

## Original Research Article

DOI: <https://dx.doi.org/10.18203/2394-6040.ijcmph20220255>

# Study of Peak Expiratory Flow Rate in young smokers in community

Bosky M. Mehta<sup>1\*</sup>, Kalpesh Satani<sup>2</sup>

<sup>1</sup>Department of Physiotherapy, Apollo Institute of Physiotherapy, Ahmedabad, Gujarat, India

<sup>2</sup>Department of Physiotherapy, College of Physiotherapy, Sumandeep Vidhyapeeth, Vadodara, Gujarat, India

Received: 14 December 2021

Accepted: 03 January 2022

**\*Correspondence:**

Dr. Bosky M. Mehta,

E-mail: mehtabosky89@gmail.com

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## ABSTRACT

**Background:** Inhaling of cigarette smoke has sudden effect on airways which causes an inflammation in the peripheral airways. Pulmonary function testing (PFT) provides a quantitative and objective assessment of the physiological derangement associated with pulmonary diseases. A study of PEFR in smokers and non-smokers would provide the necessary data to correlate smoking and the effect on the pulmonary health of smokers. Objectives were to study the effect of smoking on lung functions in apparently healthy young smokers and to measure the PEFR and compare the values between young smokers and non-smokers in the villages surrounding Vadodara District, Gujarat.

**Methods:** It was a cross-sectional comparative study. With convenient sampling of total 60 male subjects which are equally divided into smokers (group A) and non-smokers (group B) group between the ages 17-25 years. The PEFR was measured by Wright's Mini PulmoPeak Flow Meter. Three readings were taken and best of three was documented. Comparison of PEFR values between smokers and non-smokers was done.

**Results:** The mean PEFR between smokers and non-smokers was group A is 310.00 and group B was 440.00 litres/minute (p value <0.05) and the t value was 7.608 which shows that the PEFR of smokers is significantly lower than non-smokers.

**Conclusions:** The values of PEFR are reduced in smokers compared to non-smokers in young individuals in community and all the values are more decreased with increase in number of cigarettes smoke per day.

**Keywords:** Non-smokers, PEFR, Smokers

## INTRODUCTION

Smoking is an act of inhaling and exhaling the fumes of burning plant material. Tobacco was introduced to Eurasia in the late 17<sup>th</sup> century where it followed common trade routes.<sup>1</sup> ‘Smoking is injurious to health’ is written on all the tobacco containing products. Today, around the world, tobacco is one of the most widely distributed and commonly used drugs.<sup>2</sup> In our society, men are more anticipated to smoke than women.

Many smokers start smoking at younger age.<sup>2</sup> The several factors that lead students to smoke are cigarette advertisements, smoking by parents, siblings and friends.<sup>3</sup> In developing world, smoking is increasing rapidly and is one of the biggest hazards to current and future world health.<sup>4</sup> By 2030, if same situation continues, smoking

will kill more than 9 million people annually.<sup>5</sup> Smoking is responsible for 90% of chronic obstructive pulmonary diseases (COPD), chronic bronchitis, emphysema and lung cancer which can be totally crippling for a smoker.<sup>6</sup>

Inhaling of cigarette smoke has sudden effect on airways which causes an inflammation in the peripheral airways. This inflammation is due to migration of neutrophils, macrophages and T-lymphocytes which impairs the endothelial lining of the airways. Airway damage results in airway rearrangement which leads to airway remodelling. These changes in the airway appear to be most definite in the smaller peripheral airways. This results in hypertrophy of glands and goblet cells within the bronchial walls which produces excessive secretions, that is either partially or completely obstruct the airways. Decrease in the ciliary function and alterations in

physiochemical characteristics of bronchial secretions also impair airway clearance and results in airway obstruction. Damaged and inflamed mucosa shows an increased sensitivity of irritant receptors within the bronchial walls, which in turn cause bronchial hyperactivity. During inspiration, the lungs and the airways are drawn open, which increases the diameter of the lumen. During exhalation, the airway narrows from inflammation, remodelling and excessive secretions, causes premature closure of the airway, trapping air in the distal airways and air spaces. This air trapping is called hyperinflation, which is defined as an abnormal increase in the amount of air within the lung tissue.<sup>7</sup>

The diagnosis of COPD in smokers at an early stage of the diseases may be done by performing spirometry tests because these obstructions in airways invariably affect the parameters of pulmonary function e.g., FVC, FEV<sub>1</sub> and peak expiratory flow rate (PEFR).<sup>8,9</sup>

Pulmonary function testing (PFT) provides a quantitative and objective assessment of the physiological derangement associated with pulmonary diseases. It assesses ventilatory functions of lungs which is the main function of human lungs by measuring FEV<sub>1</sub> and PEFR in these patients.<sup>10</sup>

