



STUDY OF PULMONARY FUNCTION VARIABLES AND RISK OF RESPIRATORY MORTALITY OR MORBIDITY IN RELATION TO CHRONIC TOBACCO SMOKING

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ABSTRACT

Tobacco smoking is widely prevalent all over the world and it continues to rise in developing countries. Smoking has a deleterious effect on pulmonary functions. Smoking is the single most significant risk factor contributing to the development of Chronic Obstructive Airway Diseases (COPD). Spirometry by a trained health professional gives an indication of lung health by measuring airway abnormality. Objectives were to study Pulmonary Function Test (PFT) in smokers and non-smokers Tobacco smoking, in the form of cigarettes, has a deleterious effect on the health, mainly on the pulmonary functions. Smoking is highly associated with an abnormal PFT. Cessation of smoking should be encouraged and PFTs from time to time in asymptomatic adults both smokers and non-smokers will be useful for early identification of abnormalities.

Key words: Smoking, Spirometer, Rural Areas, Pulmonary Function Test, Smokers, Non-Smokers.

INTRODUCTION

Smoking is one of the most severe public health problems in the world. According to the WHO Global report on trends in prevalence of tobacco use 2000– 2025, smoking accounts for 9% of all deaths worldwide, and more than half of smokers die from smoking-related diseases¹. Smoking has long been linked to adverse effects on the respiratory system, causing malignant and non-malignant diseases, exacerbating chronic lung diseases, and increasing the risk for respiratory infections. The observational evidence showing associations with multiple diseases of the respiratory tract is extensive as is the evidence supporting the biological plausibility of smoking as a cause of these associations. Tobacco smoking is widely prevalent all over the world and it continues to rise in developing countries. Various forms of tobacco smoking practiced in India, include chutta (reverse smoking), chillum (clay pipe), and hukku (hubble-bubble) with Cigarette and Beedi smoking being the commonest.[1]

Tobacco smoke contains more than 4000 chemicals and around 40 carcinogens.[2] Smoking has a deleterious effect on pulmonary functions. Accumulation of inflammatory cells such as CD8+ T-lymphocytes, B cells, neutrophils and macrophages, in response to irritants found in smoke inhalation, is responsible for an inflammatory reaction. Hence, the risk of respiratory mortality or morbidity is high with smoking.

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].

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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].

The understanding of COPD, a leading cause of premature mortality and morbidity, has evolved substantially over the past 5 decades with advances related to its pathogenesis, genetic basis, natural history, and underlying structural changes in the lung. Asthma is the most common chronic disease of childhood and is also very common among adults.

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 (PH 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].

Material and Methods:

The present study was conducted in Department of Medicine, Mahaveer Institute of Medical Sciences. The present study consists of total 100 subjects between the age group 18-65 years who are further subdivided into two groups. 50 subject comprised smokers group as cases.

Selection criteria:

The random sample of 50 smokers and 50 non-smokers selected fulfilled the following criteria.

Non-smokers:

According to definition non-smoker is a person who does not smoke tobacco. The person under study was not dwelling in the home where their spouse or other family members were smokers of hookah, cigarette, cigar or bidi. In other words they were not passive smokers. A passive smoker refers to exposure to tobacco consumption products from smoking of others.

Cigarette smokers :

They are persons who are engaged in the inhalation and exhalation of fumes of burning tobacco in cigarettes. By definition, cigarette smokers are the person who inhale, exhale and burn or carry any lightened cigarette. Every smoker must have been smoked at least 5 cigarettes a day.

Inclusion Criteria:

Informed consent from the subject, Subjects in the age range between 18-65 years, Non-smokers from population of Rourkela, Smokers with present or past history of 12 years of smoking.

