Section: Physiology

Original Research Article

THE EFFECT OF DURATION OF CIGARETTE SMOKING ON PULMONARY FUNCTION TESTS IN MALES

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ABSTRACT

Background: Various respiratory diseases are caused and worsened by cigarette smoking. Cigarette smoking is linked directly with a reduction in pulmonary function parameters. The concept that duration of smoking might be the factor to accelerate the carcinogenic processes. Thus, the aim of the present study is to elucidate the effect of smoking duration in adult smokers on Pulmonary Functions. **Aim:** To determine the effects of smoking duration in adult Male smokers on lung function.

Materials and Methods: This cross-sectional study included 50 healthy medical students (25 males and 25 females) aged 18–24 years, selected through convenience sampling. Inclusion criteria required participants to be healthy without any major illness, upper limb trauma, or skeletal muscular disorder. After obtaining informed consent, demographic details obtained using questionnaire and face to face interview, Anthropometric measurements taken and BMI was calculated, then participants were seated with their elbows straight and close to the body. The maximum grip strength of the dominant hand was measured twice, with the higher value recorded for analysis. Statistical analysis was conducted using paired t-tests with SPSS trial software to compare handgrip strength between males and females.

Results: The lung function parameters (FVC, FEV1) were found more decreased in patients with greater smoking duration (> than 10 years).

Conclusion: This study found that the smokers with duration of smoking greater than 10 years shows very low FVC and FEV1 values than the predicted value and also lower than the persons having lesser smoking duration. This decline in pulmonary function tests shows that prolonged cigarette smoking leads to progressive airway obstruction and impaired respiratory efficiency.

Keywords: smokers, Pulmonary Function Tests, FVC, FEV1.

INTRODUCTION

Cigarette smoking is a leading cause of preventable diseases and premature death worldwide, contributing significantly to various respiratory disorders. One of the most common areas affected by smoking is pulmonary function, which refers to the ability of the lungs to take in oxygen and expel carbon dioxide efficiently. The impact of smoking on lung function is well-documented, with chronic exposure leading to conditions such as Chronic Obstructive Pulmonary Disease (COPD), emphysema, and chronic bronchitis.[1]

In the United States, smoking is responsible for about 80% of chronic airway disease cases.[2] The human respiratory system is the system most significantly affected by smoking; disease spreads from the smaller to the larger airways.[3]

The World Health Organization (WHO) 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.[17] By the early 2030, tobacco

related death would increase to about 10 million a year. 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. Tobacco has remained as one of the most important predisposing factors responsible for so many respiratory and cardiovascular diseases.[18]

The duration of smoking, or the number of years a person has smoked, plays a crucial role in determining the extent of lung damage and the impairment of pulmonary function. As the duration of smoking increases, the cumulative exposure to harmful toxins in cigarette smoke, such as carbon monoxide, nicotine, and tar, can cause progressive damage to the lungs' airways and alveolar structures.[5] Pulmonary function tests (PFTs) are essential diagnostic tools used to assess the lungs' ability to inhale, exhale, and transfer oxygen into the bloodstream, providing valuable insight into the degree of lung impairment.[7]

In males, the effects of smoking on pulmonary function are particularly concerning, as they tend to have a higher prevalence of smoking and may exhibit more pronounced respiratory dysfunctions compared to females, especially in the long term.[8] This study explores the relationship between the duration of cigarette smoking and the results of pulmonary function tests in male individuals, aiming to understand how long-term smoking influences lung health and contributes to respiratory dysfunction.

Understanding this relationship is crucial for health professionals to design effective strategies for early detection, prevention, and management of smoking-related pulmonary diseases, ultimately improving public health outcomes.[10]

MATERIALS AND METHODS

Sample Size

The present cross sectional study was conducted in Tirunelveli medical college and hospital, Tirunelveli, Tamil Nadu. The study sample comprised of 50 males. The participants were divided into two groups based on smoking duration. Group 1- smoking less than 10 years, Group 2- smoking greater than 10 years.

Inclusion Criteria: Male Smokers

Exclusion Criteria: HT, DM, H/o cardiac disease, chest workers, H/O or symptoms of any neuromuscular disorder, Severe lung infections like TB.

Methodology

After getting ethical committee approval, Each participants undergone demographic and anthropometric measurements ,smoking history such as duration of smoking ,number of cigarettes smoked per day.

