Original Article

Tobacco Smoking is a Risk Factor for Decline Peak Expiratory Flow Rate in Young Healthy Smokers

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ABSTRACT

Objective: To compare peak expiratory flow rate among smokers and nonsmokers and to establish a relation between PEFR and smoking.

Methodology: A cross-sectional study was conducted at Bahria Medical and Dental College, Karachi from August to October 2020. It was comprised of 151 male smokers and nonsmokers healthy subjects of 20 to 25 years age. After taking ethical approval (ERC 21/2020), hundred and fifty one subjects, who fulfill the inclusion criteria were enrolled in the study. PEFR values were estimated by Wright's Peak flow meter. Data was analyzed by SPSS22. Mean PEFR was compared among smokers and nonsmokers. Association between PEFR and smoking was determined by regression analysis. p-value ≤0.05 was considered significant.

Results: This study was comprised of 151 male participants. Of total subjects, 49 (32.5%), 102(67.5%) were smokers and nonsmokers respectively. Mean±SD age of the study participant's was 22.74±2.657 years. Smokers have lower PEFR values as compared to nonsmokers (323.94 versus 352.65L/min.), this difference was statistically significant (p-value 0.04). Regression analysis showed the negative association of PEFR with smoking, however, this association was not statistically significant (p-value 0.17).

Conclusion: Peak expiratory rate was comparatively lower in smokers than nonsmokers healthy young subjects.

KEYWORDS: Healthy subject, Peak expiratory flow rate, Smokers, nonsmokers, Wright's Peak flow meter.

INTRODUCTION

The trend of tobacco consumption is increasing at an alarming rate among young adults across the world.[1] The highest rate of tobacco smoking were reported in South Asian countries.[1] In Pakistan, tobacco is consumed in various forms such as pipes, cigarettes, hookah/shisha, cigar, pan and gutka. However the most common source of tobacco consumption is in the form of cigarette smoking.[2] The peer pressure, parental smoking and poor compliance to bans on promotion of tobacco are contributing factors for promoting of smoking especially in young adults.[3] There are several thousand chemical substances including nicotine, nitrites, hydrogen cyanide, ammonia, arsenic, carbon mono oxide, and several others substances responsible for effecting oxygen transport by the erythrocytes. Thence, ultimately damaging every system of the body. Tobacco consumption is the second leading cause of preventable death worldwide and accountable for six million annual deaths across the world.[3] According to estimates by the Tobacco Control Cell Ministry of National Health Services Regulation and Coordination, Government of Pakistan, approx. 160,100 mortalities every year are due to tobacco smoke.[4] Tobacco smoking primarily damages the respiratory system causing airflow limitation and subsequent chronic obstructive pulmonary diseases (COPD). It is characterized as the limitation of airflow which is considered as the irreversible state. This limitation is believed due to the development of inflammation or thickened respiratory wall resulting from smoking.[5] Countries where tobacco consumption is higher are at risk of increasing burden of irreversible chronic obstructive pulmonary disease. Due to asymptomatic nature of the early stages of COPD, it usually remains undiagnosed especially in developing countries with limited resources.[6] Subjects with misdiagnosis might be prone to the exacerbation such as pneumonia, pneumothorax, associated with the decline in lung functions leading to unexpected early death particularly in smokers. Airflow limitation before progression to COPD can be reversed by smoking cessation, so by early detection and treatment, burden of this chronic

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disease might be reduced.[7] Forced expiratory volume in 1st second (FEV1) and forced vital capacity (FVC) are gold standard spirometric parameters for assessment of lung functions and diagnosis of symptomatic chronic obstructive pulmonary disease (COPD). However, these parameters are not reliable for the detection of asymptomatic airflow obstruction. On contrary to this, Peak expiratory flow rate is the simple, reliable, and convenient procedure to detect asymptomatic cases as well as obstruction of smaller airways.[8,9] Global Initiative for Chronic Obstructive Lung Disease (GOLD) encourages the early detection of airflow obstruction in asymptomatic cases by reliable new tools to reduce the burden of irreversible airway obstruction.[8] Data concerning the assessment of lung functions by PEFR in healthy young adults is still limited in Pakistan. This study was designed to assess lung functions of the healthy young smokers and nonsmokers by using peak expiratory flow rate.

METHODOLOGY

This cross-sectional study was conducted at Bahria Medical and Dental College, Karachi from August to October 2020. It was comprised of 151 male subjects 20 to 25 years ago. After taking ethical approval from the institute (ERC21/2020), participants were selected from 1st year to final year MBBS by non-probability convenience sampling technique. Initially, 200 students were interviewed and relevant information about ethnicity, residence, and socioeconomic status, history of cigarettes smoking including duration and pack-years (number of cigarettes per day by years), history of prolonged cough, phlegm, allergies, COPD and frequent respiratory infections were tailored on the predesigned proforma. Medical history about use of bronchodilators for airway obstruction was also recorded. Hundred and fifty one students who fulfilled the inclusion criteria were included in the study.

