



## THE STUDY OF PULMONARY FUNCTION TESTS AMONG SMOKERS AND NON-SMOKERS OF MIDDLE AGE GROUP IN TERTIARY CARE HOSPITAL IN MADHUBANI DISTRICT OF BIHAR, INDIA.

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**ABSTRACT** **Background:** The UN health agency reports that about 4.9 million people die each year across the globe due to cigarette smoking. Cigarettes kill an estimated 5 million people annually world-wide. By the early 2030, tobacco related death would increase to about 10 million a year. Tobacco smoking rates have decreased in industrialized countries since 1975, but there has been a corresponding 50% increase in smoking rates in low-income countries.

**Aims And Objective:** To study the differences in pulmonary function test values in smokers and non-smokers and their variation.

**Methods And Material-** The study population comprised smoker group and non-smoker group and was carried out in the department of TB & Chest and Respiratory Medicine at Madhubani Medical College, Madhubani, Bihar from July 2018 to December 2019 by using computerized spirometer in 120 male subjects comprising of 60 smokers and 60 non-smokers.

**Result:** Almost all the pulmonary function parameters were significantly reduced in smokers and obstructive pulmonary impairment was commonest. The observed value of pulmonary functions in mean  $\pm$  standard deviation, FVC was  $2.98 \pm 1.06$  litres, FEV1 was  $2.48 \pm 1.02$  litres, FEV1 % was  $83.93 \pm 23.98$ , PEFR was  $5.30 \pm 3.46$  litres/minute and FEF 25-75% was  $2.99 \pm 2.02$  litres. The observed value of pulmonary functions in rural non-smoker population in mean  $\pm$  standard deviation, FVC was  $3.13 \pm 0.98$  litres, FEV1 was  $2.81 \pm 0.86$  litres, FEV1% was  $89.49 \pm 10.54$ , PEFR was  $6.80 \pm 3.44$  litres/minute, and FEF-2575% was  $3.59 \pm 1.74$  litres.

**Conclusion:** There was significant decrease in pulmonary function in the rural smoker population in comparison to the non-smoker population.

**KEYWORDS :** Smoker, Pulmonary functions test and Spirometry.

### INTRODUCTION:

The World Health Organization (WHO) reported that tobacco smoking killed 100 million people worldwide in the 20<sup>th</sup> Centuries and warned that it could kill one billion people around the world in the 21<sup>st</sup> Century [1]. By the early 2030, tobacco related death would increase to about 10 million a year [2]. Tobacco has remained as one of the most important predisposing factors responsible for so many respiratory and cardiovascular diseases. Tobacco smoking is an intentionally invited health hazards. Smoking leads to rapid decline in pulmonary function test. (PFTs) [3]. Chronic obstructive Pulmonary Disease (COPD) has been recognized as one of the most important causes of morbidity and mortality in chronic tobacco smokers worldwide [4]. Tobacco is the biggest external cause of non-communicable disease and is responsible for more deaths than adiposity, both in high income countries and globally [5, 6]. Tobacco smoking is an intentionally invited Health hazards. The U.N Health agency reports that about 4.9 million people die each year across the globe due to cigarette smoking [7]. The overall death rate for male smokers is 70% greater than that for male non-smokers. In United States 4.40,000 premature deaths are attributed to tobacco smoking trends are reversed, the figure expected to rise to 10 million deaths per year by 2020 or early 2030 with 70% of those death occurring in developing countries [8].

Tobacco contains number of substances which may exert some effects upon body. During burning of tobacco in cigarettes, various processes such as pyrolysis, Prosynthesis, Distillation, sublimation, hydrogenation, oxidation, decarboxylation, dehydration result in generation more than 4000 identifiable compounds present in tobacco itself or new compound generated thereof. The smoke is composed of fine aerosol with a particle size distribution predominantly in the range to deposit in the airways and alveolar surface of lung and vapour phase. They include particles of smoke dust which disturb the function of respiratory airways. Tars which exert an irritant effect upon bronchial epithelium (tar is the aggregate of particular matter after subtracting nicotine and moisture) and nicotine which increases heart rate and elevate systolic blood pressure. The tobacco smoke inhalation causes an immediate rise in the airway resistant which persists for at least an hour. This is due to vagally mediated smooth muscle constriction presumably by way of stimulating sub mucosal irritant receptors. Experimental studies have shown that prolonged cigarette smoking impairs ciliary movements, inhibition of function of alveolar macrophages, leads to hypertrophy and hyperplasia of mucus secreting

glands. It is probable that smoke also inhibits anti-proteases and causes polymorphonuclear leucocytes to release proteolytic enzymes acutely. Cigarette smoking is by far the most important risk factor for COPD and most important that tobacco contributes risk of COPD. [9]

