

A Comparative Study of Pulmonary Function Tests among Smokers and Non-Smokers in a Tertiary Care Hospital

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Abstract

Background: Cigarette smoking has a significant impact on pulmonary function. Pulmonary function testing is a common procedure for diagnosing and monitoring respiratory disorders. In this study, the pulmonary function tests of smokers and nonsmokers were compared.

Materials and Methods: Between January and June 2022, a case-control study was undertaken among smokers and nonsmokers. A total of 100 participants were recruited, 50 of whom were nonsmokers (controls) and 50 of whom were smokers (cases). PFT measurements were performed three times on each patient, with the greatest level recorded. Unpaired t test was used to analyse the data.

Result: Pulmonary function parameters were significantly reduced in smokers and obstructive pulmonary impairment was commonest. The mean FVC, FEV₁, FEV₁/FVC, PEFR, FEF_{25%-75%} in nonsmokers and smokers were 3.15±1.02, 2.62±0.92: 2.81±0.97, 2.17±0.75: 85.12±26.32, 82.13±21.85: 7.12±2.12, 5.86±1.98: 3.86±0.83, 3.12±1.21 respectively.

Conclusion: Smokers had significantly lower lung function tests than nonsmokers, with obstructive pulmonary impairment being the most frequent. Thus, spirometry can detect a variety of lung problems at an early stage, reducing eventual morbidity.

Keywords: Smoking, Spirometry, Pulmonary Function Test.

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Introduction

According to the World Health Organization (WHO), tobacco smoking killed 100 million people globally in the twentieth century and is expected to kill one billion people in the twenty-first century [1]. Tobacco-related deaths would rise to almost 10 million per year by early 2030 [2]. Tobacco has remained one of the most prominent risk factors for a wide range of respiratory and cardiovascular disorders. Tobacco smoking creates health

risks on purpose. Tobacco use causes a fast deterioration in pulmonary function tests (PFTs) [3].

Tobacco is the leading external cause of noncommunicable illness and kills more people than obesity, both in high-income nations and worldwide [4,5]. Cigarette smoke is a heterogeneous aerosol formed by the incomplete combustion of tobacco leaves [6].

Tobacco smoke includes about 4000 compounds, 60 of which are recognised carcinogens that cause lung cancer. Cigarette smoke's acidic pH (5.3) significantly ionises nicotine, and a desirable amount of nicotine is absorbed into the lungs [4]. Cigarette smoke's initial effect is on the respiratory system. Chronic bronchitis, emphysema, chronic obstructive pulmonary disease (COPD), and bronchogenic cancer are all illnesses induced by smoking [5]. The major components of cigarette smoke are nicotine and carbon monoxide, which cause these effects [7].

Chronic cigarette smoke exposure dramatically impairs the function of tiny airways. Smoking causes an increase in inflammatory cells in the lungs, which produces free radicals. The development of smoking-related respiratory problems and other diseases is influenced by oxidative stress [8]. They considerably worsen the gradual loss of lung function and have an impact on all indices of Tests of pulmonary function (PFT). Cigarette smoking has a wide range of impacts on respiratory function and is definitely linked to the genesis of many respiratory disorders, including chronic bronchitis, emphysema, and bronchial cancer.

Since the 1970s, pulmonary function testing has been widely used [9]. Pulmonary function testing is a standard practise for diagnosing and monitoring respiratory disorders [10]. Tests are also valuable since they are less costly, non-invasive, repeatable, and cause the subjects the least amount of discomfort. Spirometric values vary with age, height, gender, and body size [11,12]. As a result, cigarette smoking has a wide range of consequences on respiratory function, which may be determined with a pulmonary function test. The study's aim was to compare pulmonary function tests in smokers and nonsmokers.

Materials and Methods

The present case control study was conducted at Viswabharathi Medical College & General Hospital, Kurnool from January 2022 to June 2022 after taking clearance certificate from the Institution. The study population included 100 subjects comprising of 50 male smokers and 50 nonsmoker controls

Inclusion criteria: Healthy adult male with no past or present history of smoking between the age group of 30- 65 years. Individuals with a history of cigarette smoking daily for at least one year were considered as smokers and they were selected for study.

