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Original Article

A comparative Study of Pulmonary Function Tests in Tobacco Smokers and Non Smokers

*^a Dr Anand Kumar, ^b Dr Harika Priyadarshini, ^c Prathyusha, ^d Prashanth Kumar

^a Assistant Professor, Department of Physiology, Malla Reddy Institute of Medical Sciences, Hyderabad.

^b Assistant Professor, Department of Physiology, Malla Reddy Institute of Medical Sciences, Hyderabad.

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ABSTRACT

Aim: The aim of the present study is to describe pulmonary function changes in smoking which declines lung function and to compare them with non smokers. **Materials & Methods:** The study was conducted in male subjects [n=100], Aged between 20-40years, who are smokers & non smokers. First the respiratory function values are taken in control group and the parameters selected for the study are FVC, FEV1, FEV1/FVC, FEF25-75%, PEFR. Case group includes 50 smokers randomly selected from population. They have history of smoking more than 10 year duration and smoking 5 cigarettes per day. **Results & Discussion:** In this study smokers are compared with non smokers. There was decrease in FVC, FEV1, FEV1/FVC, thus decrease in lung function in smokers. **Conclusion:** Regular smoking induces significant decrease in the pulmonary function tests. This study suggest that young smokers within few years of starting to smoke developed changes in pulmonary functions indicating decreased growth in lung functions and early peripheral airway narrowing and that these effects worsen progressively with continued smoking.

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1. Introduction

Cigarette smoking produces an inflammatory response in the Airways. The reduction in FEV1 associated with chronic cigarette smoking can be partially explained by loss of lung elastic recoil pressure which reduces the force driving air out of the lung [1]. Smoking a pack of cigarettes per day increases the annual decline of FEV1 and it also concluded that stopping smoking at any age reduces the progression of lung function loss [2]. A longitudinal study of long term effect of smoking on physical fitness and lung function observed a reduction in fitness and the reduction in FEV1 was higher among smokers than among non smokers. They also concluded that decline in physical fitness and lung function among healthy middle aged men was considerably greater among smokers [3]. Analyses were suggesting that smokers may start to lose lung function at an earlier age than non-smokers [4]. Study showed that impact of cigarette smoking on pulmonary function in smokers had a significantly greater percentage decline in the FEV1, FEV25-75% and FEV1/FVC ratio than non-smokers, they suggested that young

smokers within a few years on starting to smoke, develop changes in pulmonary function indicating early peripheral airway narrowing and these effects worsened progressively with continued smoking [5].

Therefore in the present study the prevalence of smoking and the effect of quantity and duration of smoking on PFTs were examined. Pulmonary function tests are useful because it is inexpensive, noninvasive and repeatable and causes minimum discomfort to the subject. The purpose of this research is to prove that smoking induces airway disease. Therefore early detection of pulmonary function tests will prevent the risk of airway disease.

2. Materials and Methods:

The study was conducted on male subjects [n=100] their age ranging from 20-40 years, who were smokers and nonsmokers. The criteria for selection of smokers should have minimum history of smoking tobacco for more than ten year duration and still smoking at least five or more than five cigarettes per day. The control group includes non smokers randomly selected from population.

The study includes PFT changes in smokers, and nonsmokers, to compare the results of above two groups and study the effect of smoking on respiratory system.

* Corresponding Author : : Dr. Anand Kumar,

Assistant Professor,

Department of Physiology,

Malla Reddy Institute of Medical Sciences,

Hyderabad 500015,

Andhra Pradesh (India).

E-mail: dranandhugar01@gmail.com

Mobile No: 09160294482

The subjects' detailed history was taken. Each subject was medically examined and their past medical history was carefully evaluated solely aimed at excluding those with cardiac or pulmonary disease or hypertension. Thus, unhealthy subjects were excluded and only the suitable subjects were accepted for this study. Prior to the study, each subject was informed in detail of its objectives and the aim of the research protocol and methods to be used. Their consent was obtained.

Experimental protocol

Computerized data logging Spirometer for recording the pulmonary function tests [UNI-EM Spiromin 6.24.9 Ink].

