

# Comparison of Forced Expiratory Volume in One Second (FEV<sub>1</sub>) between Smoker and Non Smoker Doctors

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## Abstract

Aim of this study was to compare the forced expiratory volume in one second (FEV<sub>1</sub>) in smoker vs. non smoker doctors. **Material and Methods:** Individuals were divided into two equal and matched groups of fifty each. Their ages ranged between 27 to 57 years with an average of 18.2 pack years of smoking. Individuals with history of pulmonary, cardiac, musculoskeletal, neurological or any systemic disease which could decline lung functions were excluded. Moderate smoking was defined as cigarette smoking of 10 pack years. Desktop Spirometer (Geratherm respiratory GmbH) was used in the study and GOLD criteria of COPD was applied to detect the abnormalities. **Results:** Mean Age of individuals was  $37.65 \pm 7.16$  years

and mean ( $\pm$ SD) height was  $174.33 \pm 7.54$  centimeters. FEV<sub>1</sub> was normal in 32 (32 %) subjects out of 100 (n=100), out of which 06 were smokers and 26 were non smokers. Signs of airway obstruction (FEV<sub>1</sub> < 80% predicted) were found in 68 (68%) subjects, among whom 44 subjects were smokers and 24 were non-smoker. Smokers had a history of 10 to 41 pack years of smoking with a mean of 18.2 pack years. P-value was calculated using Chi-square test, which turned out to be 0.00 **Conclusion:** The prevalence of persistent air flow obstruction is high in asymptomatic smokers. A low FEV<sub>1</sub> in an asymptomatic smoker indicates individual with high risk of developing COPD. **Key Words:** Forced Expiratory Volume in one second, COPD, Smoking

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## INTRODUCTION

Smoking is a pernicious scourge of the world today.<sup>1</sup> It is addictive and harmful to health, people usually start smoking in the adolescence and they become addicted due to the pharmacological properties of nicotine. Smoking usually begins for psychosocial reasons, such as parental smoking, curiosity, peer pressure, rebelliousness and assertion of independence; once it becomes regular the pharmacological properties of nicotine are a major influence on the persistence of the habit. Russel<sup>2</sup> et al showed that cigarette smoking is probably the most addictive and dependence producing form of object specific self gratification known to human beings. London drug users rated tobacco as their most needed drug, more than heroin, methadone, amphetamine, LSD or Alcohol<sup>3</sup>. In the UK, 28% of men and women aged 16 years and above smoke, compared to 22% of adults in the USA.<sup>4</sup> Smoking is on the increase in many developing countries. National health survey of Pakistan showed

that the highest prevalence of cigarette smoking was among young and middle aged males (25-44y), which was 48.6%. After this age, there was decline in the smoking habits among males in Punjab and Khyber pakhtunkhwa. In 2000, there was an estimated 4.8 million premature deaths in the world attributable to smoking, 2.4 million occurred in developing countries and 02 million in the industrialized countries. The leading cause of death from smoking was cardiovascular diseases (1.7 million deaths), chronic obstructive pulmonary disease and lung cancer<sup>5</sup>. Smokers die 5-8 years earlier than never smokers; they have twice the risk of fatal heart disease, 10 times the risk of lung cancer and several times the risk of cancers of mouth, throat esophagus, pancreas, kidney, bladder and cervix. They have a two to three fold higher incidence of stroke and peptic ulcer.<sup>6</sup>

Assessment of pulmonary function testing plays a central role in every day practice of the pulmonary physician. New patients are diagnosed and graded in

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severity on the basis of results from these tests and the course of the disease in previously diagnosed patients is judged with the help of lung function measurements. Because of its ease of measurement and its very good reproducibility, the forced expiratory volume in one second (FEV1) is most widely used and quoted lung function test in clinical practice, as well as in patient based research.

At any given time in adulthood, FEV1 is determined by three factors: (1) the maximally attained level of lung function during early adulthood; (2) the onset of decline of lung function or, alternatively, the duration of plateau phase; and (3) the rate of decline of lung function. The average yearly decline from 25 years of age is assumed to be 29 ml/year for men and 25ml/year for women<sup>7</sup>.