Exclusion criteria: subjects unwilling to participate, Female subjects, and Male subjects with a history of smoking less than one year, Male subjects suffering from diseases which directly or indirectly affect the lung functions.

Demographic information was collected, including age, weight, and height. All patients were thoroughly informed about the study's purpose and aims, and formal consent was obtained. To avoid confusing results, a complete general physical examination of the patient was performed, including height, weight, body mass index, pallor, vital statistics, and a thorough systemic examination. PFT was recorded using a pulmonary function test equipment (Med-spirometer version 8.91), a nasal clip, and a mouthpiece.

The individuals were advised to sit comfortably on a chair to evaluate their respiratory functioning. The entire method was described to the individuals, and they were directed to breathe in fully via deep inspiration with their nostrils closed with a nasal clip, seal their lips over the sterile mouthpiece of the spirometer, and then forcibly exhale air out. Best of three readings was recorded and interpreted

Results

The physical characteristics of Smokers and Nonsmokers are shown in Table 1. In the present study the age range of subjects was 30-65 years with mean age 47.42 years in

smokers and 47.86 years in non-smokers. Similarly, there was no significant difference in the means of BMI in smokers and non-smokers.

Table 1: Physical Characteristics of smokers/non smokers

| Variable | Nonsmokers | Smokers | P value |
|-----------------------|-------------|------------|---------|
| Age (years) | 47.42±9.65 | 47.86±9.76 | >0.05 |
| Body Mass Index (BMI) | 24.61 ±2.96 | 24.12±2.87 | >0.05 |

The mean values of all the pulmonary function tests are significantly reduced in smokers compared to nonsmokers. The association of impaired PFT in smokers was found to be statistically highly significant. Table 2.

Table 2: Pulmonary function tests among smokers and non-smokers

| Pulmonary function tests (PFTS) | Non Smokers | Smokers | P value |
|---------------------------------|-------------|-------------|---------|
| FVC | 3.15±1.02 | 2.62±0.92 | 0.003 |
| FEV1 | 2.81±0.97 | 2.17±0.75 | 0.002 |
| FEV1/FVC | 85.12±26.32 | 82.13±21.85 | 0.0001 |
| PEFR | 7.12±2.12 | 5.86±1.98 | 0.00001 |
| FEF25%-75% | 3.86±0.83 | 3.12±1.21 | 0.001 |

Out of total 100 study subjects, 78 had normal lung functions, whereas 22 had impaired lung functions, out of which 21 were smokers and 1 nonsmoker. Table 3

Table 3: Interpretation of PFT results in smokers and non-smokers

| Pulmonary function test results | Smokers | Nonsmokers | Total |
|---------------------------------|---------|------------|-------|
| Obstructive | 19 | 1 | 20 |
| Restrictive | 1 | 0 | 1 |
| Mixed | 1 | 0 | 1 |
| Normal | 29 | 49 | 78 |
| total | 50 | 50 | 100 |

Discussion

The study comprised data from 100 male individuals aged 30-65 years, separated into two groups of 50 nonsmokers and 50 smokers. There was no significant difference in the mean physical characteristics such as age and body mass index when mean and standard deviation were calculated in smokers and non-smokers, with adequate matching of smokers and non-smokers.

Using an unpaired t-test of significance, all pulmonary function indicators such as FVC,

FEV1, FEV1/FVC, PEFR, FEF25-75%, and MVV revealed a statistically highly significant connection between smokers and non-smokers. Burrows *et al* [13], Pandya *et al* [14], Dhand *et al* [15], Gosavi *et al* [16] and Gupta *et al* [17] also found similar findings of pulmonary function decline among smokers.

In the current study, 78 (78.0%) of the 100 study individuals had normal lung functions, whereas 22 (22.0%) had impaired lung

functions, with 21 (95.5%) being smokers and just 1 (4.5%) being non-smokers. The link between smoking and poor PFT performance was statistically significant. Smokers were 17.3 times more likely than nonsmokers to have reduced lung function [18].

Conclusion

Smoking is harmful to one's health, particularly pulmonary functions. As a result, smoking increases the risk of respiratory mortality or morbidity. The study concluded that spirometry was an efficient and simple tool for detecting obstructive lung disorders in high-risk populations such as smokers.

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