Non smokers of similar age were taken as control group [50]. Pulmonary function tests of smokers and control groups were measured using a spirometer [UNI-EM Spiromin 6.24.9 Ink]. Prior to pulmonary function testing, the required manoeuvre was demonstrated by the operator and subjects were encouraged and supervised throughout the test performance. Pulmonary function testing were performed using the acceptability standards outlined by the American Thoracic Society [ATS] with subjects in a standing position and wearing nose clips. Pulmonary function tests were performed three times in each subject with an acceptable technique. Subjects were educated prior to PFT measurements regarding the PFT performance. PFT measurements were carried out three times in each subject and there were small variation among three measurements. The highest level for forced vital capacity [FVC], forced expiratory volume in one second [FEV₁], peak expiratory flow [PEF], maximal mid expiratory flow [MMEF] and maximal expiratory flow at 75%, 50%, and 25% of the FVC [MEF75, MEF50, and MEF25 respectively] were taken independently from the three curves.

Statistical Methods

Data were reported as mean and standard deviation [mean±SD]. Means were compared between two groups by 't' test. A p value of <0.05 was considered statistically significant. Descriptive statistical analysis was carried out in the present study. Results on continuous measurements were presented on Mean ±SD. Student't' test has been used to find the significance of study parameters between two groups. Analysis of variance was used to find the significance of parameters across the age groups in smokers.

RESULTS:

According to the present study, we compared smokers 20-40 years with 10 year duration with non-smokers. There was highly significant decrease in FVC [L] by 20% in smokers compared to nonsmokers [p<0.001]. There was highly significant decrease in FEV₁ by 21% in smokers compared to nonsmokers [p<0.001]. There was significant decrease in FEV₁/FVC by 3% in smokers compared to nonsmokers [P < 0.05]. There was no significant decrease in FEF 25-75% by 0.1% in smokers compared to nonsmokers [P > 0.05] there was no significant decrease in PEFR by 4% in smokers compared to nonsmokers [P > 0.05]

Table 1 Relationship between pulmonary function tests (PFT) of smokers and nonsmokers

PFT Parameters	Non Smokers Mean ± SD	Smokers Mean ± SD	t value	P value
FVC	4.15 ± 0.57	3.31 ± 0.69	6.542	<0.001, HS
FEV ₁	3.8 ± 0.54	3.0 ± 0.58	6.696	<0.001, HS
FEV ₁ /FVC	92.6 ± 5.5	90.5 ± 4.8	2.077	<0.05, S
FEF _{25-75%}	5.17 ± 1.21	5.07 ± 1.28	0.414	>0.050, NS
PEFR	83.9 ± 15.4	81.1 ± 17.5	0.846	>0.050, NS

4. Discussion

In the present study the prevalence of smoking and the effect of quantity and duration of smoking on PFTs were examined. The results showed statistically highly significant decrease in FVC, FEV₁. Statistically significant decrease in the ratio of FEV₁/FVC. However PFT values include PEFR and FEF25-75% were not significant [Table 1]. In our study we found that FVC in nonsmokers is found to be 4.15liters and in smokers it is 3.31liters [table 1] It is also shown that level of FVC decreases more with an increase in duration of smoking and also with the increase in the number of cigarettes smoked per day. FVC measures ventilable lung volume; Similar findings were also reported by Danuser B et al [6]. In our study we found that FEV₁ in nonsmokers is found to be 3.8liters and in smokers it is 3liters [table 1]. It was observed that FEV₁ decreases more with increase in duration of smoking and also with the increase in number of cigarettes smoked per day. Similar findings were also reported from Tashkin DP et al [7], Camilli AE et al[8], Hogg C] et al[9], Kerstjens et al[10]. The reduction in FEV₁ associated with chronic cigarette smoking can be partially explained by loss of lung elastic recoil pressure which reduces the force required to drive air out of the lung. This loss of elastic recoil pressure is attributed to microscopic enlargement of air spaces rather than to grossly visible emphysema [8]. It also showed that ratio of FEV₁ /FVC was decreased with increase in duration of smoking and also with increase in number of cigarettes per day. These findings are similar to many other studies from Walter S et al [5], Gold RD et al [11], and Gorecka D et al [12].

Our study has not shown a statistically significant decrease in the level of PEFR. It has also shown that, the PEFR decreases with increase in duration of smoking and also with an increase in number of cigarettes smoked per day. These findings were similar to those reported by Prasad BK et al [13].

CONCLUSION:

The actual values of FVC, FEV₁, ratio of FEV₁/ FVC, FEF25-75% and PEFR are decreased in smokers compared to non smokers and all the values are more decreased with increase in duration of smoking and increase in number of cigarettes smoked per day. Thus showing a dose response relationship. The results also demonstrated the profound the results also demonstrated the profound effect of smoking on PFTs specially those indicating large airways. There were also increased respiratory Symptoms among smokers.

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