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Effect of Smoking on Peak Expiratory Flow Rate

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Abstract: *Tobacco smoking in India has been increasing alarmingly.Smoking is a known risk factor for chronic obstructive pulmonary disease(COPD),cardiovascular diseases and certain cancers, especially, the lung cancer.Nicotine is the addictive drug in tobacco smoke that causes smokers to continue to smoke. PEFR is a useful parameter to monitor airway obstruction, assess its severity and variation and evaluate the effects of treatment.40 healthy adult males aged between 20-50 years smoker for more than one year at Pimpri – Chinchwad area in Pune were selected .They constitute the study group (cases).40healthy adult males non-smokers aged 20-50 years were selected as control. Our study group falls in Light smoker's category (smoking index1-100). Peak Expiratory Flow Rate was carried out using RMS Helios 401 spirometer, Chandigarh. The present study showed decreased PEFR in smokers as compared to non-smokers but the difference was not significant statistically. Airway narrowing and reduction in recoil are responsible for the reduction in flow rates. So, aggressive tobacco control programme must be started.*

Keywords: *Smokers, Non-smokers, PEFR, RMS Helios spirometer.*

I. Introduction

India is the second largest consumer of tobacco products and third largest producer of tobacco in the world. The adult population of smokers in India is about 84.8 million and is almost equal to the population of Vietnam or Germany.

The death toll from tobacco use is projected to rise from 5.4 million in 2004 to 8.3 million in 2030[1].Tobacco smoking is a major risk factor for cardiovascular disease ,chronic obstructive pulmonary disease and some cancers and the morbidity and mortality with tobacco use is entirely preventable[2].

Nicotine is the addictive drug in tobacco smoke that causes smokers to continue to smoke.Along with nicotine ,smokers inhale about 7000 other chemicals in cigarette smoke. Many of these chemicals coming from burning tobaccoleaf.Some of these compounds are chemically active and trigger profound and damaging changes in the body.

Further, a quarter of smokers develop chronic obstructive pulmonary disease[3] and is the fourth commonest cause of death worldwide[4]. COPD is characterized by airflow limitation that is not fully reversible.[5,6]

Air flow limitation may be due to inflammation[5,7]or due to increase in the thickness of the wall[9]. PEFR is a useful parameter to monitor airway obstruction ,assess its severity and variation and evaluate the effects of treatment.[10]

Earlier studies have reported that the PEFR is an effort dependant parameter emerging from large airways[11-12] and it does not detect small airways obstruction.[13] Further ,there are inconsistent finding which show that smoking affects medium and large airways.[14,15] Others have reported that smoking affects both small and large airways.[16-17]

Several studies have reported that PEFR was significantly lower in smokers than in non-smokers [18-22] and some studies found maximum reduction in PEFR was in bidi smokers than cigarette smokers. [21]The primary objective of the study was to investigate whether PEFR differs between cigarette smokers compared to non-smokers.

II. Methods

Institute ethical committee clearance was obtained before start of the study. The present study was conducted in the Department of physiology, Dr. D.Y. Patil medical college,Pimpri , Pune. 40 healthy adult males aged between 20-50 years smoker for more than one year at Pimpri –Chinchwad area in Pune were selected .They constitute the study group (cases).

40healthy adult males non-smokers aged 20-50 years were selected as control group.Anthropometrical measurements were taken along with preliminary clinical examination to exclude any systemic disorder affecting respiratory and cardiovascular system.

Purpose designed questionnaire were usedand peak expiratory flow rate of these two groups were compared.

The Smoking Index[23] This is a parameter which is used to express the smoking exposure quantitatively. This is especially useful in defining the risk ratio of a smoking related disease. Here, the smoking index was calculated by multiplying the average number of cigarettes which was smoked per day and the duration of smoking in years. The number of cigarettes meant, the average number of cigarettes which was smoked per day in the past seven days.

According to the smoking index, the smokers can be classified into:

1. Light smokers(Smoking index1-100)
2. Moderate smokers(Smoking index101-200)
3. Heavy smokers(Smoking index>201)

Our study group falls in Light smoker's category (smoking index1-100)

E xclusion criteria for study group:

1.Subjects with cardiac arrhythmias ,hypertension ,diabetes mellitus, ischemic heart disease, neuropathy & any other chronic disease.
2.History of respiratory and other cardiovascular diseases.
3. Obeseand underweight subjects were excluded..