Pulmonary function tests were done using a spirometer in the Research lab, Department of Physiology, Tirunelveli medical college to measure FVC and FEV1.After getting informed consent for during the test, each person sat or stood up straight and wore a nose clip to prevent air from escaping. A mouthpiece was placed about two centimeters into the mouth, and the person had to seal their lips tightly around it.

For the FVC test, each person took a deep and fast breath in, held it for less than one second, and then breathed out as hard and fast as possible until no more air could come out. The spirometer recorded the amount of air exhaled (FVC) and how much was exhaled in the first second (FEV1).

Predicted values were measured such as FVC and FEV1 by the spirometry that based on patient specific properties like age, gender, height and weight.

The measured values such as FVC and FEV1 were compared with the predicted values. SPSS Software-23 version was used. paired t test was used for analysis. p value less than 0.05 was considered to be significant.

RESULTS

Descriptive Statistics

The general characteristics of the study participants are presented in Table 1.

Table 1: Comparing anthropometric measurements with pulmonary function tests

Descriptive Statistics	N	Minimum	Maximum	Mean	Std. Deviation
age	50	44	68	55.90	7.332
height (cm)	50	159	173	163.20	3.854
weight (kg)	50	37	95	61.60	16.445
duration of smoking (yrs)	50	3	21	10.60	7.814
number of cigarette/day	50	5	12	8.40	2.129
predicted value FVC (L)	50	2.68	3.89	3.0870	0.40588
predicted value FEV1 (L)	50	2.09	3.13	2.4870	0.34908
measured value FVC (L)	50	1.47	2.91	2.0850	0.37163
measured value FEV1 (L)	50	0.43	1.64	1.1700	0.33460

Group Comparison Based on Smoking Duration:

Participants were divided into two groups: Those who smoked ≤10 years and those who smoked >10 years. The comparison of predicted and measured values is summarized in Table 2.

Table 2: comparing predicted value with measured value for two groups

DurationDicot	N	Mean	Std. Deviation	Std. Error Mean
Predicted FVC				
Upto 10 Years	30	3.0433	0.43824	0.08001
>10 Years	20	3.1525	0.35239	0.07880
Predicted FEV1				
Upto 10 Years	30	2.4417	0.36819	0.06722
>10 Years	20	2.5550	0.31502	0.07044
Measured FVC				
Upto 10 Years	30	2.2517	0.36024	0.06577
>10 Years	20	1.8350	0.22011	0.04922
Measured FEV1				
Upto 10 Years	30	1.3967	0.13892	0.02536
>10 Years	20	0.8300	.23764	0.05314

The t-test comparing the two groups is shown in Table 3. Table 3: Independent Samples Test

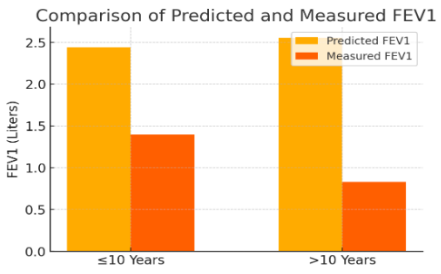
Parameter	F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% CI Lower	Upper
Predicted FVC	2.010	0.163	-0.930	48	0.357	-0.10917	0.11733	-0.34507	0.12674
Predicted FEV1	1.117	0.296	-1.128	48	0.265	-0.11333	0.10049	-0.31539	0.08872
Measured FVC	6.352	0.015	4.621	48	**0.000**	0.41667	0.09018	0.23535	0.59798
Measured FEV1	10.308	0.002	10.644	48	**0.000**	0.56667	0.05324	0.45962	0.67371

TABLE 2 and TABLE 3 shows,
Predicted FVC and Predicted FEV1 values are slightly higher in smokers with **>10 years duration**, showing no significant expected difference in lung function based on smoking duration.

Measured FVC and Measured FEV1 values are **markedly reduced in smokers with >10 years of smoking** compared to those who smoked for **up to 10 years**:

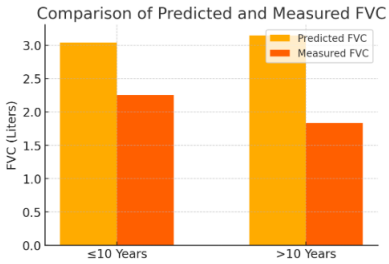
- Measured FVC: **2.2517 (≤10 years) vs. 1.8350 (>10 years)**

Measured FEV1: **1.3967 (≤10 years) vs. 0.8300 (>10 years).**This suggests that **prolonged smoking (>10 years) significantly impairs lung function**, reducing both FVC and FEV1 compared to shorter smoking durations.



