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SHORT COMMUNICATION

STUDY OF LUNG FUNCTIONS IN SMOKERS AND NON-SMOKERS IN RURAL INDIA

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Abstract : Smoking is a common habit prevalent in both the urban and rural areas in India. Smoking is a well-known risk factor for chronic obstructive pulmonary disease (COPD), a group of lung diseases that includes emphysema and chronic bronchitis. Pulmonary-function tests provide objective, quantifiable measures of lung function.

The objective of the present study was to study and compare the pulmonary function tests among smokers and non-smokers in a rural area, to study the role of possible associated factors and relation of type, quantity and duration of smoking on the pulmonary function tests in Rural Maharashtra.

The pulmonary function tests were assessed on computerized spirometer in 400 male subjects comprising of 200 smokers and 200 non smokers. Almost all the pulmonary function parameters were significantly reduced in smokers, more commonly in those aged 50 years and above. Obstructive pulmonary impairment was commonest among smokers. 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 rural area

INTRODUCTION

Some people commit suicide by drowning but many by smoking. Cigarettes kill an estimated 5 million people annually world wide (1). The World Health Organization

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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 century (2). By the early 2030, tobacco related death would increase to about 10 millions a year (3). Tobacco smoking rates have decreased in industrialized countries since 1975, but there has been a corresponding 50% increase in smoking rates in low-income countries (4).

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. Bidi smoke is more injurious because bidi contains unrefined form of tobacco as compared to cigarettes (5).

MATERIALS AND METHODS

The present cross sectional study was conducted in Pravara Rural Hospital of Rural Medical College, Loni, in district Ahmednagar, Maharashtra. The study population included 400 male subjects comprising of 200 smokers and 200 non smoker controls aged between 30-60 years.

Inclusion criteria: Individuals aged between 30-60 years with history of smoking cigarettes/bidis daily for at least one year were considered as smokers (6).

Exclusion criteria: All subjects were examined and those with any disease of respiratory system were excluded from the study. Also ex-smokers or past smokers were excluded from the study.

Anthropometry:

The subjects were subjected to anthropometry at the point of entry using the standard procedures and instruments. Age was recorded from birthday by calendar to the nearest of year (<6 months and >6 months). Standing height was recorded without shoes and with light clothes on a wall mounted measuring tape to the nearest of centimeters (<5 mm and >5 mm). Weight was recorded without shoes and with light cloths on a Krups weighing machine with a least count of 100 grams. Body mass index was calculated by the formula of weight (in kg) and height (in meters). BMI = Weight (kg)/(height in m^2).

Respiratory Parameters:

Pulmonary function tests were done by a computerized spirometer (RMS-Med Spirometer). After rest for 5–10 min and briefing to the technique FVC (maximum inhalation followed by maximum exhalation & to be sustained until asked to inhale again), the test was carried out in a private and quiet room , between 10 to 12 a.m. to rule out any diurnal variation and in sitting posture with the nose clip held in position on the nose. The flow, volume/timed graphs were taken out and best of the three acceptable curves was selected as the recording. The quantification of tobacco smoking was done by calculating the smoking index.

Smoking Index: It is equal to multiplication of the average number of cigarettes/bidis smoked per day and duration (in years) of tobacco smoking (6, 7).

Habit	**Smoking Index** (Frequency × duration)
Non-smokers	0
Light/Mild smokers	1-100
Moderate smokers	101-200
Heavy smokers	more than 200

Statistical analysis: Means and standard deviations of all the sets of observations were calculated. By applying 'Z' test and 't' test. 'P' value <0.05 is taken as significant. Analysis was also done by one way ANOVA test.

RESULTS

In the present study it was observed that there was no significant difference in the mean physical parameters like age, height, weight, and body surface area by calculating mean and standard deviation in smokers and non-smokers, though Body Mass Index was slightly lower in smokers (Table I). Most of the smokers smoked only bidis (62.0%) followed by both cigarette and bidis (24.0%) and only cigarettes (14.0%).