Healthy male cigarette smokers of age 20- 25 years, who reported smoking more than 100 cigarettes in their life regularly and had neither previous history of airway obstruction were recruited in the study. For the comparison purpose, nonsmokers, who never smoke or smoke less than 100 cigarettes in their life and don't have a previous history of airway obstruction of the same age were included in the study. Female students prevent gender bias, students with a history of asthma, COPD, pneumonia tuberculosis, lung cancers, and any systemic disease affecting lung functions were excluded. Students having thoracic spine deformities and oral lesions, who were unable to perform the procedure were excluded. The purpose, benefits, and risk of the study as well as procedure were explained and participants who gave consent were included in the study. Confidentiality was assured to all subjects. Anthropometric measurements were recorded by standard protocol. Weight in kilogram (kg) and height in centimeters (cm) were obtained by stadiometer. BMI was estimated by weight in kg/height in m^2. Clinical examination was done to exclude any systemic disorder affecting the respiratory system. PEFR was recorded by Wright's Peak flow meter following standard guidelines by the American thoracic society (ATS). The students were directed to take a deep breath and exhale with forced expiration as fast as possible in a single blow into the apparatus while maintaining an airtight seal between lip and mouthpiece. Three consecutive readings were recorded at about two-minutes intervals, and the highest value was recorded for data analysis. PEFR values among the smokers and nonsmokers were compared.

RESULTS

The current study comprised of 151 male participants. Of the total subject 102(67.5%) were smokers and 49 (32.5) were nonsmokers. Mean±SD age of the study participants was 22.74±2.657 years. The descriptive of the study population are described in table1.

Table1: Basic characteristics of study population(n=151)

Study Variables	Mean± SD
Age (Years)	22.74±2.657
Weight (Kilogram)	78.12±12.79
Height (Centimeter)	170.07±12.05
BMI (Kilogram/meter^2)	38.19±4.72
PEFR (Liter/minute)	343.33±75.32

Table 2 depicts the comparison of mean PEFR among smokers and nonsmokers. Smokers have lower PEFR values as compared to nonsmokers; this difference was statistically significant with a p-value of 0.04.(Table 2).

Table 2: Comparison of PEFR among smokers and Non Smokers(n=151)

Study groups	Frequency n(%)	PEFR(L/min) Mean±SD	p-value
Smokers	102(67.5)	323.94±77.60	0.045
Non Smokers	49(32.5)	352.65±89.26	

Peak expiratory flow rate (PEFR), Liter/minute (L/min), p-value ≤0.05 was taken significantly

Regression analysis showed the negative association of PEFR with smoking with beta coefficient β value -7.89. However, this association was not found to be statistically significant (p-value 0.17).

DISCUSSION

The increasing trend of tobacco smoking especially the youth affecting lung functions is a serious issue in this modern era. PEFR is a simple and reliable measure of airflow in the bronchial tree and it gives an idea about bronchial tone. Evidence is available showing PEFR is adversely affected by smoking. Initial stages of airflow obstruction due to tobacco smoking are reversible but it can progress to irrepressible obstructive pulmonary disease if not managed timely. Even symptom free smokers also have diminished values of PEFR than nonsmokers reflecting its deleterious effects of smoking on lung functions.[9] This study is conducted to highlight this burning issue and focused to establish the relation between smoking and PEFR. Almost one-third of our study population were smokers (32.5%).

The mean PEFR of the total population was 343.33 L/min. Similar reference values have been reported by an Indian study by Jena et al.[10] On comparing the PEFR among the smokers and nonsmokers, we found a significant reduction in PEFR value in smokers as compared to nonsmokers. Our results were congruent with previous local research showing a significant decline in PEFR in smokers than non-smokers.[11] These results are also in agreement with other international studies, reporting reduced PEFR values in smokers.[12,13] Repeated inflammation is frequent and constant pathological finding in cigarette smokers destroying alveolar walls, which might be the possible reason for the reduction in PEFR. Increase secretion of inflammatory mediators causing hyper-reactivity are the hallmarks of tobacco consumption that enhances the tone of alveolar smooth muscles.[12] Alveolar wall thickness and narrowing due to bronchopulmonary leakage and edema eventually causes decreased diffusing capacity and further aggravate airway obstruction leading to a reduction in PEFR.[13-15] The current study showed a negative association of PEFR with smoking, β coefficient of −7.89 suggested that each unit increase in smoking rate will lead to a 7.89 unit decrease in PEFR. However, this association was not found to be statistically significant which might be due to the small sample size. Our results are justified by Indian researches conducted in India showing a strong negative correlation of smoking with PEFR.[16] Early stages of airway obstruction can be reverted to normal with normal lung functions, if cigarette smoking cessation is implanted as early as possible. Awareness and motivational programs should be conducted at the government level for healthy youth to discourage smoking.

Limitations: It was a cross-sectional study, causal inferences were not established. Small sample size may not represent the whole population.

CONCLUSION

Peak expiratory flow rate was comparatively lower in smokers than nonsmokers healthy young subjects.

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Conflicts of Interest: None.

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Authors' Contribution:

Dr. Saifullah Shaikh	Study design, data collection, manuscript writing critically revise and approve the manuscript
Dr. Rabiya Ali	Study design, data collection, Statistical analysis, manuscript writing a critical revision of the manuscript and approve the final version. Accountable for research work
Dr Hina Moazzam	Data collection, Statistical analysis, interpretation of results, revision and approval of the final version

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