

A Study of the Pulmonary Function Test among Smokers and Non Smokers in a Rural Area of Gujarat

SUNITA NIGHUTE, ABHIJIT AWARI

ABSTRACT

Introduction: In India smoking is a common habit in both the urban and rural areas. There are many respiratory diseases like chronic bronchitis, bronchial carcinoma and emphysema which are caused due to chronic tobacco smoking.

Materials and Methods: In this study 100 healthy male subjects, 50 chronic smokers and 50 nonsmokers were assessed

for their pulmonary function tests by using a computerised spirometer.

Observation and Results: Almost all their respiratory parameters were significantly reduced.

Discussion: In the present study obstructive lung dysfunction was the commonest finding in smokers.

Key Words: Smoking, Spirometer, Rural areas

KEY MESSAGE

- To study the effect of tobacco smoking on the respiratory system.
- To establish a correlation between chronic tobacco smoking and its effects on the parameters which were studied.
- To create awareness in tobacco smokers about the effects of tobacco on their health.

INTRODUCTION

- 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 century also [1].
- The classification criteria as suggested by WHO (1998) was [2]:
 - **Smoker:** Someone who, at the time of the study, smoked any tobacco products either daily or occasionally.
 - **Non-smoker:** Someone who, at the time of the study, did not smoke at all.
 - **Ex-smoker:** Someone who was formerly a daily or occasional smoker, but currently does not smoke at all.
- Tobacco smoking is a well recognized risk factor for the development of coronary heart diseases, angina pectoris and sudden cardiac death [3].
- Besides the direct consequences of smoking on smokers, passive smoking by non-smokers who are exposed to tobacco smoke also has shown an increased risk of respiratory and cardio vascular problems in children [4].
- There is approximately a 50 % increase in the smoking rates in the low-income countries [5].
- In India, smoking is a common habit in both the urban and rural areas in the form of cigarettes, beedies, pipes, cigar, hookah, etc [6].
- Cigarette smoking has an extensive effect on the respiratory function and it has been clearly implicated in the aetiology of respiratory diseases like chronic bronchitis, emphysema, and bronchial carcinoma [7].

- After the inhalation of cigarette smoke, nicotine is quickly distributed to the brain and it can affect the central nervous system instantaneously [8].
- Nicotine affects the cardiovascular system first by stimulating and then paralyzing all the automatic ganglia and so, at first, there is cardiac slowing, followed by the acceleration of the heart rate [9].
- Beedi smoke may be more injurious because beedi contains an unrefined form of tobacco as compared to that in the cigarettes [10].
- Tobacco smoke contains 4000 chemicals out of which 60 are known carcinogens which can lead to lung cancer. The known chemical constituents of tobacco smoke include Acetone, Ammonia, Arsenic, Butane, Cadmium, Carbon monoxide, Hydrogen Cyanide, Methane, Toluene, Naphthalene and Vinyl chloride. The smoke of cigarettes is acidic (P^H 5.3) and nicotine is relatively ionized and insoluble in the lipids. Only a desired amount of nicotine is absorbed if it is taken in to the lungs where there is an enormous surface area for lower lipid solubility. Cigarette smokers therefore, have a high rate of death due to lung cancer [11].

MATERIALS AND METHODS

1. The present cross sectional study was conducted in the College of Medical Science, Amargadh, from April 2010 to June 2010.
2. The study population included 100 healthy male subjects who were aged 30-60 years. It comprised of 50 smokers and 50 non-smokers. Females were not included in this study,

considering the low prevalence of tobacco smoking among females and also its non-reporting by the female workers.

3. Individuals with a history of cigarette smoking, daily for at least one year, were considered as smokers and they were selected voluntarily from the residents who lived in and around the K.J. Mehta Hospital and the College of Medical Science, Amargadh. The study subjects attended the OPDs at these hospitals.
4. Smokers with a smoking history of less than six months and ex-smokers with a history of any major illness in the past were excluded from the study.
5. The selection criteria for the control group were 50 healthy non smokers males age almost same at that of experimental group with no history of smoking of any type. It was ensured that none of them had any significant present or past history of sicknesses, particularly those of the respiratory system.
6. The materials which were used in this study were a computerized RMS med-spirometer, a weighing machine and a measuring tape.
7. For evaluating the respiratory functions, the subjects were asked to sit comfortably on a chair. The complete procedure was explained and the subjects were instructed to breathe in fully by deep inspiration with their nostrils closed, to seal their lips around the sterile mouthpiece of the spirometer and to forcefully expire air out. The best three readings was recorded and interpreted.
8. Then obtained data was tabulated statistically and analyzed by using various standard statistical methods.