A simple but important test is to measure the maximal airflow rate achieved while forcefully expelling air from the lungs, following maximal inspiration.<sup>11</sup> This is called PEFR. Narrowing of the airways reduces the ability to move air in and out of the lungs. The narrower the tubes, the lower will be the PEFR.<sup>12</sup> 50% of smokers develop clinically significant airflow obstruction.<sup>13</sup>

PEFR is generally considered as a key indicator of changes in elastic recoil pressure and/or inflammatory change in the bronchiolar walls.<sup>14</sup> If a cigarette smoker stops smoking, PEFR improves with the passage of time.<sup>15-17</sup> PEFR measures the maximal airflow rate achieved while forcefully expelling air from the lungs, following maximal inspiration.<sup>11</sup>

Earlier detection of airflow obstruction and smoking cessation may result in substantial health gain.<sup>18</sup> If a person quits smoking, PEFR improves with the passage of time.<sup>19-21</sup>

A study of PEFR rates in smokers and non-smokers would provide the necessary data to correlate smoking and the effects it has on the health and specifically pulmonary health of people addicted to it. Such a study may prove to be useful to evaluate and quantify the effect of smoking in young adults, and the health deteriorations they experience as a result of their addiction.

The aim was to study the effect of smoking on lung functions in apparently healthy young smokers and the objective of the study was to measure the PEFR and

compare the values between young smokers and non-smokers in the villages in Vadodara district.

## METHODS

The research design was cross-sectional comparative study. With convenient sampling of total 60 Male subjects were recruited between the ages 17-25 years from different villages across Vadodara district, Gujarat, India. Smokers (group A) and non-smokers (group B) included 30 healthy individuals, respectively. The materials used in the study are Wright's mini Pulmopeak Flow Meter, gauze piece, weighing scale and measure tape.

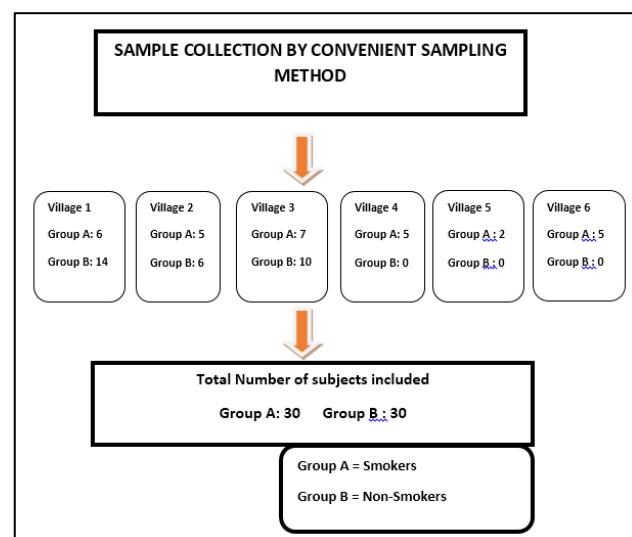


Figure 1: Sample recruitment.

The subjects were healthy individuals- self reported and were not on any medications. Here, Smokers are the persons who were engaged in smoking (cigarettes/beedi) for not less than 6 months and the non-smokers were the persons who never smoked. Smokers were classified into 3 groups. A) Mild smoker- a person who smokes 10 or less than 10 tobacco products per day. B) Moderate smoker- a person who smokes more than 10 but less than 20 tobacco products per day. C) Heavy smoker- a person who smokes more than 20 tobacco products per day. The subjects were excluded if they had any history of respiratory diseases and any other neurological or musculoskeletal problems.

## Procedure

Ethical clearance was obtained from the institutional ethical committee. The subjects were identified through door to door survey that has habit of smoking. Those who fulfilled the selection criteria were included in the study. The subjects who were willing to participate in the study, informed consent was taken from them. They were explained in detailed about the study. Their detail assessment was taken. The assessment included

demography i.e., age, height in meters, weight in kilograms, body mass index and history for all the subjects.

All the subjects were divided into two groups. The smokers were included in group A and non-smokers were included in group B. The subjects of both the groups were assessed for PEFR. The PEFR was measured by Wright's mini PulmoPeak Flow Meter which was recorded in litres/minute.

Before recording an observation on the peak flow meter, subjects of both the groups were shown a demonstration. Mouthpiece of the peak flow meter was covered with gauze piece and was changed for every subject. The recordings were done with each subject in standing

position and the neck should not be flexed. The instructions were given to inspire maximally, apply the lips firmly around the mouthpiece to seal it tightly, and then expire as forcefully and as rapidly as possible into the peak flow meter.

The above procedure was repeated thrice with an interval of half a minute between each attempt. Three readings of PEFR were taken. Out of the three readings, best of three was taken. Comparison of PEFR values between smokers and non-smokers was done.

