

## Variation in PFT values between smoker and non-smokers from tribal region of north Maharashtra

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### Abstract

**Background:** Major risk factor causing worsening of function of lung is smoking. Several researchers had established changes of pulmonary function on outcome of spirometry test. Our intention was to learn influence of smoking on spirometry parameters of individual living in tribal region of our state.

**Methodology:** Pulmonary function test was performed by group of 50 smoker and 50 nonsmoker subjects of age 20 to 60 years living in nearby tribal locality.

**Results:** Pulmonary function parameters and result of test was compared between group of smoker & nonsmoker subjects.

**Conclusions:** We conclude that mean FVC, FEV1 and PEFR were higher in nonsmoker. Smoking habit leads to definite pulmonary function impairments. Mixed pattern of lung function impairment turns out to be most common and obstruction pattern as 2<sup>nd</sup> most common among smokers.

**Keywords:** Smoker; Nonsmoker; PFT.

### Introduction

A report by WHO stated that population of 100 million died around the world in 20th century because of tobacco smoking. In 21st century the count can go high up to one billion people. Till early 2030 tobacco related death would increase to about 10 million a year [1]. Smoke of tobacco consist of numerous chemical and around 40 types of carcinogens like methoprene, propylene glycol, benzopyrene, butane, nicotine, cadmium, acetone, ammonia, tar, lead, benzene, formaldehyde [2]. This type of smoke contains smaller particles which get deposited deep in the lungs. Smoking is well known as the most important causative factor for chronic obstructive pulmonary diseases, lung malignancies and other pulmonary diseases.

The smoke consists of fine particle size aerosol which can easily deposit in alveoli and airways of lung. This smoke dust interferes in the function of respiratory airways. The bronchial epithelium gets eroded by tar and nicotine causes increase in heart rate and blood pressure. The inhalation of tobacco smoke leads to smooth muscle constriction resulting in to rise of airway resistance which lasts up to an hour. Cigarette smoking for many years disturbs ciliary activity and restricts work of alveolar macrophages leading to disruption of mucus secreting gland. It also causes acute release of proteolytic enzymes from polymorphonuclear leucocytes [3]. The major risk factor for chronic obstructive pulmonary disease is tobacco smoking [4]. There is large prevalence of pulmonary function abnormality, rapid annual decline in FEV1 and high COPD mortality rate among smokers than nonsmokers demonstrated by numerous research studies [5].

Lung function tests are regularly used method to illustrate obstructive or restrictive behavior of airways. It is a reliable method that serve important role in assessment of pulmonary function, follow up of disease and monitoring of

treatment. The Forced Expiratory Volume in 1 second (FEV1), FEV1/FVC Ratio and Forced Vital Capacity (FVC) are significant variables required for the analysis of functional abnormality like obstructive and restrictive respiratory illness [6,7]. Our intention was to gather statistics of airway function parameters of smoker and nonsmoker individuals residing in tribal region of north Maharashtra. This study was done:-

1. To observe the repercussions of smoking on variables of pulmonary dynamics,
2. To evaluate the pulmonary function test parameters between smokers and non-smoker individuals,
3. To demonstrate the variant of airway impairment induced by smoking viz. obstruction, restriction or mixed and compares the results with other studies.

### Materials and Methods

This study was conducted in Department of respiratory medicine of medical college & Hospital established in tribal region of Maharashtra state, after complete approval from ethics committee. We included 100 male subjects of age between 20 to 60 years in our study (after obtaining informed consent); we divide them in to two groups of 50 smokers and 50 non-smoker individuals. Females were excluded due their hesitation to disclose smoking habit.

#### Inclusion Criteria:

1. Male subjects of age 20 years to 60 years, Ready to give informed consent
2. An adult subject labeled as nonsmoker if he is not in direct or indirect contact with tobacco smoke, he has never smoke or exposed to burned tobacco in form of bidi or cigarette.
3. An adult subject is labeled as smoker if he has smoked earlier and currently smoking burned tobacco in form of

bidi or cigarette. Minimum 5 number of bidi or cigarette in a day.

#### Exclusion Criteria:

Following individuals are not included:

1. Former smokers and females were omitted from analysis.
2. Subjects who were diagnosed case of bronchial asthma.
3. Subjects with co-morbid conditions as Cor-pulmonale, Heart failure, cardiomyopathies, cardiac surgeries.
4. Subjects working in cement factories, textile mills or places where exposure to dust or fumes.