Pulmonary function test was carried out using RMS Helios 401 spirometer with built in computer program, was entered into the compute, using standard laboratory methods. The questionnaires were filled up and the relevant data, name, age ,sex, height, weight ,occupation, smoker or non-smoker, lab temperature was entered to the computer. All subjects were made familiar with the instrument and procedure for performing pulmonary function tests. All pulmonary function tests were done on the subject comfortably seated in upright position. The subject was connected to mouthpiece and was asked to breath in order to familiarize himself with equipment. During the tests subject was adequately encouraged to perform at their optimum level and also a nose clip was applied during the entire manoeuvre.

To perform the PEFR manoeuvre , the subject was instructed first to breath in deeply to their full extent. The subjects then place the transducer to the mouth and expel the air from their lungs as quickly as possible still with the transducer to the mouth until the lungs were full. One single expiratory effort gives reading about PEFR.

Pefr: peak expiratory flow rate.

All data were expressed as Mean (S.D.). Unpaired t-test was used to assess the effect of smoking on PEFR. P-value <0.05 was accepted as statistically significant.

III. Results

40 smokers aged 20-50 years male compared with 40 non-smokers aged 20-50 years with age and BMI matched.

Table 1: Age, Body mass index of smokers and non-smokers..

Parameters	**(Non-smokers)Control**	**(Smokers)Cases**	**P Value**
	Mean (S.D.)	**Mean (S.D.)**	
Age (in years)	30.23(6.59)	30.9(8.40)	0.69
BMI (in kg/m2)	24.04(3.20)	23.58(3.36)	0.53

Table 2: Comparison of peak expiratory flow rate between smokers and non-smokers

PFT Parameters	**(Non-smokers)Control**	**(Smokers)Cases**	**P Value**
	Mean(S.D.)	**Mean(S.D.)**	

PEFR(L/MIN)	6.42(1.59)	5.91(1.44)	0.14

p value <0.05 is statistically significant.
p value <0.001 is statistically highly significant.
PEFR reduced in smokers but not significant statistically as indicated by p-value.

IV. Discussion

There was no significant difference in the mean physical parameters like age, height , weight and body mass index on calculating the mean and the standard deviation in the smokers and non-smokers.[Table1].
Mean age of non-smokers found to be 30.23 with standard deviation 6.59 Mean (S.D.)=30.23(6.59) and in smokers found to be 30.9 with standard deviation 8.40 Mean(S.D.) =30.9(8.40).
The BMI (body mass index) was found to be in non-smokers Mean (S.D.)=24.04(3.20) in smokers mean(S. D.)=23.58(3.36).

There was no significant difference between smokers and non-smokers when age and BMI was compared. This indicates that both the groups comparable.

Peak expiratory flow rate (PEFR): In non-smokers value was 6.42(1.590 and in smokers 5.91(1.44).but the values were statistically insignificant as p value=0.14. [Table2.]

The mean PEFR in the control group was higher than that in the test group. The difference between the groups was statistically not significant.

Padmavati et al. found that cigarette smokers had a lower PEFR .Similar results were presented by other workers .Airway narrowing and reduction in recoil are responsible for the reduction in flow rates.[21]

Chatterjee et al.did not observe any statistically significant difference between the mean PEFR in smokers and non-smokers in the age group 20-45 years.[24]

Heaviness of cigarette smoking i.e. no.of cigarette sticks per day did not significantly affect the lung function(PEFR) in smokers in our study as documented by Ukoliet al.[25]

Bajentril AL, Veeranna N(2003) [17]studied that 2-5 years of tobacco smoking tends to a definite tendency to narrowing of both the large and small airways and significantly lowering lung function.

Ferris and Cotes showed a decrease in diffusing capacity in cigarette smokers and this was probably related to a lower pulmonary capillary blood volume in smokers compared with non-smokers.[26]

Kim WD (1985) studied that smokers have fewer alveolar attachments than non-smokers and that loss of alveolar attachments represents an early stage in the destruction of lung parenchyma.[27]

Chatterjee S, Nag SK et al.(1988)[28] studied on 334 healthy male non-smokers and 300 healthy male smokers of the age range of 20-60 years and found that value of PEFR is significantly lower in smokers than non-smokers.[28]

V. Conclusion

Therefore, it is concluded that the value of Peak Expiratory Flow Rate is lower in smokers than non-smokers. Lower pulmonary function are associated with greater risk for lung disease, cardiovascular disease, cancer and other disease.

So, aggressive tobacco control programme aimed to inform the public about the hazards of tobacco use and to provide restriction on the use of or purchase of tobacco must be started. This will be helpful to change policies towards tobacco use, in order to prevent tobacco induced morbidity and mortality.

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