Original Article

THE CORRELATION OF FVC%, FEV_1%, PEFR CORRESPONDING TO PULMONARY FUNCTION IN SMOKERS AND NON-SMOKERS

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ABSTRACT

Back ground and Objectives: Smoking is one of the major causes of preventable morbidity and mortality in both developed and developing countries. Cigarette smoke is a heterogeneous aerosol contains 4000 chemicals, on chronic exposure reduces small air ways function, increase inflammatory cells in lung, which produce free radicals. The oxidative stress increases progressive deterioration of lung function and affects all the parameters of pulmonary function test. Our work is aimed to highlight the changes in FVC%, FEV_1%, PEFR in smokers so that early intervention prevents the morbidity and mortality.

Methods: This study include 50 healthy male subjects aged between 40 - 55yrs. Out of them 25 are non-smokers and 25 are smokers, who smoke 11 - 25 cigarettes per day for the past 15 yrs. All of these underwent computerized pulmonary function tests (**WinspiroPRO**).

Results: The results showed that there is significant decrease in mean values of FVC%, FEV_1%, PEFR in smokers as compared to the non-smokers with significant P value < 0.001.

Interpretation and Conclusion: The irritants present in the smoke cause release of elastase from alveolar macrophages that degrades structural elements of the lung which leads to loss of elastic recoil causing decrease in FVC%, FEV1%, PEFR in our present study.

KEYWORDS: FVC, FEV_1, PEFR, PFT, BMI, Spirometer, chronic bronchitis, emphysema, chronic obstructive pulmonary disease (COPD), and bronchogenic carcinoma. .

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INTRODUCTION

Smoking is one of the major causes of preventable morbidity and mortality in both developed and developing countries. 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 [1] also the overall prevalence of current tobacco use from The National Household Survey of Drug and Alcohol Abuse in India (NHSDAA) was 55.8%.[2]

In India smoking is a common habit prevalent in both urban and rural areas. The cigarette smoke is a heterogeneous aerosol produced by the incomplete combustion of the tobacco leaf.[3] Tobacco smoke contains 4000 chemicals out of which 60 are known carcinogens which lead to lung cancer. The acidic pH (5.3) of cigarette smoke relatively ionize nicotine and a desired

amount of nicotine is absorbed in to the lungs.[4] The effect of cigarette smoke is first on the respiratory system. The diseases caused by smoking are chronic bronchitis, emphysema, chronic obstructive pulmonary disease (COPD), and bronchogenic carcinoma.[5] These effects are mainly related to nicotine and carbon monoxide which are the chief components of cigarette smoke.[4]

Chronic exposure to cigarette smoke reduces small air ways function significantly. Smoking increase inflammatory cells in lung, which produce free radicals. The oxidative stress is involved in the development of smoking related respiratory conditions and other pathologies.[6] They significantly increases progressive deterioration of lung function and affects all the parameters of Pulmonary function tests (PFT). The most common parameters measured are Forced vital capacity (FVC), Forced expiratory volume in 1 second (FEV$_1$) and Peak expiratory flow rate (PEFR).

Hence Cigarette smoking is the cause of all these health hazards, Governments of the developing and developed countries are educating the public, through many forms of advertisements saying "Smoking is injurious to health". Our work is aimed to highlight the pulmonary changes in smokers so that early intervention prevents the morbidity and mortality.

Aims and objectives

The present study is to correlate the changes in FVC%, FEV$_1$%, PEFR corresponding to pulmonary changes in smokers and non- smokers.

MATERIALS AND METHODS

The present study was carried out at Pulmonary function Lab, Department of Pulmonology, S.V.R.R.G. Hospital, Tirupati. with due approval of the ethical committee. This study include 50 healthy male subjects aged between 40 - 55yrs, they were selected from the outpatient department at S.V.R.R.G Hospital, Tirupati. The selection criteria for the control group were 25 healthy non smokers aged almost same at that of experimental group with no history of smoking of any type and the 25 individuals with a history of cigarette smoking 11 - 25 cigarettes per day for the past 15 yrs were considered as smokers (Classification criteria as suggested by

WHO (1998)[7]. The study was carried out under the guidance of an eminent Pulmonologist by computerized software of pulmonary function test named '**WinspiroPRO**' ver.2.5.1. Winspiro PRO is an instrument designed for lung function screening; the core of the system is the 'intelligent' flow meter that is connected through the USB cable, turns any personal computer into a complete spirometric lab. Winspiro PRO is easy and simple to operate and give highly accurate results. With the help of Winspiro PRO it is easy to analyze data and it gives accurate result without manual calculation according to standardize testing protocol and predictions.

All subjects were physically healthy, without any symptoms. The height and weight was obtained in the subjects wearing light-weight clothing and barefoot, at room temperature. General and systemic examination was done according to standard protocol to rollout systemic diseases. The experimental procedure was explained and demonstrated to all the subjects and written consent was obtained from them. 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 of three readings was recorded and interpreted.

The statistical analysis was done using Epi info T version (CDC, Atlanta, USA) having mean and SD for continuous variables and proportions for categorical variables. The mean differences was analyzed using ANOVA test (F ratio) while the differences to the proportion was analyzed using Chi-square test. A probability value of less than 0.05 is considered to be statistically significant.

RESULTS

In this study age of the subjects range between 40-55 years, with a mean age of 46.4 ± 4.26 years in the smokers and 45.5 ± 3.45 in non-smokers [Table1]. There was no significant difference in the mean of the other physical parameters like height, weight, and body mass index (BMI) in the smokers and non-smokers as they belong to the same socio economic status.

