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ORIGINAL ARTICLE

COMPARATIVE STUDY OF PULMONARY FUNCTION TEST BETWEEN SMOKERS AND NON-SMOKERS IN KOSI REGION OF BIHAR

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ABSTRACT: Smoking is well-known to cause respiratory disorders and pulmonary functions decline. Respiratory system evaluation and screening can easily be done by Pulmonary Function Tests. This study was carried out in the Kosi region, Katihar, Bihar, in 74 participants. Prior consent was obtained from the Ethical committee for this study. For this study, computerized spirometer, "RMS Helios 701"was used. In view of increasing behaviour of smoking among the people of Kosi region of Bihar, this study was undertaken for a better understanding of the correlation between smoking and its effects on pulmonary functions. It was observed that pulmonary function in mean ± standard deviation, FVC was 2.93±0.66 litres, FEV1 2.74±0.57 litres, FEV1 % was 94.19±7.37 and PEFR was 7.69±1.74 litres and FEF 25-75% was 4.08±1.15 litres. The pulmonary function tests in smoker population in mean ± standard deviation, FVC was 2.54±0.86 litres, FEV1 1.81±0.88 litres, FEV1 % was 74.83±31.43 and PEFR was 5.98±2.35 litres and FEF 25-75% was 2.95±1.31 litres. The comparison of PFT in non-smokers and smoker population was significant with "p" value <0.05, showing decreased pulmonary functions in smokers.

KEYWORDS: Smoking, Smokers, Non-smokers, pulmonary function test.

INTRODUCTION: It is an established fact that, inhalation of tobacco smokes either actively or passively is highly injurious to health. Consumption of tobacco has been very common among people, in the form of cigarette as well as bidi (Tobacco filled in Tendu; Diospyrys Melanoxylon or Diospyrus Ebenum, leaf in the shape of small cigarette). Tobacco has remained as one of the most important predisposing factors responsible for so many respiratory and cardiovascular diseases. Chronic Obstructive Pulmonary Disease (COPD) has been recognized as one of the most important causes of morbidity and mortality in chronic tobacco smokers all over the world.[1]

As Dr. Gro Harlem Brundtland (Former Director General of WHO and former prime minister of Norway) rightly said:

"A cigarette is the only consumer product which when used as directed, kills its consumer".

Tobacco kills more than five million people worldwide. Tobacco uses both in the smoking and non-smoking form is quite common in India; about 15% to over 50% men use tobacco in this country. Thus tobacco smoke related respiratory diseases like COPD, lung cancer etc., are increasing rapidly. Furthermore, tobacco consumption has a deleterious effect on the course of bronchial asthma, pulmonary tuberculosis, lung function and other lung diseases.[2] Moreover, there is accelerated decline in lung function, if airway obstruction already exists.[3]

Cigarette smoking produces inflammatory changes in small airways, especially in respiratory bronchioles. This leads to dilatation and destruction of small airways, characterized as emphysema.[4] The pulmonary damage induced by smoking acts slowly and may show no symptoms until pulmonary functions are lost.[5]

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In a population based of Delhi, the prevalence of bronchial asthma and allergic rhinitis was found to be higher than reported earlier from India. Smoking was one of the major risk factors for higher prevalence of bronchial asthma and allergic rhinitis.[6]

Smoking is well-known to cause respiratory disorders and pulmonary functions decline and when it co-exists with air pollution, the effects could be more harmful.

Tobacco smoking is widely prevalent all over the world and it continues to rise in developing countries. By 2030 the developing world is expected to have 7 million deaths annually from tobacco use.[7]

Respiratory system evaluation and screening can easily be done by Pulmonary Function Tests. It is an important and useful adjunct for correlation and evaluation of, the presenting complaint of patients like cough and dyspnoea, the imaging studies and pre and post treatment respiratory function status, as well as to identify patients with no or insignificant signs and symptoms of respiratory impairment.

In view of increasing behaviour of smoking among the people of Kosi region of Bihar, where a large population is migrant workers, with poor hygiene and low socioeconomic status, this study was undertaken for a better understanding of the correlation between smoking and its effects on pulmonary functions.

MATERIALS AND METHODS: This study was carried out in the Kosi region, Katihar, Bihar. Prior consent was obtained from the Ethical committee. Informed consent was taken from the 74 participants before performing the pulmonary function tests.

For this study, computerized spirometer, RMS Helios 701was used. For performing the spirometry, day time between 11.00 A.M. to 2.00 P.M. was chosen to avoid diurnal variations. Neither hot nor very cold day was selected to perform the tests.