### AIMS AND OBJECTIVE:

1. To study the differences in pulmonary function test values in smokers and non-smokers and their variation from other reported values for smokers by other studies.
2. To use pulmonary functions test as a tool to identify the quantum of damage to the respiratory tree

### MATERIAL AND METHODS:

The study was carried out in the department of TB & Chest and Respiratory Medicine at Madhubani Medical College, Madhubani, Bihar from July 2018 to December 2019 by using computerized RMS Med-Spirometer, weighing machine, measuring tape, blood pressure set and stethoscope in 120 male subjects comprising of 60 smokers and 60 non-smokers. The test was done between 10:00 a.m. to 05:00 p.m. to avoid diurnal variation. The subjects selected for present study were recruited from medical outpatient department at our institution. Prior consent was obtained from ethical committee. Informed consent was taken from the study participants before performing the pulmonary function tests. For this study computerized spirometer, RMS Helios 701 with a flow range of  $\pm 14$  litres per second with overall accuracy of  $\pm 1\%$  using standard 3 litres calibration syringe was used.

### Classification Criteria As Suggested By WHO (1998) [10]

#### Smoker:

Someone who, at the time of the study, smokes any tobacco product either daily or occasionally.

#### Non-smoker:

Someone who, at the time of the study, does not smoke at all.

#### Ex-smoker:

Someone who was formerly a daily or occasional smoker but currently does not smoke at all.

In this study a detailed record of smoking with reference to duration of smoking (in years) and number of cigarettes / bidis smoked per day was taken. None of individuals smoked tobacco in any form other than

bidis or cigarettes. To evaluate dose and duration response relationship, quantification of tobacco smoking was performed by calculating smoking index for smokers.

**Smoking Index:**

The Smoking index for an individual was equal to multiplication of the average number of cigarettes/bidis smoked per day and duration (in years) of tobacco smoking. Further, smokers were classified as per exposure level, on the basis of smoking index criteria [11, 12].

Habit	Smoking Index (Frequency x duration)
Non-smokers	0
Light smokers	1-100
Moderate smokers	101-200
Heavy smokers	more than 200

**Procedure of Spirometry:**

The subject was asked to sit comfortably in a chair. The complete procedure was explained, all doubts if any are cleared. Subject was instructed to breathe in fully by deep inspiration with nostrils closed. Seal the lips around the sterile mouthpiece of spirometer and forcefully expire the air out, as fast and as far as possible. Best of three readings was recorded and interpreted.

**SELECTION CRITERIA:**

Selection criteria for non-smoker controls for the control group, 50 healthy non-smoker males belonging to almost same age and matching other characteristics with no history of smoking of any type. It was ensured that none of them had any significant present or past history of sickness particularly of the respiratory system.

**1. Non Smokers:** According to definition non-smoker is a Person who does not smoke tobacco [13]. A passive smoker refers to exposure to tobacco consumption products from smoking of others [14].

**2. Cigarette Smokers:** They are persons who are engaged in the inhalation and exhalation of fumes of burning tobacco in cigarettes. By definition cigarette smokers are the person who inhale, exhale and burn or carry any lightened cigarette. Every smoker must have been smoked at least five cigarettes a day for a period of more than 10 years and subjects who did not smoke at all were included in non-smokers group.

**Exclusion Criteria:**

(1) Asthma and COPD Patients (2) Chronic infections such as TB or other infections of lungs (3) Recent MI less than one month old (4) Subjects with respiratory symptoms such as cough (5) Presence of an acute disease process that might interfere with test performance (e.g. Nausea, Vomiting etc.) (6) Subject has not performed vigorous exercise within half an hour (7) Subject has not smoked within an hour (8) Subject has not consumed alcohol within four hours (9) Females were not included in this study (10) The person who worked in textile mills or other places where lungs are affected by dust or fumes (11) The person who were morbid or full-fledged picture of cor-pulmonale on clinical examination.

A detailed history and general examination was done to rule out exclusion criteria before performing pulmonary function test. Each person was allowed to rest for about two minutes before the actual test. The details of the test were explained and demonstrated to each of them. All the measurements were recorded with the subject in standing position and wearing nose clips [15].

**Statistical Analysis:**

The data is expressed in mean ±S.D. Standard error of difference between two means z value and p value. Comparison between the two groups was done using the z test taking p value < 0.05 as significant. Results were analysed by statistical methods like percentages, chi square test and t-test of significance.

**RESULT:**

**Table 1: Physical Characteristics of Smokers and Non-Smokers**

Variables	Smokers Mean ±2 S.D	Non-Smokers Mean ±2 S.D
Age (Years)	48.26 ± 10.09	48.10 ± 10.54
Height (m)	1.66 ± 0.11	1.67 ± 0.12
Weight (Kg)	65.4 ± 8.8	64.4 ± 11.5
Body Mass Index (BMI)	23.52 ± 3.20	23.80 ± 3.37

Body surface area (m <sup>2</sup> )	1.71 ± 0.06	1.74 ± 0.14
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**Table-1:** shows the present study of the age range of subjects was 30-60 years with mean age 48.26 years in smokers and 48.10 years in non-smokers. There was no significant difference in the means of other physical parameters like height, weight, body mass index and body surface area in smokers and non-smokers.