Exclusion Criteria:

Those subject who did not give consent, Recent myocardial infarction less than one month old, Asthma and COPD subjects, Chronic infections such as tuberculosis or other infections of lungs, Subjects with respiratory symptoms such as cough, Hemoptysis of unknown origin (forced expiratory maneuver may aggravate the underlying condition), Pneumothorax, Thoracic, abdominal, or cerebral aneurysms, Recent eye surgery (e.g., cataract), Presence of an acute disease process that might interfere with test performance (e.g., nausea, vomiting), Previous accidents or surgery involving thorax or abdomen, Subjects who were not able to give desired co-operation for the test procedure. The statistical analysis was done by SPSS-16, $p < 0.05$ as significant.

Results:

This present study consists of 100 subjects in the age group of 18-65 years with 50 non-smokers and 50 smokers. The study observed decreased pulmonary functions in smoker population compared to the non-smoker population.

Smoking leads to disease and disability and harms nearly every organ of the body. More than 16 million Americans are living with a disease caused by smoking. For every person who dies because of smoking, at least 30 people live with a serious smoking-related illness. Smoking causes cancer, heart disease, stroke, lung diseases, diabetes, and chronic obstructive pulmonary disease (COPD), which includes emphysema and chronic bronchitis. Smoking also increases risk for tuberculosis, certain eye diseases, and problems of the immune system, including rheumatoid arthritis. There is now extensive evidence from many countries that conditions before birth and in early childhood influence health in adult life. Children are unable to choose the environment in which they live, their diet, living situation, and exposure to tobacco smoke and other air pollutants. They also have a very limited ability to understand the long-term consequences of their behaviour. Yet it is precisely during this crucial phase that many health

behaviours are shaped. Young tobacco smokers, for example, may acquire the habit and become dependent well before reaching adulthood.

Pulmonary function testing is a routine procedure for the assessment and monitoring of respiratory diseases. Spirometric values vary according to age, height, sex, and body size.^{3, 4} Most of the studies regarding the effect of obesity on pulmonary function tests have been conducted in males, in the age group of 5 to 16 years or they have been carried out in the elderly age groups [10-11].

The spirometry is a valuable tool to identify these subjects. Studies showed higher incidence of asthma in smokers due to sensitivity to specific airborne agents and possibly due to overall high IgE level in [12] smokers. The study by Vaidya et.al, showed a lower pulmonary function parameters in smokers as compared to nonsmokers, while in ex- smokers, the PFT values were better than in smokers but less [13] than nonsmokers. FEV1 was significantly lower than nonsmokers, but not much lower than ex-smokers. The FEF25-75% was also significantly reduced in smokers but FVC showed no significant difference. While in the study by Mohammad et al. showed lower PFT values in smokers in comparison to nonsmokers except MEF 25% (FEF25%) the relationships between quantities of smoking [14] were not significant. Smokers are not only the cause of health problems for themselves, but also by producing environmental tobacco smoke, they impose dangers for others. Environmental tobacco smoke constitutes a common problem in many countries.

Further observed that although the number of alveoli per unit volume and area was identical in boys and girls, the total number of alveoli was larger in boys than girls resulting in larger lung volumes in boys. As a result of larger lung volume but proportionately smaller conducting airways at similar stature, boys are expected to have lower FEV1/FVC % at every age compared to girls of similar stature. Another variable which females consistently failed to exceed was PEF. As PEF is the most effort dependent pulmonary function, the difference may reflect gender differences in effort rather than in the function. However, more studies are required to explain the gender differences in the lung function. Studies have found that measures of body weight and fat were inversely related to the spirometric variables. Adiposity, especially of chest and abdomen was considered to restrict the normal movements of chest and diaphragm).[15] Age was found to be necessary independent variable for all spirometric parameters.

Today, passive smoking, or Environmental Tobacco Smoke (ETS) exposure, is an important health concern worldwide. The study by Padmavathy K.M. at Chennai, India, showed significantly reduced FEV1, PEF and FEF25-75% in beedi smokers than cigarette smokers [16]. The 'p' value was less than 0.001. Our study was

similar to the various studies done previously in Indian as well as foreign studies and revealed that a detailed pulmonary function assessment is required in Rourkela where prevalence of smoking is higher.

