

A COMPARATIVE STUDY OF PULMONARY FUNCTION TESTS IN SMOKERS AND NON-SMOKERS IN RURAL MAHARASHTRA

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ABSTRACT:

Background: In India smoking is a common habit prevalent in both urban and rural areas. Cigarette and bidi smoking has extensive effects on respiratory function and is clearly implicated in the etiology of a number of respiratory diseases.

Objectives:

1. To study and compare the pulmonary function tests among smokers and non-smokers in a rural area.
2. To study the role of possible associated factors and relation of type, quantity and duration of smoking on the pulmonary function tests.

Setting: Pravara Rural Hospital, Loni, District Ahmednagar, Maharashtra.

Study design: Cross sectional study.

Materials & Methods: The pulmonary function tests were assessed on computerized spirometer in 400 male subjects comprising of 200 smokers and 200 non smokers and results were compared.

Statistical analysis: SPSS Statistical Software.

Results & Conclusion: Almost all the pulmonary function parameters were significantly reduced in smokers and obstructive pulmonary impairment was commonest. Thus by spirometry a spectrum of lung disorders may be detected at an early stage and subsequent morbidity can be minimized.

Key words: Smoker, Spirometry, Pulmonary functions

Introduction:

Cigarettes kill an estimated 5 million people annually world wide¹. The World Health Organization reported that tobacco smoking killed 100 million people worldwide in the 20th century and warned that it could kill one billion people around the world in the 21st century². By the early 2030, tobacco related death would increase to about 10 millions a year³. Tobacco smoking rates have decreased in industrialized countries since 1975, but there has been a corresponding 50% increase in smoking rates in low-income countries⁴.

In India smoking is a common habit prevalent in both urban and rural areas irrespective of mode of smoking i.e. cigarettes, bidis, pipes, cigar, hookah etc. In India, tobacco is consumed mainly in the form of bidis (54%), followed by smokeless tobacco (27%) and cigarettes (9%)⁵.

Bidi smoke may be more injurious because bidi contains unrefined form of tobacco as compared to cigarettes^{6,7}. Cigarette smoking has extensive effects on respiratory function and is clearly implicated in the etiology of a number of respiratory diseases, particularly chronic bronchitis, emphysema, and bronchial carcinoma⁸.

Materials and Methods:

The present cross sectional study was conducted in Pravara Rural Hospital of Rural Medical College, PIMS, Loni, in district Ahmednagar, Maharashtra from January 2007

to August 2008. The study population included 400 male subjects comprising of 200 smokers and 200 non smoker controls aged between 30-60 years. Individuals with history of smoking cigarettes / bidis daily for at least one year were considered as smokers⁹. Ex-smokers or past smokers were excluded from the study. For the control group, 100 healthy non smokers of almost same age and matching other characteristics were selected. The materials used in the study were a computerized RMS Med-spirometer, weighing machine, measuring tape and Blood Pressure set. To evaluate dose and duration response relationship, quantification of tobacco smoking was performed by calculating smoking index for smokers.

Smoking Index:

It is equal to multiplication of the average number of cigarettes/bidis smoked per day and duration (in years) of tobacco smoking^{10,11}.

| Habit | Smoking Index (Frequency x duration) |
|------------------|---|
| Non-smokers | 0 |
| Light smokers | 1-100 |
| Moderate smokers | 101-200 |
| Heavy smokers | more than 200 |

The observations of the study were analyzed by statistical methods like percentages, chi square test and t-test of significance.

Observations :

In the present study it was observed that there was no significant difference in the mean physical parameters like age, height, weight, body mass index and body surface area by calculating mean and standard deviation in smokers and non-smokers (Table 1). Most of the smokers smoked only bidi (62.0%) followed by both cigarette and bidi mixed (24.0%) and only cigarettes (14.0%) (Table 2). Most smokers were light smokers (42.0%) followed by moderate smokers (32.0%) and heavy smokers (26.0%) based on the criteria of smoking index (Table 3). Majority of the light smokers were in the age group of 41-50 years (51.85%), moderate smokers in 51-60 years (46.66%) and heavy smokers, 51-60 years (75.0%) (Table 4).

All Pulmonary function parameters like FVC, FEV₁, FEV₁/FVC, PEFR, FEF_{25-75%} and MVV showed statistically highly significant association between smokers and non-smokers by applying unpaired t-test of significance ($p < 0.001$) (Table 5). The association between smoking and impaired PFT was statistically highly significant. The smokers had 17.3 times more risk of having impaired pulmonary functions as compared to non-smokers (Table 6). The obstructive lung changes were most common and were observed predominantly in bidi smokers (72.22%) (Table 7).

Discussion :

In the present study it was observed that there was no significant difference in the mean physical parameters like age, height, weight, body mass index and body surface area thereby showing proper matching of smokers and non-smokers (Table 1). None of individuals smoked tobacco in any form other than bidis or cigarettes. Most smokers were bidi smokers (62.0%) (Table 2). Also the cigarette smokers usually smoked non-filter cigarettes since they are cheap and easily available in rural areas. In the present study most smokers were light smokers (Table 3) in the age group of 41-50 years (51.85%). Similarly, Burrows et al¹² reported that there is quantitative significant relationship between impaired ventilatory function and duration and frequency of smoking (Table 4). All Pulmonary function parameters showed statistically highly significant association between smokers and non-smokers by applying unpaired t-test of significance ($p < 0.001$). Similar, observations showing lung function impairment in smokers were reported by Burrows et al¹², Pandya et al¹³, and Gupta et al¹⁴.