## RESULTS

Data analyses were done by SPSS 17.0 password coated computer program.

**Table 1: Intergroup comparison of PEFR between smokers and non-smokers.**

PEFR						
Group	Minimum	Maximum	Mean	SD	T value	P value
A	164.202	95.797	310.00	80.301	7.608	0.000
B	164.365	95.634	440.00	48.066		

Table 1 shows the intergroup comparison of PEFR between smokers and non-smokers. Mean score of group A was 310.00 and group B was 440.00. The t value of PEFR was 7.608 and p value was 0.000 which shows that there is significant difference between two groups. It proves that PEFR is lower in smokers compared to non-smokers.

**Table 2: Descriptive analysis of age, BMI, height, weight, pulse and respiratory rate.**

Characteristics	Smokers	Non-smokers
Age	21.46	20.833
BMI	20.18±2.75	19.81±3.31
Height	1.63±0.70	1.64±0.051
Weight	54.16±7.97	54.16±11.06
Pulse	84.7±9.32	82.46±9.98
Respiratory rate	20.46±1.75	19.56±2.25

**Table 3: Correlation between mild, moderate and heavy smokers.**

PEFR	P value
Mild	0.000
Moderate	0.379
Severe	0.957

Table 3 shows correlation of PEFR values in mild, moderate and heavy smokers. The p value of mild smoker was p=0.000, moderate smoker was p=0.379 and heavy smoker was 0.957 which shows that there is a significant difference between mild, moderate and heavy smokers.

## DISCUSSION

Tobacco smoking is the major preventable cause of death. This study analyses the effect of smoking on lung functions of young individuals. The purpose of the study was to measure and compare the values of PEFR between young smokers and non-smokers. The comparison was done to see that even among young individuals, smoking confers a high risk of developing respiratory diseases and deterioration of ventilatory functions. The outcome measure used was peak expiratory flow rate which was assessed by peak flow meter. The subjects were divided into two groups group A (smokers) and group B (non-smokers). All the subjects were assessed with peak flow meter.

Smoking greatly affects the lungs from an annoying repeated cough to grave illnesses like chronic bronchitis, emphysema and bronchial carcinoma. There is retardation of the rate of lung development and lung function in involved in childhood and adolescent smoking.<sup>22-24</sup>

The study was conducted surrounding the villages of Vadodara district. Thirty male smoking subjects and thirty non-smoking subjects were taken in the study between the age group 17 to 25 years and those who fulfilled the inclusion criteria. Their physical characteristics were assessed like height, weight and BMI. Peak expiratory flow rate was measured using PulmoPeak Flow Meter. The subjects were asked to take deep breath and then blow out as hard as possible, through the mouth piece of peak flow meter. Three readings were taken and out of three, best of three was taken.

All the statistical data was analysed by using SPSS 17.0 for windows software. Descriptive analysis for both groups was done for pulse, respiratory rate, height, weight and BMI. The intergroup comparison for PEFR was analysed by using independent t-test ( $p=0.000$ ). There was significant difference between the PEFR values between smokers and non-smokers. The intragroup correlation of PEFR values in mild, moderate and heavy smokers were analysed by using Karl Pearson's correlation test. The  $p$  value of mild smoker was ( $p=0.000$ ), moderate smoker was ( $p=0.379$ ) and heavy smoker was 0.957 which shows that there was a significant difference between mild, moderate and heavy smokers.

The result of this study has shown a statistical decrease in the level of PEFR between smokers and non-smokers. It has also shown that PEFR decreases more with increase in number of cigarettes smoked per day. This result because of smoking may cause inflammation and narrowing of airways which gives resistance to airflow and decrease in elastic recoil pressure of the lung. The result of this study is in agreement with many other studies done to evaluate the effect of various factors influencing PEFR in healthy subjects and one study which was a comparative study of the peak expiratory flow rate of Indian and Nepalese young adults in a teaching institute shows no significant difference between the smokers and non-smokers of Indian and Nepalese young adults.<sup>25-29</sup> Smokers were found to have significantly lower value of PEFR in comparison to non-smokers.

Hence this study may help in prevention of obstructive lung diseases and risk factors occurring due to smoking in young smoker.

## CONCLUSION

In conclusion, the values of PEFR are reduced in smokers compared to non-smokers in young individuals in community and all the values are more decreased with increase in number of cigarettes smoke per day.

*Funding: No funding sources*

*Conflict of interest: None declared*

*Ethical approval: The study was approved by the Institutional Ethics Committee*

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**Cite this article as:** Mehta BM, Satani K. Study of peak expiratory flow rate in young smokers in community. *Int J Community Med Public Health* 2022;9:872-6.