We involved subjects from people living around nearby who smoke tobacco, also from the patients coming to outpatient department of our general hospital for non-respiratory complaints. Individuals who satisfy inclusion criteria were incorporated in our research. Their medical illness background entered & details about their smoking habit and co morbidities were noted. A primary screening was done for excluding major pulmonary ailment, chest or spinal anatomical deformity, any infective lung diseases like tuberculosis. Anthropometric measurements (age, height, weight and BMI) were noted and all vital data such as pulse, blood pressure, respiratory rate was obtained.

All participants were thoroughly briefed regarding research process, predicted conclusions before initiation of

the research. Written consents were secured from all the participants.

Subjects were instructed about activities to avoid prior performing the test as follows:- Smoking within at least 1hr of testing

1. Consuming alcohol within 4hr of testing.
2. Exercise within 30 min of testing.
3. Wearing tight clothing which may restricts full expansion of chest.
4. Eating heavy meal within 2hr of testing.

Subject was taken to pulmonary function laboratory for demonstration of procedure of spirometry. After complete demonstration of PFT, they were asked regarding doubts or queries about procedure and their doubts are cleared till subject satisfied. Then under supervision of investigator subject perform PFT by himself. Our computerized spirometry machine RMS Helios Medispiror documents the flow-volume loop and key variables such as FEV1/FVC ratio, FEV1, FVC and PEFR were acquired. The data was entered in Microsoft Excel sheet then transferred to SPSS software and analyzed by applying proper tests.  $p < 0.05$  was considered as significant.

#### Observations & Results

**Table 1: Physical criterion of smoker and non-smoker**

	Smoker	Non Smoker
Age(mean $\pm$ SD)	52.18 $\pm$ 16.72	44.90 $\pm$ 19.20
Weight(mean $\pm$ SD)	53.84 $\pm$ 11.57	53.80 $\pm$ 10.36
Height(mean $\pm$ SD)	159.22 $\pm$ 8.32	158.32 $\pm$ 9.25
BMI(mean $\pm$ SD)	21.26 $\pm$ 4.35	21.6 $\pm$ 4.14

We observe the physical characteristics of smokers and nonsmokers (Table 1) and found that mean age was 52.18 years and 44.90 years, mean weight was 53.84 and 53.80 kg, mean height was 159 and 158 cm, mean BMI was 21.26 and

21.6 respectively. Mean values of physical criterion such as weight, body mass index and height does not conclude significant difference.

**Table 2: Comparison of lung function scale between smoker & nonsmoker (independent t test)**

PFT variables	Smoker (mean $\pm$ SD)	Non Smoker (mean $\pm$ SD)	P-value	Significance (at 5% I.o.s)
FVC	73.58 $\pm$ 25.56	94.04 $\pm$ 27.95	0.0002	Significant
FEV1	58.28 $\pm$ 27.02	83.8 $\pm$ 33.44	0.0001	Significant
FEV1/FVC	71.64 $\pm$ 19.98	88.68 $\pm$ 20.48	0.0001	Significant
FEF25-75	35.56 $\pm$ 24.54	48.24 $\pm$ 27.24	0.0163	Significant
PEFR	40.16 $\pm$ 31.11	56.16 $\pm$ 31.95	0.0128	Significant

PFT: Pulmonary function test, FVC: Forced Vital Capacity, FEV1: Forced Expiratory Volume in 1 Second, FEF: Forced expiratory flow 25%-75%, PEFR: Peak Expiratory floe rate, SD: Standard Deviation

We carry out pulmonary function test of all subjects and compiled the obtained data then we compare the lung function test values such as forced vital capacity, forced expiratory value in 1 sec, FEV1/FVC ratio, FEF 25-75 and Peak expiratory flow rate between smokers and nonsmokers (Table 2). We found in our study that the mean value of FVC is 73(+/-25) and 94( $\pm$  27.95), mean FEV1 is 58.28 ( $\pm$  27.02)

and 83.8 ( $\pm$ 33.44), mean FEV1/FVC is 71.64 ( $\pm$ 19.98) and 88.68( $\pm$ 20.48), mean FEF25-75 is 35.56 ( $\pm$ 24.54) and 48.24( $\pm$ 27.24), mean PEFR is 40.16( $\pm$ 31.11) and 56.16 ( $\pm$ 31.95) in smoker and nonsmoker group respectively. It recognizes that there is fall in mean of all significant lung function variables among smoker group. The association of

impaired PFT parameters in smokers was found to be statistically highly significant.