OBSERVATIONS AND RESULTS

The physical parameters of the smokers and the non-smokers are shown in [Table/Fig-1]. The age range of the subjects was 30-60 years, with a mean age of 49.25 years in the smokers and a mean age of 49.10 in the non smokers. There was no significant difference in the mean of the other physical parameters like height, weight, body mass index and body surface area in the smokers and non-smokers.

The mean values of all the pulmonary function tests were significantly reduced in the smokers as compared to the non-smokers. The impaired PFT in the smokers was found to be statistically significant, on applying the unpaired (*t*) test of significance [Table/Fig-2].

In our study, 36.0 % were obstructive changes which were the most common, followed by the restrictive (8.0 %) and the mixed (4.0 %) changes. 98.0 % non-smokers had normal PFT results [Table/Fig-3].

DISCUSSION

There was no significant difference in the mean physical parameters like age, height, weight, body mass index and body surface area, on calculating the mean and the standard deviation in the smokers and non-smokers [Table/Fig-1].

Most of the cigarette smokers usually smoked non-filter cigarettes because they were easily available and cheap in the rural areas. Also, the smokers belonged to the rural background and were of a low socio-economic status.

In our study, almost all the smokers were deep inhalers. Deep inhaler means that they drew in the cigarettes with prolonged inspiration and exhaled through the mouth or the nose. Others are considered as 'Puffers'.

In our study, all the pulmonary function parameters like FVC, FEV₁, FEV₁/FVC, PEFR, FEF_{25-75%} and MVV showed a highly significant association between the smokers and the non-smokers ($p < 0.001$) and this was similar to the observations on the impairment of the lung function in smokers, as was reported by Dhand et al [12] Gosavi et al [13] and Pandya et al [14]. Malo [15], Angelo [16] and Indian workers like Mahajan et al [17] and Gupta et al [18] observed that there was no change in the FVC of the smokers and the non-smokers.

In the present study, out of a total of 100 study subjects, 75 had normal lung functions and 25 had impaired lung functions, out of which 24 were smokers and only one was a non-smoker. The smokers had an 18 times more risk of having impaired pulmonary functions as compared to the non-smokers. A fall in the FVC indicated restrictive lung changes and a fall in the FEV₁, the PEFR and others indicated obstructive lung diseases.

In the present study, obstructive lung dysfunction was the commonest finding in both the smokers and the non-smokers (2%).

Cigarette smoking has extensive effects on the respiratory functions and it has been clearly implicated in the aetiology of a number of respiratory diseases, particularly chronic bronchitis, emphysema and bronchial carcinoma. Beedi contains an unrefined form of tobacco as compared to the cigarettes.

Smoking may directly induce an arterial endothelial injury and an increased platelet consumption may reflect the adherence or the deposition of these cells, to damage site was suggested by Hind C.R. [19].

Variables	Smokers Mean \pm 2 S.D.*	Non-Smokers Mean \pm 2 S.D.*
Age (Year)	49.25 \pm 10.08	49.10 \pm 10.50
Height (M)	1.66 \pm 0.10	1.67 \pm 0.11
Weight (Kg.)	68.4 \pm 8.4	67.4 \pm 11.2
Body Mass index (BMI)	24.50 \pm 3.10	23.10 \pm 3.37
Body surface area (m ²)	1.71 \pm 0.02	1.73 \pm 0.10

[Table/Fig-1]: Physical Characters of Smokers and Non-Smokers
*S.D. = Standard Deviation.

Pulmonary Function Test (PFTS)	Smokers Mean \pm 2 S.D.	Non-Smokers Mean \pm 2 S.D.	Significance P Value*
FVC	2.97 \pm 1.04	3.10 \pm 1.09	0.3240 (S)
FEV ₁	2.40 \pm 1.11	2.84 \pm 0.80	0.000694 (HS)
FEV ₁ /FVC	82.90 \pm 21.80	87.45 \pm 10.40	0.003605 (HS)
PEFR	4.29 \pm 3.46	5.80 \pm 3.42	0.000031 (HS)
FEF _{25-75%}	2.11 \pm 2.11	2.60 \pm 1.70	0.00190 (HS)
MVV	82.1 \pm 40.20	100.6 \pm 32.66	0.00002 (HS)

[Table/Fig-2]: Pulmonary Function Test among Smokers and Non-Smokers
 $p < 0.001$ highly significant.