However, several researchers like Angelo¹⁵ and Mahajan et al¹⁶ observed no change in FVC in smokers and non-smokers (Table 5). The association between smoking and impaired PFT was statistically highly significant. The smokers had 17.3 times more risk of having impaired pulmonary functions as compared to non-smokers (Table 6). The fall in FEV₁, PEFR and other flow rates indicate obstructive lung changes and fall in FVC indicates restrictive

lung changes. Padmavathy¹⁷ in a study concluded that the pulmonary function tests are more affected in bidi smokers than in cigarette smokers (Table 7).

Conclusion :

The pulmonary function tests were assessed on a computerized spirometer in 400 male subjects comprising, 200 smokers and 200 non smoker controls. The present study reveals the effect of type, duration and pattern of smoking on the pulmonary functions in smokers. Bidi smoking was most common as the study setting was in rural India. Almost all the pulmonary function parameters were significantly reduced in smokers and obstructive pulmonary impairment was commonest in smokers. By screening smokers, by computerized pulmonary function testing, the early changes in airflow obstruction may be detected and special emphasis shall be made on smoking cessation.

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Table 1
PHYSICAL CHARACTERISTICS OF SMOKERS AND NON-SMOKERS

| Variables | Smokers Mean ± 2 S.D | Non-smokers Mean ± 2 S.D |
|-------------------------------------|-------------------------|-----------------------------|
| Age (years) | 48.26 ± 10.09 | 48.10 ± 10.54 |
| Height (m) | 1.66 ± 0.11 | 1.67 ± 0.12 |
| Weight (Kg) | 65.4 ± 8.8 | 64.4 ± 11.5 |
| Body Mass Index (BMI) | 23.52 ± 3.20 | 23.80 ± 3.37 |
| Body surface area (m ²) | 1.71 ± 0.06 | 1.74 ± 0.14 |

S.D. = Standard Deviation

Table 2
TYPE OF TOBACCO SMOKING IN SMOKERS

| Type of smoking | No. | % |
|----------------------|-----|-------|
| Only Bidi | 124 | 62.0 |
| Both cigarette/ bidi | 48 | 24.0 |
| Only Cigarette | 28 | 14.0 |
| Total | 200 | 100.0 |

Table 3
DISTRIBUTION OF GRADE OF SMOKING IN SMOKERS

| Grade of smoker | Number of smokers | (%) |
|-----------------|-------------------|-------|
| Light smoker | 108 | 54.0 |
| Moderate smoker | 60 | 30.0 |
| Heavy smoker | 32 | 16.0 |
| Total | 200 | 100.0 |

Table 4
AGE WISE DISTRIBUTION OF GRADE OF SMOKING

| Age group (years) | Light Smoker No. (%) | Moderate smoker No. (%) | Heavy smoker No. (%) | Total No. (%) |
|-------------------|----------------------|-------------------------|----------------------|---------------|
| 31-40 | 28 (25.92) | 8 (13.33) | 0 (0.0) | 36 (18.0) |
| 41-50 | 56 (51.85) | 24 (40.0) | 8 (25.0) | 88 (44.0) |
| 51-60 | 24 (22.22) | 28 (46.66) | 24 (75.0) | 76 (38.0) |
| Total | 108 (100.0) | 60 (100.0) | 32 (100.0) | 200 (100.0) |

Table 5
PULMONARY FUNCTION TESTS AMONG SMOKERS AND NON-SMOKERS

| Variables | Smokers | Non-smokers | Significance p value |
|-----------------------|---------------|---------------|-------------------------|
| | Mean ± 2 S.D | Mean ± 2 S.D | |
| FVC | 2.98 ± 1.06 | 3.13 ± 0.98 | 0.03242 (S) |
| FEV ₁ | 2.48 ± 1.02 | 2.81 ± 0.86 | 0.000692 (HS) |
| FEV ₁ /FVC | 83.93 ± 23.98 | 89.49 ± 10.54 | 0.003808 (HS) |
| PEFR | 5.30 ± 3.46 | 6.80 ± 3.44 | 0.000034 (HS) |
| FEF _{25-75%} | 2.99 ± 2.02 | 3.59 ± 1.74 | 0.00196 (HS) |
| MVV | 86.1 ± 44.22 | 103.6 ± 33.66 | 0.00002 (HS) |

Significance has been calculated by unpaired t test (p < 0.001)

Table 6
INTERPRETATION OF PFT RESULTS IN SMOKERS AND NON-SMOKERS

| PFT Results | Smokers No. (%) | Non-smokers No. (%) | Total No. (%) |
|-------------|--------------------|------------------------|------------------|
| Obstructive | 72 (36.0) | 8 (4.0) | 80 (20.0) |
| Restrictive | 4 (2.0) | 0 (0.0) | 4 (1.0) |
| Mixed | 8 (4.0) | 0 (0.0) | 8 (2.0) |
| Normal | 116 (58.0) | 192 (96.0) | 308 (77.0) |
| Total | 200 (100.0) | 200 (100.0) | 400 (100.0) |

Chi square value = 20.84, p < 0.001, highly significant. (Odds' ratio = 17.3)

Table 7
RELATION OF TYPE OF SMOKING WITH PULMONARY FUNCTION TESTS

| Type of smoking | Pulmonary Function Test Interpretation | | | | Total |
|----------------------|--|-------------|-----------|-------------|-------------|
| | Obstructive | Restrictive | Mixed | Normal | |
| Only Bidi | 52(72.22) | 0 (0.0) | 8 (100.0) | 64(55.17) | 124 (62.0) |
| Both cigarette/ bidi | 16(22.22) | 4 (100.0) | 0 (0.0) | 28 (24.13) | 48 (24.0) |
| Only Cigarette | 4 (5.55) | 0 (0.0) | 0 (0.0) | 24(20.68) | 28 (14.0) |
| Total | 72 (100.0) | 4 (100.0) | 8 (100.0) | 116 (100.0) | 200 (100.0) |