**Table 3: Interpretation of PFT results between smoker and non-smoker**

Classification\ Smoking	Obstruction	Restriction	Mixed	Normal	Total
Smoker	12	6	20	12	50
Non smoker	5	1	8	36	50
Total	17	7	28	48	100

Among the 100 subjects performed PFT, 52 (52%) subjects shows lung functions impairment in form of Obstruction or Restriction or Mixed Pattern. Out of these 52 subjects 38(73%) were smoker and 14(27%) nonsmoker.

### Discussion

The study being conducted in tertiary care institute established in tribal region of state it was quite difficult to make the subject convince about the benefits of this study. Also it was difficult to make them to reach this tertiary care institute, continuous efforts were taken to improve their awareness about their health and the facilities provided for them in the center. We studied the physical characteristic such as BMI, age, height and weight of smoker and nonsmokers of tribal area of Maharashtra. We noticed that there is no significant difference in physical criterion and it is corresponding to the findings observed by Khan A [9], Raj JB [10] and Banur A [11]. In our analysis of Pulmonary function parameters of smoker individual's reveals significant difference compare to parameters of nonsmoker individuals. There is significant decline in the PFT values like FVC, FEV1, FEV1/FVC and PEFR, indicates that there is decrease in the lung functions of smokers. Similarly a considerable decline of FVC values amongst smokers was mentioned by M.S. Islam et al., [12]. However several researchers like Angelo13, Malo14 and Indian researchers Gupta et al, [15] Mahajan et al [16] observed that there was no change in FVC in smokers and nonsmokers. The mean FEV1/FVC in smoker group was 71.64 ( $\pm 19.98$ ) and 88.68( $\pm 20.48$ ) in non-smoker group this correlate with the study by Banur A [11]. His research population belongs to urban area whereas our study subjects were from tribal area. The mean PEFR is 40.16( $\pm 31.11$ ) and 56.16 ( $\pm 31.95$ ) in Smoker and nonsmokers, it was statistically significant. This could be probably because function of large and medium airways is affected due to smoking. Similar observations were reported by Bajantri AL et al., [17] And Khan A et al., [9]. Mean FEF (25-75) was 35.56 ( $\pm 24.54$ ) and 48.24( $\pm 27.24$ ) in Smoker and Nonsmoker, which was statistically highly significant. It suggest significant obstructive defect in small airways of smokers compared to non-smoker. Similar finding was observed by Kumar A et al., [18], many researchers have different findings in their studies like Sackner MA et al., [19], Boskabady MH et al., [20] noticed no major difference. Result of PFT was assessed and we observed that 52% (52) of subjects had lung function impairment, in these 73% (38) of subject were smoker. Among the smokers 52% (20) of them had mixed pattern i.e. Obstruction as well as Restriction, 31% (12) had only

obstruction and 15% (6) had Restriction. The association between smoking and impaired lung function was statistically significant. Drop in the value of flow rate such as FEV1, PEFR suggest obstruction while drop in FVC considered as restriction pattern in PFT. In our study, mixed pattern of dysfunction was most common and obstruction pattern was 2<sup>nd</sup> common. Mixed pattern can be explained by possibility of obstruction induced restriction changes, which might be due to delayed attention or less perception of ill symptoms. Majority smokers usually smoked bidi since they are cheap and easily available in nearby area. Pulmonary functions are more affected in bidi smokers than in cigarette smokers concluded by Padmavathy [21]. Also, most smokers belonged to rural background and were of low socio-economic status. They were encouraged to quit smoking habit with help of counseling by psychiatrist and pulmonologist.

### Conclusions

We made an attempt to provide statistical information regarding changes in lung function of smokers living in Tribal region of state. We conclude that mean FVC, FEV1 and PEFR were higher in nonsmoker compared to smokers. Pulmonary function impairment such as obstruction, restriction and mixed pattern was identified in smokers. Mixed pattern of lung function impairment was most common and obstruction was 2<sup>nd</sup> most common. This information will be useful in comparing the changes with people from different region.

**Conflicts of Interests:** None declared.

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