.0%	37	42.0%
41-50yrs	30	28.8%	0	0.0%	34	38.6%
51-60yrs	72	69.2%	8	100.0%	0	0.0%
>61yrs	2	1.9%	0	0.0%	0	0.0%

In present study, the mild changes in FVC was significantly seen in older age group individuals compared to the normal findings in younger age group. (p<0.05)

Table :4 Comparison of FEV1/FVC ratio changes in age-wise groups

Age group	FEV1/FVC ratio					Chi-square (p-value)
	Mild	Moderate	Normal			
	Count	N %	Count	N %	Count	N %
25-30yrs	0	0.0%	0	0.0%	17	19.3%
31-40yrs	0	0.0%	0	0.0%	37	42.0%
41-50yrs	30	28.8%	0	0.0%	34	38.6%
51-60yrs	72	69.2%	8	100.0%	0	0.0%
>61yrs	2	1.9%	0	0.0%	0	0.0%

In present study, the mild changes in FEV1/FVC ratio was significantly seen in older age group individuals compared to the normal findings in younger age group. (p<0.05)

Table :5 Showing the comparison of FEV1, FEV1/FVC and FVC with type of smoking.

		Bidis		Cigarette		Chi-square (p-value)
		Count	N %	Count	N %	
FEV1	Mild	44	55.7%	60	49.6%	3.191 (0.203)
	Moderate	5	6.3%	3	2.5%	
	Normal	30	38.0%	58	47.9%	
FEV1/FVC	Mild	44	55.7%	60	49.6%	3.191 (0.203)
	Moderate	5	6.3%	3	2.5%	
	Normal	30	38.0%	58	47.9%	
FVC	Mild	44	55.7%	60	49.6%	3.191 (0.203)
	Moderate	5	6.3%	3	2.5%	
	Normal	30	38.0%	58	47.9%	

On comparison of spirometric parameter changes with the smoking type, there was higher incidence of moderate and mild grade among the bidi smokers as compared to the cigarette smokers.

Table :6 Comparison of the pack year of smoking with the spirometry changes in participants

Pack years	Normal	Mild	Moderate	Chi-square
10-19	60 (68.1%)	12 (11.5%)	0 (0.0)	22.01 (0.01)*

20-29	21(24%)	30 (28.8%)	1(12.5%)	
>30	7 (7.9%)	62 (59.7%)	7 (87.5%)	

On comparison of the pack year with the spirometry measurements, there is significant derangement in spirometry with higher pack year of smoking. (p<0.05) There is significant changes in the FEV1 with the pack years of smoking among the patients. (p<0.05) Also

DISCUSSION:

Spirometry measures the pulmonary function by measuring the air flow rates, lung volumes in the form of measuring FEV1, FVC, FEV1/ FVC. It should be compared to their normal predicted values. If there is a decline in any of the above values, then the risk of occurrence of COPD in the near future can be assessed. Patient can be advised to quit smoking, as cessation of smoking can halt the incidence and progression of the disease. In study airflow obstruction was found to be mild grade in 52%, moderate grade in 4% and normal in 44% of patients.

In present study total of 200 patients fulfilling inclusion criteria consenting to be part of study were included. The mean age of patients included in the study was found to be 47.22±9.85yrs. Agewise distribution, majority of patients were in age of 51-60yrs (40%) followed by 32% with 41-50yrs, 18.5% with 33-40yrs, 8.5% with 25-30yrs and 1% with more than 61yrs of age. Elumalai SK et al., documented the mean age (mean ± SD) of non-smokers and asymptomatic smokers enrolled was 34.7±5 and 33.8±5 years respectively, with inclusion of 20-45yrs male. The mean smoking dose amongst the asymptomatic smokers was 15.74±5.5 pack years. FEV1 amongst the asymptomatic smokers showed a negative correlation with smoking dose.⁶ In study by Bano R et al., the age range of subjects was 30-60 years with mean age 48.26 years in smokers.⁷