The evidence presented studies relates to death from any cause. Data on cause of death were not available at the time this study was conducted. International evidence shows that the vast majority of excess deaths in smokers are caused by smoking and are due to conditions such as cardiovascular disease, cancer, and chronic lung disease. However, it should be borne in mind that a minority of deaths, such as those related to suicide, may be increased in smokers but may not be wholly caused by smoking. Hence, although we are not able to exclude the relatively small number of deaths that are less likely to be causally related to smoking, the large majority of the observed excess mortality in smokers observed here would have been caused by smoking.

Conclusion:

Tobacco smoking in any form, bidi or cigarette or both, has significantly deleterious effects on the pulmonary functions. In this rural study area, bidi smoking was most common. Almost all the pulmonary function parameters were significantly reduced in smokers and obstructive pulmonary impairment was commonest. Most cigarette smokers usually smoked non-filter cigarettes since they are cheap and easily available in rural areas. Also, most smokers belonged to rural background and were of low socio-economic status. A smoker was considered as "deep inhaler" if he drew in the cigarette/bidi with prolonged inspiration, and exhaled through mouth or nose, otherwise he was considered as "puffers". In the present study all the smokers were deep inhalers. To evaluate dose and duration response relationship, quantification of tobacco smoking was performed by calculating smoking index for smokers. The smokers were classified into light, moderate and heavy smokers as per the criteria of smoking index. Lung function changes from adolescence to old age but it's differing in males and females. BMI was not significantly associated with the most of spirometric values. In order to generalize these reference values, a larger study following the ATS criteria is needed. As the demographic and anthropometric characters change with the passage of time, a larger study following the criteria set by ATS is required for this purpose. Finally it may be concluded that smoking causes definite pulmonary function impairments specially the obstructive type.

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. Our results show that the number of current smokers in India remains high and that smoking increases the risk of all-cause mortality. This situation is expected to

directly impact many health problems in the future. The government must also consider potential interventions in order to encourage smoking cessation among current smokers.

Acknowledgments

REFERENCE:

1. Chhabra SK, Rajpal S, Gupta R, *et al.* Patterns of smoking in Delhi and comparison of chronic respiratory morbidity among beedi and cigarette smokers. *Indian J Chest Dis Allied Sci.* 43, 2001, 19-26.
2. Kumar R, Prakash S, Kushwah AS, Vijayan VK, *et al.* Breath carbon monoxide concentration in cigarette and bidi smokers in India. *Indian J Chest Dis Allied Sci.* 52, 2010, 19-24.
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* 8(6), 1967, 789-96.
4. World Tobacco epidemic, 3rd edition by WHO Geneva 6, 1994.
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* 11, 1998, 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.* 123, 1969, 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. Shishani K, Nawafleh, H. and Sivarajan Froelicher, E. Jordanian Nurses' and Physicians' Learning Needs for Promoting Smoking Cessation. *Progress in Cardiovascular Nursing*, 23, 2008, 79-83.
13. Omar A, Adile B D, Bahar K, Vefa A *et.al*, Correlation of functional and radiological findings of lung in asymptomatic smokers, *Turkish Respiratory Journal*, April 9(1), 2008, 9-15.
14. Vaidya P, Kashyap S, Sharma A, Gupta D, Mohapatra PR, Respiratory symptoms and pulmonary function test in school teachers of Shimla; *Lung India* 24, 2007, 6-10.
15. Mohammad H B, Hamideh D, Mehdi E, Pulmonary Function and their reversibility in smokers; *Tannafofos* (Journal of respiratory disease, thoracic surgery, intensive care and Tuberculosis), 2(8), 2003, 23-30.
16. Padmavathy K M, Comparative study of pulmonary function variables in relation to type of smoking; *Indian Journal of Physiology and Pharmacology* 52(2) 2008, 193-196.

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Conflicts Of Interest

The authors declare no conflict of interest.