Smoking affects all three factors that determine the level of FEV1 at any given time-namely, the maximal FEV1 attained, the time of onset of decline and the rate of decline. The influence of environmental tobacco smoke begins in utero and has been convincingly documented in infancy. Active smoking has its effect on lung function within a few years of taking up the habit in adolescents. It affects both the level and rate of growth of lung. As a consequence due to smoking during adolescence a lower maximum peak level of FEV1 is achieved. Tager and colleagues estimated that FEV1 was on average, 390ml lower for boys who smoked as compared to non smokers<sup>8</sup>.

Several authors have shown that smoking shortens the plateau phase of FEV1. The third factor which determines the FEV1 is the rate of decline after the plateau phase. This factor has traditionally received the most attention. Fletcher and colleagues were probably the first to look longitudinally at the effect of smoking on the level and decline of lung function in their landmark study of London workers<sup>9</sup>. They documented that smokers had a steeper decline in FEV1 than non-smokers, and also that only a small percentage of smokers develop clinically manifest obstructive lung disease with much more loss of lung function, the so-called susceptible smokers. Subjects who already have some airway obstruction were found to be the ones most at risk for subsequent accelerated decline, for which they coined the term "horse racing effect". Soon after the publication of these findings, came several other large epidemiological studies all documenting detrimental effects of smoking on the decline in FEV1.

Important observations have been reported in the studies which document a dose response relationship of smoking on the rate of decline of pulmonary functions, the effect being higher with more cigarettes, more years, or more pack years smoked.

Smoking cessation has been shown in many studies to result in normalization of decline in FEV1 to the rate of never smokers and this has recently been confirmed in a large scale intervention study.

There is, to date, little clarity on sex differences in the susceptibility to cigarette smoke, with similar number of studies reporting that men are more susceptible and others reporting that women are more vulnerable.

It has long been shown that smoking both active and passive has a negative influence on lung functions; particularly cigarette smoke has influence on all three determinants of FEV1 at any given time during adult life, the peak achieved during early adulthood, the duration of ensuing early adulthood plateau phase, and the rate of subsequent decline. On average, moderate to heavy male smokers roughly have a 15ml/year greater decline in lung function than non-smokers.

## METHODS

This was a comparative cross sectional study carried out medical unit III Allied Hospital Faisalabad. 100 male doctors were included using non-probability convenience sampling. They were divided in two equal and matched groups of fifty each. Individuals with history of pulmonary, cardiac, musculoskeletal, neurological or any systemic disease which could affect lung functions were excluded. Study was based on the hypothesis that asymptomatic smokers are apparently in good state of health but they may still have more decline of FEV1 as compared to non-smokers for that age group and it might cause them health problems later in their life. The objective of this study was to compare the FEV1 among asymptomatic moderate smoker doctors and a matched group of non-smoker doctors. Moderate smoking for the purpose of study, was defined as cigarette smoking of 10 pack years. Pack year was calculated using the following formula:

Pack years = cigarettes smoked per day × years smoked / 20.

Informed consent was obtained from each participant and approval of hospital ethical committee was obtained. A Performa was filled for each participant and Forced expiratory volume in one

second (FEV1) was measured using spirositik complete desktop Spirometer (Geratherm respiratory GmbH). Predicted values depend upon age and height. Best FEV1 was obtained after three efforts. These results were compared with reference values for Asians. GOLD criteria of COPD were applied to detect the abnormalities and were interpreted as follows.

Stage	Severity	FEV1/FVC	Findings
Stage I	Mild COPD	FEV1/FVC<0.70	FEV <sub>1</sub> ≥ 80% of normal
Stage II	Moderate COPD	FEV1/FVC<0.70	FEV <sub>1</sub> 50-79% of normal
Stage III	Severe COPD	FEV1/FVC<0.70	FEV <sub>1</sub> 30-49% of normal
Stage IV	Very Severe COPD	FEV1/FVC<0.70	FEV <sub>1</sub> <30% of normal, or <50% of normal with chronic respiratory failure present

## RESULTS

A total of 100 subjects were included in the study, 50 smokers and 50 non-smokers. FEV1 was measured in all the participants using spirositik complete desktop spirometer. Only males were included with the mean ( $\pm$  SD) age of  $37.65 \pm 7.16$  years and mean ( $\pm$  SD) height  $174.33 \pm 7.54$  centimeters. Character of study subject are given in Table-1 are shown in the Table.