Daily calibration of spirometer was done with a 3 litre syringe, before starting the tests. The weighing machine was also calibrated daily with a standard 10 kg weight.

Before performing the pulmonary function test, informed consent was taken from the subjects. A detailed history taking of the subject like name, age, sex, weight, height occupation, education, smoking habits, housing, present illness like asthma and epilepsy, past illness like accidents and surgery, allergy and psychotic disorders were asked. A complete general examination was done to rule out exclusion criteria.

SELECTION CRITERIA: Strict selection criteria were followed to select the sample size as mentioned below:

INCLUSION CRITERIA:

1. Informed consent from the subject.
2. Subjects in the age range between 30-70 years.
3. Nonsmokers from population of Kosi Region Katihar.
4. Smokers with present or past history of 10 years of smoking.

EXCLUSION CRITERIA:

1. Those subject who did not give consent.
2. Recent myocardial infarction less than one month old.

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3. Asthma and COPD subjects.
4. Chronic infections such as tuberculosis or other infections of lungs.
5. Subjects with respiratory symptoms such as cough.
6. Hemoptysis of unknown origin (forced expiratory maneuver may aggravate the underlying condition).
7. Pneumothorax.
8. Thoracic, abdominal, or cerebral aneurysms.
9. Recent eye surgery (e.g., cataract).
10. Presence of an acute disease process that might interfere with test performance (e.g., nausea, vomiting).
11. Previous accidents or surgery involving thorax or abdomen.
12. Subjects who were not able to give desired co-operation for the test procedure.

In the start of study screening questionnaires were asked to confirm the exclusion criteria but later, it was omitted as history taking and general examination sufficed the purpose of selection criteria. A detailed history taking and general examination was done to rule out exclusion criteria.

Before performing pulmonary function test, following points were ascertained that the

- Subject has not consumed alcohol within four hours.
- Has not smoked within one hour.
- Has worn comfortable clothing, not restricting chest and abdominal movements.
- Has not performed vigorous exercise within half an hour.

These subjects were advised to come on next day for test. The statistical analysis was done using the' z' test, assuming´ p'<0.05 as significant.

OBSERVATION: Observations are presented in tables and histograms.

I. Pulmonary Function Test (PFT) results in Kosi Region of Bihar.
   A. PFT results in nonsmoker population.

PFT results in Nonsmokers (n=24)		
Parameters	**Mean**	**Standard Deviation (SD)**
FVC (in litres)	2.93	0.66
FEV_1(in litres 1sec)	2.74	0.57
FEV_1% (percentage)	94.19	7.37
PEFR(in litres/min)	7.69	1.74
FEF_{25-75}% (in litres)	4.08	1.15

Table 1

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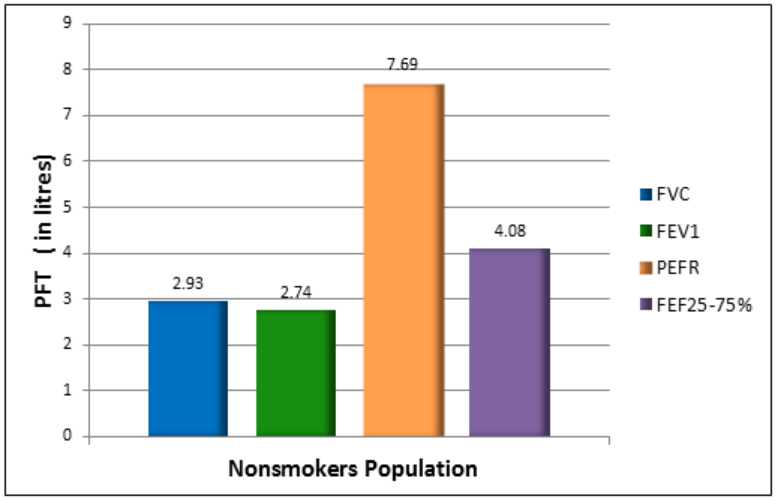

Chart 1

B. PFT results in smoker population.

PFT results in Smokers (n=50)		
Parameters	**Mean**	**Standard Deviation (SD)**
FVC (in litres)	2.54	0.86
FEV_1 (in litres 1sec)	1.81	0.88
FEV_1% (percentage)	74.83	31.43
PEFR (in litres/min)	5.98	2.35
FEF_{25-75}% (in litres)	2.95	1.31