PFT Result	Smokers No. (%)	Non-smokers No. (%)	Total No. (%)
Obstructive	18 (36.0)	1 (20)	19 (19.0)
Restrictive	4 (8.0)	0 (0.0)	4 (4.0)
Mixed	2 (4.0)	0 (0.0)	2 (2.0)
Normal	26	49 (98.0)	75 (75.0)
Total	50	50	100

[Table/Fig-3]: Interpretation of PFT Result in Smokers and Non-Smokers

CONCLUSIONS

Tobacco smoking, in the form of cigarettes, has a deleterious effect on the health, mainly on the pulmonary functions.

In this study in a rural area, cigarette smoking was found to lead to the reduction of almost all the pulmonary function parameters and obstructive impairment was the commonest finding.

Hence, the risk of respiratory mortality or morbidity is high with chronic tobacco smoking.

REFERENCES

- [1] WHO report: Tobacco could kill one billion by 2100. *Science Daily* 2008 Aug; 24:71.
- [2] The WHO Guidelines for controlling and monitoring the tobacco epidemic. WHO Geneva 1998;76-101.
- [3] Lucchesi BR, Schuster CR. The role of nicotine as a determinant of the cigarette smoking frequency in man with an observation of certain cardiovascular effects which are associated with the tobacco alkaloid. *Clinical Pharmacology and Therapy* 1967; 8(6): 789-96.
- [4] World Tobacco epidemic, 3rd edition by WHO Geneva 1994;6.
- [5] Yuj J, Shopland DR. Cigarette smoking behavior and consumption which are characteristic for the Asia Pacific region. *World Smoking Health* 1989; 14:7-9.
- [6] Anonymous, IUALID, The world tobacco situation. *IUALID News Bull Tobacco Health* 1998;11:19-21.
- [7] WHO, *World tobacco epidemic* 1993; 2nd edition: 47.
- [8] WHO, *Women and tobacco*. Geneva, 1992.
- [9] Greenspan K, Edemands RE. Some effects of nicotine on the cardiac automatic conduction and introphy. *Arch Intern Med*. 1969; 123:707-12.
- [10] World Health organization, Health situation in the south East Asian region 1999; 12-83.
- [11] *Tobacco Atlas by WHO*: Dr. Julith Mackay, Eriksen 2002; 26.
- [12] Dhand R, Malik SK, Sharma PK. The long term effects of tobacco smoking and the results of the spirometer study in 300 old men. *Ind. J. Chest Dis and Allied Sciences* 1985; 27:44-9.
- [13] Gosavi GR, Pisolkar M, Deshkar BV. The forced vital capacity in smokers and non- smokers. *Journal of the Indian Medical association* 1981; 77(12):189-91.
- [14] Pandya KD, Dadhani AC. The effect of physical training, age, sex posture and smoking on the peak flow rate. *Indian J. of Physiology and Pharmacology* 1984; 28(3); 38.
- [15] Malo JL, Leblanc P. The functional abnormalities in young asymptomatic smokers with a special reference to the flow volume Curve. *Mer Rev Resp. Dis*. 1975; 3: 623-29.
- [16] Angelo MT, Silva D, Hamosh P. The effect of cigarette smoking on the small airways. *Jour. Appl. Physio* 1973; 3: 361-65.
- [17] Mahajan BK, Maini BK. The effect of cigarette smoking on the airways. *AmRev Respiratory diseases* 1983;27:1-37.
- [18] Gupta S, Tondon VR. The acute effects of cigarette smoking. *Jour. of Asso. Physio. of India* 1977; 25:119-23.
- [19] Hind CR, Joyle H. Plasma leucocytes elastase concentration in smoker *J. Clin. Pathol*. 1991; 44(3): 232-5.

AUTHOR(S):

1. Dr. Sunita Nighute
2. Dr. Abhijit Awari

PARTICULARS OF CONTRIBUTORS:

1. Corresponding Author.
2. Associate Professor Microbiology, Kesar Sal Medical college, Ahmedabad, India.

NAME, ADDRESS, TELEPHONE, E-MAIL ID OF THE CORRESPONDING AUTHOR:

Dr. Sunita Nighute
Staff Quarter No. 9,
Kesar SAL Medical College and Research Institute,
Ahmedabad – 380060 (Gujarat)
Opposite Science City, Bhadaj.
Phone: 8141331297
E-mail: drsunitanighute@gmail.com

DECLARATION ON COMPETING INTERESTS:

No competing Interests.

Date of Submission: **Jun11, 2011**
Date of peer review: **Jul20, 2011**
Date of acceptance: **Aug16, 2011**
Date of Publishing: **Nov 11, 2011**