Bar Diagram 1

The bar diagram 1 illustrates a marked decrease in measured FEV_1 with increased smoking duration.



Bar Diagram 2

The bar diagram 2 shows a significant decline in measured FVC among smokers with more than 10 years of smoking.

DISCUSSION

Smoking exerts various effects on the human pulmonary system and symptoms eventually develop.[17]

The relationship between smoking duration, number of cigarettes smoked per day, age and pulmonary function parameters was evaluated in this study.

Investigation of pulmonary function among males with a history of smoking for less than 10 years showed that means of measured pulmonary function values were below the means of predicted spirometer values that based on patient specific properties (like age, gender, ethnicity, weight and height). Investigation of pulmonary function among males with a history of smoking for more than 10 years showed that means of measured pulmonary function values were very low the means of predicted spirometer values that based on patient specific properties (like age, gender, ethnicity, weight and height). This finding may reflect obstruction of the airways and respiratory muscle weakness in both division of participants.

In addition, a significant correlation was found between duration of smoking, participant age and lung function parameters (FVC, FEV1 values). These results indicate that a decrease in lung function parameters (FVC, FEV1) is correlated conversely with smoking duration. On the other hand, non-significant correlation was found between number of cigarettes smoked per day and lung function parameters (FVC, FEV1).

The above findings suggest that smoking duration could adversely affect lung capacity by reducing the volume associated with the FVC, FEV1 values.

The present study aimed to evaluate the effect of smoking duration on pulmonary function tests (PFTs) among males. Our findings align with several studies indicating that prolonged smoking exposure significantly impairs lung function.

Smoking has long been established as a major risk factor for respiratory dysfunction. The study by Rehman et al. (2023) emphasized that cigarette smoking leads to dose-dependent worsening of spirometric parameters, including FVC and FEV_1, and impairs diffusion capacity, even in younger individuals.[10] This supports our results showing significant reductions in these parameters with increasing smoking duration.

Similar findings were reported by Al-Ani et al. (2018), who observed that adults over 40 years with longer smoking histories demonstrated significantly lower FVC, FEV_1 values compared to non-smokers, suggesting that both age and duration of smoking synergistically contribute to pulmonary decline.[13]

Additionally, Ghaffar et al. (2011) found that prolonged smoking leads to rapid declines in lung function, particularly affecting parameters that reflect airway obstruction, such as FEV_1. They concluded that the decline was directly proportional to both the quantity and duration of smoking (14). This is in agreement with our study, where participants smoking for more than 10 years exhibited more severe declines in FEV_1 and FVC than those with less than 10 years of smoking history.

Comparative studies also reveal that heavy smokers with longer durations of smoking show greater impairment. Bairwa et al. (2022) found significantly lower lung function parameters in smokers than in non-smokers, confirming obstructive patterns in heavy and chronic smokers.[15]

Interestingly, even shorter durations of smoking in younger populations show adverse effects. According to Baik et al. (2014), youth smokers with 1-3 years of smoking history demonstrated reduced FVC and maximal expiratory pressure (MEP), indicating that pulmonary damage may start early in the smoking timeline.[16]

These findings, along with our results, confirm that the duration of smoking plays a critical role in the progressive decline of lung function. The pathophysiological changes such as airway inflammation, mucus hypersecretion, and alveolar wall destruction contribute to the development of obstructive pulmonary patterns, commonly leading to chronic obstructive pulmonary disease (COPD).

CONCLUSION

Our study concludes that the duration of smoking has a significant negative impact on pulmonary function among males. An increase in smoking duration is associated with progressive declines in FVC, FEV_1, indicating obstructive airway changes.

These findings are consistent with previous studies and underline the importance of early smoking cessation to prevent further pulmonary damage. Public health interventions should focus on raising awareness among young males about the cumulative harmful effects of smoking on lung function.

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Competing Interest

There is no competing interest

Authors Contribution

All authors in our study contributed to the data collection of the patients

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