Table 2

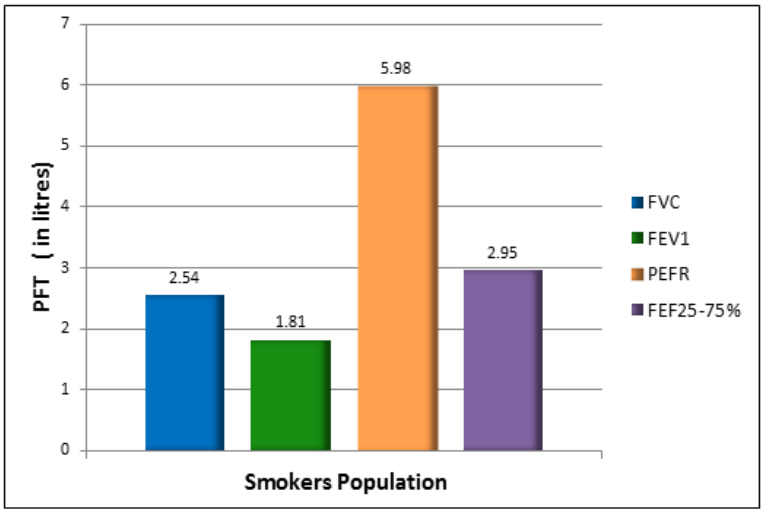

Chart 2

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C. Comparison of PFT in non-smokers and smokers population.

PFT	NON SMOKER MEAN±SD n=24	SMOKER MEAN±SD n=50	S.E.D (Standard error of difference between two means)	Z value	p value
FVC	2.93±0.66	2.54±0.86	0.15	2.6	<0.05 significant
FEV_1	2.74±0.57	1.81±0.88	0.15	6.2	<0.05 significant
FEV_1%	94.19±7.37	74.83±31.43	4.69	4.12	<0.05 significant
PEFR	7.69±1.74	5.98±2.35	0.48	3.56	<0.05 significant
FEF_{25-75}%	4.08±1.15	2.95±1.31	0.28	4.03	<0.05 significant

Table 3

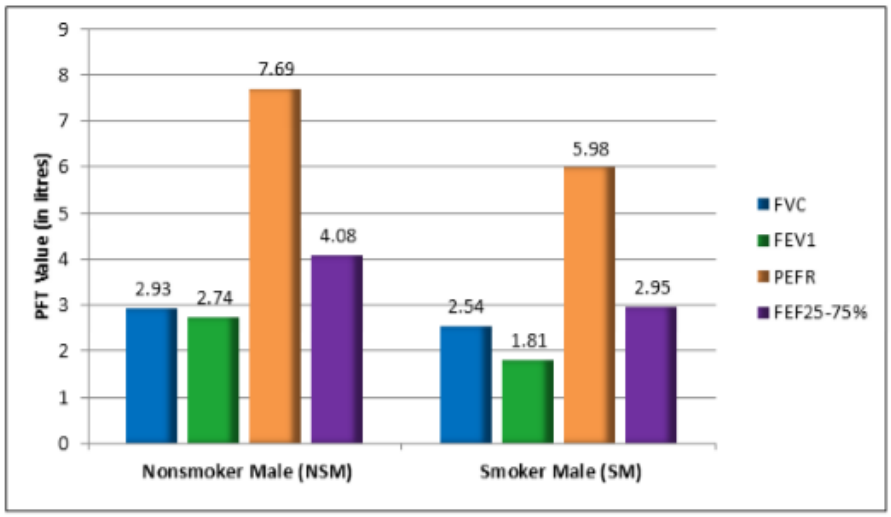

Chart 3

Table 1 and chart 1shows pulmonary function tests in nonsmokers with different parameters, in mean±standard deviation. FVC was 2.93±0.66 litres, FEV1 2.74±0.57 litres, FEV1% was 94.19±7.37 and PEFR was 7.69±1.74 litres and FEF 25-75% was 4.08 ± 1.15 litres.

Table 2 and chart 2 shows pulmonary function tests in smoker population with different parameters, in mean ± standard deviation. FVC was 2.54± 0.86 litres, FEV1 1.81±0.88 litres, FEV1 % was 74.83±31.43 and PEFR was 5.98±2.35 litres and FEF 25-75% was 2.95±1.31 litres.

Table 3 and chart 3 shows the comparison of PFT in non-smokers and smoker population. Data of comparative study was significant with "p" value <0.05.

DISCUSSION: This study included data on 74 subjects in the age group of 30-70 years with 24 nonsmokers and 50 smokers. The study observed decreased pulmonary functions in smoker population compared to the non-smoker population.

It is showed in Table 3.that there were statistically significant changes in pulmonary function ("p" value <0.05) between smokers and nonsmoker population.

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Smoking is well-known to cause respiratory disorders and pulmonary functions decline and when it co-exists with air pollution, the effects could be more harmful.