By occupation 21.5% were farmers, 20% were businessperson, 19% were mason, 12.5% were sweeper and 8% were carpenter. In study FEV1 was mild grade in 52%, moderate grade in 4% and normal in 44% of patients. FEV1/FVC ratio was found to be mild grade in 52% patients, moderate grade in 4% and normal in 44% of the patients. In present study FVC 25-75% were found with mild grade in 52%, moderate in 4% and normal in 44% of the patients. Mistry A et al., documented that PFT parameters decrease significantly by increasing the number of cigarettes smoked per day and increasing the duration of smoking. This study shows significant differences in most PFT parameters between smokers and non-smokers, confirming that PFT values are lower in smokers due to the respiratory toxic effects of smoking and is a major cause of COPD in the Indian population.⁸

The mean difference in values for pulmonary function test for FEV1 was highly significant, while for the other parameters, viz. FVC and FEV1/ FVC ratio, the differences were not found to be statistically significant between smokers and non-smokers group on applying independent sample t test. Smoking has a deleterious effect on the health, mainly on pulmonary functions. Hence, the risk of respiratory mortality or morbidity is high with smoking. The study observed that spirometry was an effective and easy method for detection of COPD in risk group population like smokers, and thus promotes smoking cessation efforts to reduce the burden of COPD in the community.⁹ FEV1/FVC has significant positive correlation with FEV1 and significant negative correlation with Smoking Index and FVC. This study concluded that 61.29% of asymptomatic smokers had mild COPD and 38.7% had moderate COPD as per GOLD guidelines.¹⁰

Study documented the mean duration of smoking was found to be 22.83yrs and mean pack years of smoking of 23.32. Between the group, the pack year was found to be significantly higher among the bidi smokers compared to the

cigarette smokers ($p < 0.05$). Between the groups, there is no significant difference in duration of the smoking. On comparison of spirometric parameter changes with the smoking type, there was higher incidence of moderate and mild grade among bidi smokers as compared to cigarette smokers. In similar to present study by Khan MM et al., documented the parameters of pulmonary function test, like FEV1, FVC and FEV1/FVC ratio were significantly affected among bidi smokers compared to cigarette smokers with similar pack year of exposure showing the harmful effect of bidi over the cigarette smoke.¹¹

Obstructive lung alterations were most prevalent in just bidi smokers (72.22%), followed by both cigarette and bidi smokers (22.22%), and alone cigarette smokers (5.55%).⁷ Padmavathy KM et al., observed in a research that bidi smokers' lung functioning are worse than cigarette smokers'.¹² When cumulative cigarette/bidi usage exceeded five pack-years, average breath CO level was considerably higher in bidi smokers (18.9 +/- 7.7 ppm) compared to cigarette smokers (13.6 +/- 5.8 ppm) ($p = 0.002$). Bidi had a substantially lower average tobacco weight (216.8 mg) than cigarettes (696 mg). Bidi is as dangerous as or more dangerous than cigarette smoking. When counting "pack-years" of smoking, one bidi is equivalent to one cigarette.¹³ Sreenivas SB et al., in his study found that there were significant effects of smoking on PFT parameters (deterioration was up-to half). All ex-smokers' parameters showed partial recovery. Some of the parameters had negative correlations with smoking frequency and duration. In conclusion, this study found that former smokers showed signs of recovery while smokers' PFT parameters showed significant decline. It is recommended to conduct a more in-depth study with a larger sample size and a stricter definition of ex-smokers.¹⁴

Male smokers are more likely to be between the ages of 30 and 55. An abnormal PFT is strongly linked to smoking. To detect anomalies early, smoking cessation should be promoted, and PFTs should be performed on asymptomatic individuals, both smokers and non-smokers, on a regular basis.¹⁵ Thus the spirometry is a very useful screening method to detect the airflow limitation very early in the course of incidence of COPD.

CONCLUSION:

Smoking tobacco, whether it is bidi or cigarette, has a significant negative effect on lung function. The duration of smoking and the number of years of packing affects lung function causing a decrease in lung volume and functional capacity. The results of the current study indicate an alarming need for smoking cessation among participants, and larger sessions are needed to raise awareness of the harmful effects of smoking on lung function.

Funding: Nil

Conflict Of Interest: Nil

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