**Table-2: Distribution Of Grade Of Smoking In Smokers.**

Grade of smoker	Number of smokers	Percentage%
Light smoker	33	42.0
Moderate smoker	18	32.0
Heavy smoker	9	26.0
Total	60	100.0

The distribution of grade of smoking is shown in table 2. Light smokers were commonest (42.0%), followed by moderate (32.0%) and heavy smokers (26.0%).

**Table-3: Type Of Tobacco Smoking In Smokers**

Type of smoking	No.	Percentage (%)
Only Bidi	34	62.0
Both Cigarette/ Bidi	15	24.0
Only Cigarette	11	14.0
TOTAL	60	100.0

Table-3, shows the present study, Bidi smoking was most common (62.0%), followed by both cigarette and Bidi smoking (24.0%) and only cigarette smoking (14.0%) in smokers.

**Table 4: Pulmonary Function Tests Among Smokers And Non-Smokers.**

Pulmonary Function Tests (PFTs)	Smokers Mean ± 2 S.D	Smokers Mean ± 2 S.D	Significance P value
FVC	2.98 ± 1.06	3.13 ± 0.98	0.032
FEV <sub>1</sub>	2.48 ± 1.02	2.81 ± 0.86	0.000
FEV <sub>1</sub> /FVC	83.93 ± 23.98	89.49 ± 10.54	0.003
PEFR	5.30 ± 3.46	6.80 ± 3.44	0.000
FEF <sub>25-75%</sub>	2.99 ± 2.02	3.59 ± 1.74	0.001
MVV	86.1 ± 44.22	103.6 ± 33.66	0.000

**Table-4** - shows the mean values of all the pulmonary function tests are significantly reduced in smokers compared to non-smokers. The association of impaired PFTs in smokers was found to be statistically highly significant by applying unpaired t test of significance.

Cigarette smokers have higher prevalence of respiratory symptoms, pulmonary function abnormality and greater annual rate of decline in FEV and greater COPD mortality rate than non-smokers. The ratio of FEV to FVC is significantly reduced in smokers. Smoking leads to rapid decline in pulmonary function test specially those indicating diameters of airways such as forced expiratory flow in one second (FEV). Even in teenagers who have smoked only for few years, maximum expiratory flow volume curves demonstrate decrease in flow rate at small lung volumes yet another expression of airway obstruction.

Almost all the pulmonary function parameters were significantly reduced in smokers and obstructive pulmonary impairment was commonest. The observed value of pulmonary functions in mean± standard deviation, FVC was 2.98 ± 1.06 litres, FEV1 was 2.48 ± 1.02 litres, FEV1 % was 83.93±23.98, PEFR was 5.30±3.46 litres/minute and FEF<sub>25-75%</sub> was 2.99±2.02 litres. The observed value of pulmonary functions in rural non-smoker population in mean± standard deviation, FVC was 3.13±0.98 litres, FEV1 was 2.81±0.86 litres, FEV1% was 89.49±10.54, PEFR was 6.80±3.44 litres/minute, and FEF<sub>25-75%</sub> was 3.59±1.74 litres.

**DISCUSSION:**

There was no significant difference in the mean physical parameters like age, height, weight, body mass index and body surface area by calculating mean and standard deviation in smokers and non-smokers thereby showing proper matching of smokers and non-smokers (Table 1). Most of the smokers smoked only Bidi (62.0%) followed by both cigarette and Bidi mixed (24.0%) and only cigarettes (14.0%). None of individuals smoked tobacco in any form other than bidis or cigarettes. All Pulmonary function parameters like FVC, FEV1, FEV1 /FVC, PEFR, FEF<sub>25-75%</sub> and MVV showed statistically highly significant

association between smokers and non-smokers by applying unpaired t-test of significance ( $p < 0.001$ ). Similar, observations showing lung function impairment in smokers were reported by Burrows et al [16], Pandya et al [17], Dhand et al [18], Gosavi et al [19] and Gupta et al [20]. However, several researchers like Angelo [21], Malo [22] and Indian workers Gupta et al [23] and Mahajan et al [24] observed that there was no change in FVC in smokers and non-smokers.

### CONCLUSION:

Pulmonary function test were markedly lower with increasing age in smokers compare to that in non-smokers. There is decline in all parameters of pulmonary function tests when there is an increase in number of cigarettes smoked per day as well as increase duration of smoking. This suggests that severity of COPD directly proportional to number of cigarettes smoked per day and duration of smoking. Finally it may be concluded that smoking causes definite pulmonary function impairments specially the obstructive type.

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