Tobacco smoking is widely prevalent all over the world and it continues to rise in developing countries. By 2030 the developing world is expected to have 7 million deaths annually from tobacco use.[7]

Nearly 17% of smokers of the world live in India. As per the World Health Organization 1993 tobacco alert report, 900 billion bidi sticks are smoked per year in India alone. The national family health survey 2005-2006 reported 29.0% men and 8.9% women smokers, in state of Bihar, India. Cigarette smoking predominates in urban areas, where bidi smoking is the commonest type of smoking in the lower income groups of illiterate and less educated people.[8]

Smokers have higher prevalence of lung function abnormalities and respiratory symptoms and higher death rates as compared to nonsmokers.

The study by Jindal et.al, showed the prevalence of COPD from four different parts of India as 4.1% and smoker to nonsmoker ratio of 2.65:1. The study by Mhase and Reddy showed lower value of FVC, FEV_1 and MEFR (FEF 25-75%) in smokers as compared to nonsmokers.[9]

A dose response relationship was found between smoking and lower levels of FEV_1 /FVC and FEF. 25-75% Smoking 15 cigarettes or more per day, as compared with never smoking was associated with a reduction in FEF25-75% of 4% in boys and 3.2% in girls by a study by Diane Gold, Xiaobin Wang et.al.[10]

Cigarette smoking produces inflammatory changes in small airways, especially respiratory bronchioles leading to dilatation and destruction of the small airways. Unfortunately, the pulmonary damage induced by smoking acts slowly and may not show symptoms until pulmonary functions are.[11] The spirometry is a valuable tool to identify these subjects.

Studies showed higher incidence of asthma in smokers due to sensitivity to specific airborne agents and possibly due to overall high IgE level in smokers.[12]

The study by Vaidya et.al, showed a lower pulmonary function parameters in smokers as compared to nonsmokers, while in ex- smokers, the PFT values were better than in smokers but less than nonsmokers.[13] FEV1 was significantly lower than nonsmokers, but not much lower than ex-smokers. The FEF 25-75% was also significantly reduced in smokers but FVC showed no significant difference.

While in the study by Mohammad et al. showed lower PFT values in smokers in comparison to nonsmokers except MEF 25% (FEF 25%) the relationships between quantities of smoking were not significant.[14]

The tobacco use in state of Bihar, India has generally been reported to be high. Bihar is the third populous state of India and the study by Sinha et.al, conducted in school personnel, showed tobacco use in 77% men and women.[15]

In an another study by Sinha et.al, in 9097 individuals in Sitamrhi district of Bihar showed the overall tobacco use by adults (15 years and older) as high as 74% for males and 45% for females. This included 42.6% smokeless tobacco users and 31.6% smokers in males and in females as 21.7% smokeless tobacco users and 23.4% tobacco smokers.[16] The study showed a significant association between the type of tobacco habit and socioeconomic status for both men and women. Interestingly as the socioeconomic status increased the prevalence of smokeless tobacco use increased and of smoking decreased.

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Smokers are not only the cause of health problems for themselves, but also by producing environmental tobacco smoke, they impose dangers for others. Environmental tobacco smoke constitutes a common problem in many countries.

Today, passive smoking, or Environmental Tobacco Smoke (ETS) exposure, is an important health concern worldwide.

The study by Bhargava and Khaliq showed that the lung volumes and capacities of active smokers and passive smokers both were significantly lower than nonsmokers.[17] Results showed a lower vital capacity (VC), tidal volume (TV), expiratory reserve volume (ERV) and maximum ventilatory volume (MVV) in both active and passive smokers as compared to nonsmokers. However, these were significant only for VC ($p = 0.031$) and ERV ($p = 0.007$) in active smokers. The inspiratory reserve volume (IRV), inspiratory capacity (IC), forced vital capacity (FVC) and forced expiratory volume in the 1st second (FEV_1), were not significantly different in the three groups. However, passive smokers had significantly lower FEV_1/FVC values ($p = 0.021$) as compared to non-smokers.

The study by Padmavathy K.M. at Chennai, India, showed significantly reduced FEV1, PEFR and FEF25-75% in beedi smokers than cigarette smokers. The 'p' value was less than 0.001.[18]

Our study was similar to the various studies done previously in Indian as well as Foreign studies and revealed that a detailed pulmonary function assessment is required in Kosi Region of Bihar where prevalence of smoking is higher. The role of conditions like low socioeconomic status, malnutrition, pollution and other factors in affecting pulmonary function need to be evaluated.

CONCLUSION: There was significant decreased pulmonary function in the smoker population in comparison to the non-smoker population. Further study for the role of other factors affecting pulmonary function is required.

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