The mean values of FVC%, FEV1%, PEFR shows significant decrease in smokers as compared to

the non-smokers. [Table -2].

Table 1: Baseline data of smokers compared to non-smokers.

S.No	Variable	Smokers (N=25)	Non-smokers (N=25)	P value
1	Age (Mean ± SD)	46.4 ± 4.26	45.5 ± 3.45	0.41; NS
2	Height (Mean ± SD)	168.7 ± 4.66	166.7 ± 5.83	0.18; NS
3	Weight (Mean ± SD)	61.1 ± 4.17	59.6 ± 4.42	0.22; NS
4	BMI (Mean ± SD)	21.5 ± 2.06	46.4 ± 4.26	1.00; NS

The mean age, height, weight as well as BMI are all similar with no statistically significant difference between smokers and non-smokers (P>0.05; NS). Thus, the smoker and non-smoker groups are comparable with each in terms of the important confounding variables.

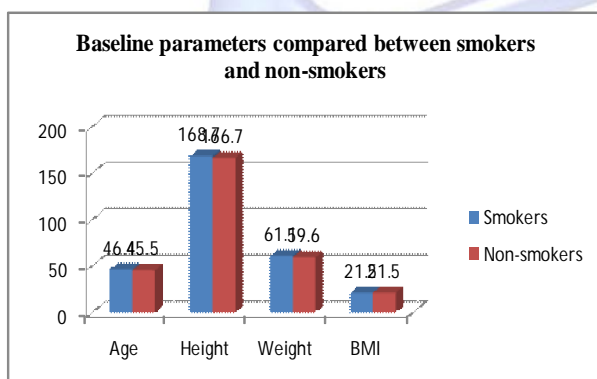**Graph 1:** Baseline Parameters compared between smokers and non smokers.

Table 2: Pulmonary function parameters compared between smokers and non-smokers.

S.No	Variable	Smokers (N=25)	Non-smokers (N=25)	P value
1	PEFR (Mean ± SD)	269.8 ± 134.3	426.1 ± 27.7	<0.001; S
2	FVC % (Mean ± SD)	53.4 ± 16.0	95.8 ± 7.07	<0.001; S
3	FEV$_1$% (Mean ± SD)	52.6 ± 19.8	94.5 ± 9.63	<0.001; S

The mean FVC%, FEV$_1$%, and PEFR are found to be significantly decreased in smokers compared to those of non-smokers. The differences are also found to be statistically significant (P<0.001; S).

Graph 2: Pulmonary function parameters compared between smoker and non-smokers.
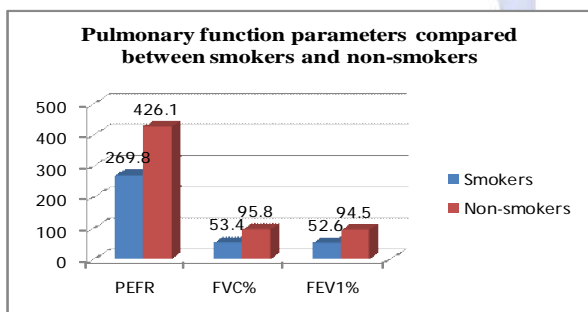
DISCUSSION

In the present study of 50 subjects, 25 are non - smokers and 25 are smokers, who smoke 11 - 25 cigarettes per day for the past 15 years. There was no significant difference in the physical parameters like age, height, weight, and body mass index, on calculating the mean and the standard deviation. [Table1].

The pulmonary function parameter FVC% showed a highly significant association between the smokers and the non-smokers (p < 0.001) and this was similar to the observations reported by S.T. Weiss, B. Rijcket et al.,[8] Fletcher C. Peto R .[9] A fall in FVC indicate restrictive changes of lung.

FEV1% and PEFR are also significantly decreased (p<0.001) in smokers similar to the studies of Wm Keith C. Morgan & Robert B. Reger.,[10] S.T. Weiss, B. Rijcket et al.,[8] K. Staven, et al.,[11] and Devid R. Jacobs et al.[12] The decreased FEV1% and PEFR indicate the obstructive lung disease.

The low FEV1% parameter is more reproducible and less effort dependent than FVC% and PEFR and is considered to be the lung function variable that predicts mortality.

The irritants present in the smoke cause release of elastase from alveolar macrophages[13,14] that degrades structural elements of the lung which leads to loss of elastic recoil causing decrease in FVC%, FEV1% , PEFR in our present study.

Cigarette smoking has varied and an extensive effect on respiratory function and it is one of the important etiologies for the number of respiratory diseases particularly chronic bronchitis, emphysema, COPD and bronchial carcinoma.

CONCLUSION

Cigarette smoking has deleterious effects on the health, mainly on the pulmonary functions. In our study cigarette smoking was found to lead to the reduction of the pulmonary function parameters and obstructive impairment is the commonest finding.[15] Hence, the risk of respiratory morbidity and mortality is high with chronic cigarette smoking.

Conflicts of interest: None

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How to cite this article:

N.Dwarakanath, Venkata Mahesh Gandhavalla, Kaarna Munisekhar. THE CORRELATION OF FVC%, FEV$_1$%, PEFR CORRESPONDING TO PULMONARY FUNCTION IN SMOKERS AND NON-SMOKERS.Int J Physiother Res 2014;2(4):663-666.