All the Pulmonary function tests like FVC, FEV1, FEV_1/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 II). Most smokers were light or Mild smokers (54.0%) followed by moderate (30.0%) and heavy smokers (16.0%). Most of the obstructive lung changes were in Mild smokers, though the severity of obstruction was more in heavy smokers by one way ANOVA analysis (Table III). Most smokers were below the age of 50 years (62.0%) and 38.0% were above 50 years. However in smokers 50 years and above obstructive (63.9%), restrictive (75.0%) and mixed (75.0%) lung changes were more common as compared to those below 50 years, and this was found to be statistically highly significant (P<0.001) (Table IV).

TABLE I: Physical characteristics of smokers and non-smokers.

Characteristics	*Smokers*	*Non-smokers*
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)	21.52±3.20	23.80±3.37

Data presented as mean±SD.

TABLE II: Pulmonary function tests among smokers and non-smokers.

Pulmonary function tests	*Smokers*	*Non-smokers*	*P value*
FVC	2.98±1.06	3.13±0.98	0.03242
FEV_1	2.48±1.02	2.81±0.86	0.000692
FEV_1/FVC	83.93±23.98	89.49±10.54	0.003808
PEFR	5.30±3.46	6.80±3.44	0.000034
$FEF_{25-75\%}$	2.99±2.02	3.59±1.74	0.00196
MVV	86.1±44.22	103.6±33.66	0.00002

P<0.001; Highly significant.

TABLE III: Association of grade of smoking with PFTs.

Grade of smoking	*PFT parameters*			
	Obstructive (n=72)	*Restrictive (n=4)*	*Mixed (n=8)*	*Normal (n=116)*
Mild	66.7±3.81	5.16±1.01	12.5±3.66	50.8±3.84
Moderate	13.9±2.72	47.15±3.26	37.5±4.73	38.8±4.42
Heavy	19.4±6.84	45.22±2.76	50.0±2.5	10.3±8.62

Data presented as mean±SD. Analysis of data was done by one way ANOVA.

TABLE IV: Age wise distribution of PFTs in smokers.

Age (years)	*PFTs*				*Total No. (%)*
	Obstructive No. (%)	*Restrictive No. (%)*	*Mixed No. (%)*	*Normal No. (%)*	
< 50	26 (36.1)	1 (25.0)	2 (25.0)	95 (81.9)	124 (62.0)
50 and above	46 (63.9)	3 (75.0)	6 (75.0)	21 (18.1)	76 (38.0)
Total	72 (100.0)	4 (100.0)	8 (100.0)	116 (100.0)	200 (100.0)

P<0.05; Significant.

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 I). None of individuals smoked tobacco in any form other than bidis or cigarettes. Most smokers were bidi smokers (62.0%). Also the cigarette smokers smoked non-filter cigarettes since they are cheap and easily available in rural areas. In the present study 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 al (8), Pandya et al (9) and Gupta et al (10).

However, several researchers like Angelo (11) and Mahajan et al (12) observed no change in FVC in smokers and non-smokers (Table II). The fall in FEV_1, PEFR and other flow rates indicate obstructive lung changes and fall in FVC indicates restrictive lung changes. Also the restrictive and mixed lung changes were more common in heavy smokers and obstructive changes in mild smokers. Similar observation was made by Kay Roy et al (13). Most of obstructive, restrictive and mixed changes were observed in smokers 50 years and above. Kalhan et al (14) also observed that lung functions in young adults predict airflow obstruction 20 years later.

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 as compared to non smoker controls and obstructive pulmonary impairment was commonest in smokers. Also the abnormal lung changes were more common in smokers aged 50 years and above. By screening smokers, by computerized pulmonary function testing, the early changes in airflow obstruction may be detected and special emphasis is to be recommended on smoking cessation strategies.

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