**Table-1**  
**Demography of study objects**

Parameters of patients	Minimum		Maximum		Mean	
	S	NS	S	NS	S	NS
Age( years)	27	23	57	49	40.7 $\pm$ 06.81	34.5 $\pm$ 07.52
Height(cms)	160	156	186	190	176.19 $\pm$ 5.68	173.7 $\pm$ 7.89
Weight(kgs)	68	56	108	110	86.4 $\pm$ 09.83	80.38 $\pm$ 11.76
% FEV1	34	53	81	90	61.8 $\pm$ 13.59	80.06 $\pm$ 11.81

FEV1 was normal in 32 (32 %) subjects out of 100 (n=100). 06 were smokers and 26 were non smokers. Signs of airway obstruction (FEV1 < 80% predicted) were found in 68 (68%) subjects, among than 44 subjects were smokers and 24 were non-smokers as shown in Table 2. Smokers had a history of 10 to 41

pack years of smoking with a mean of 18.2 pack years. Chi-square test was applied on the data and p-value turned out to be 0.00, which is significant.

**Table-2**  
**Grouping of patients according to gold criteria smokers vs non-smokers**

FEV <sub>1</sub>		Group		Total
		Non-Smoker	Smoker	
Mild	80-100%	26	06	32
Modrate	50-79%	23	38	61
Severe	30-49%	1	06	07
Total		50	50	100

## DISCUSSION

We studied a population of doctors, we measured FEV1 in 50 smoker doctors and matched group of non-smoker doctors. The prevalence of previously undetected airflow obstruction was measured according to Global initiative Of Lung Diseases (GOLD) criteria. It was found that 44 smokers had moderate to severe airflow obstruction as compared to 24 non smokers. Similar study carried out in the Department of Medicine, Military Hospital Rawalpindi<sup>10</sup> showed that 16 out of 100 smokers had mild obstructive air way diseases compared to only one non smoker who had mild obstructive air way disease. This study was a cross sectional study and the readings were taken at a single point in time for each individual. Most of the international landmark trials were longitudinal prospective studies in which multiple readings were taken at different points in time. The data of these studies is more robust and reliable as compared to this cross sectional study. The famous London study done by Fletcher et al<sup>11</sup> showed that there was an average 36ml/yr decline in FEV1 in non smokers where as this decline was 54 ml/yr in smokers( 20 cigarette/day).

In another study by Tashkin et al<sup>12</sup> similar results were seen. The decline in FEV1 in non-smoker males was 56 ml/yr & in smoker males this decline was 70 ml/yr. Tager et al<sup>13</sup> showed that the average FEV1 decline in less than 40 yr old non-smoker was 20ml/yr as compared to 40ml/yr in 33-43 yr old smokers. Lange et al<sup>14</sup> showed that in their 05 year follow up study the average FEV1 decline in less than 55 years old non-smokers was 21

ml/yr and the decline in age matched smokers was 35 ml/yr.

All these studies point to one conclusion that is, smoking results in a rapid decline of FEV1 even in asymptomatic smokers. Our study shows the same conclusions. Cigarette smokers have diverse effects on structure and function of lungs. The effects of smoking on lung function are not evident at a younger age but become prominent with the increasing age and increasing pack years of smoking. The decline of FEV1 is seen maximum in current smokers. It is intermediate in former smokers and is least in non-smokers<sup>15</sup>.

Lung health study (LHS) was the first study which showed that early intervention in smokers identified to be at risk of developing COPD could change the natural history of disease. It recommended spirometry test for patients over 45 years presenting with a history of smoking for early detection of COPD. Both LHS and national health & nutritional examination survey III (NHANES III)<sup>16</sup> have shown the ability of spirometry to detect mild obstruction in asymptomatic smokers. These studies also showed if these smokers participated in a smoking cessation programme, the rate of decline of their FEV1 was reduced significantly as compared to those who continued to smoke.

## CONCLUSION

The prevalence of persistent air flow obstruction is high in asymptomatic smokers. A low FEV1 in an asymptomatic smoker indicates individual with high risk of developing COPD. If these individuals are identified early by screening programmes, then smoking cessation programmes at an earlier stage can modify the outcome of disease process and reduce the financial burden on the health care system.

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