

Assessment of Respiratory Morbidity and Epidemiological Survey of Tobacco Smokers and Non-Smokers Among Educated Young Adults in Visva-Bharati, Santiniketan: A Case Study

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Abstract

Tobacco smoking among adults have become a serious health concern worldwide due to its increasing addicting nature. Tobacco smoke contains highly harmful gaseous and volatile chemical substances that impair the respiratory system and reduce lung function capacity. The study's primary objectives were to investigate the cause of smoking, behaviour of smokers, social responsibility, family history of the smoker, and significant respiratory health problems among young educated adults. The survey was conducted with some pre-framed questionnaires and screening relevant to the subjects for our study. The respiratory health assessment was carried out by questionnaire-based personal interviews for different respiratory and non-respiratory health symptoms. Subsequently, the lung function or pulmonary function test (LFT or PFT) of selected smokers and non-smokers individuals was performed. The LFT or PFT test revealed the normal and abnormal breathing patterns of exposed and non-exposed individuals. The significant findings indicated that curiosity (72%) and expressing smartness (20.46%) were the leading causes of smoking in early adulthood (16 to 20 years). Family history of smoking also influenced young adults to initiate regular smoking. Smoking within thirty minutes after waking up in the morning was a habit in 52% of smokers. Findings revealed that 50% of the heavy smokers' smoke 11-15 units daily. About 26% of the smoker students invested an average of Rs. 100-150 weekly to purchase smoking materials. Measured spirometric indices forced vital capacity (FVC), forced expiratory volume in one second (FEV₁), forced expiratory volume in one-second percentage



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(FEV₁%), and peak expiratory flow rate (PEFR), showed the reduced lung performance in smokers as compared to their fellow non-smokers. This study has focused on the smoking behaviour of educated young adults and revealed the presence of different respiratory symptoms in smokers than non-smokers, which is an emerging health issue. Smoking-related respiratory abnormalities, which were positively associated with smokers, led to reduced lung functions.

Introduction

The tobacco product is made from the leaves of tobacco.^{1,2} Tobacco leaves, after being harvested, are cured, aged, and processed in various ways.² More than 70 tobacco plant species are known, but the chief commercial is *Nicotiana tabacum* (Solanaceae family).³ Tobacco contains nicotine, a prime addictive chemical, and a psychoactive (mind altering) drug that rapidly affects the central nervous system.⁴ Worldwide, tobacco is available in many products, including cigarettes, Bidi, pipe, chewing tobacco, and snuff or snus (a powder form inserted between the lower lip or cheek and gums).^{4,5} Tobacco smoke is a complex mixture of chemicals, including carbon monoxide, nicotine, phenol, polycyclic aromatic hydrocarbons (PAHs), hydrogen cyanide, benzene, formaldehyde, and tobacco-specific nitrosamines.^{6,7,8} About 70 chemicals are identified as carcinogenic among 7000 chemicals found in tobacco smoke.^{9,10} Worldwide, more than 80% of the 1.3 billion tobacco smokers are from low and middle-income countries, particularly in Asia.¹⁸ After China, India is the second-largest tobacco market globally, having about 100 million smokers.^{11,12} In India, 19% of men, 2% of women, and 10.7% (99.5 million) of all adults smoke tobacco.¹³ About 39% and 30% of Indian adults are exposed to second-hand smoking at home and workplace, respectively.¹³ Worldwide, with the increasing number of tobacco smokers, the death rate is also increased due to different health symptoms, such as lung cancer, change in gene expression, chronic obstructive pulmonary disease (COPD), oxidative stress, etc.^{14,15} The significant health risks of tobacco smokers are the brain and mental effects, less sense of smell, eye etching, teeth damage, sore throat, reduced sense of taste, cancers (lips, mouth, throat, and larynx), strokes, anxiety, respiration system damage (lung cancer, cough and sputum, shortness of breath, colds and flu, pneumonia,

asthma, tuberculosis, chronic obstructive pulmonary disease, and emphysema) and other male and female reproduction diseases.^{1,16,17} The world is now facing one of the prevalent health crises raised by the tobacco epidemic, accounting for over 8 million deaths annually. More than 7 million deaths are caused by direct consumption of tobacco and exposure to second-hand smoke leads to a death of 1.2 million.¹⁸

Smoking directly or indirectly affects our lung function and needs frequent monitoring. Spirometric lung function test is a simple, non-invasive, reliable, and economical method widely adopted for the primary diagnosis of abnormality in lung function.¹⁹ Spirometry test is a standard lung function or pulmonary function test that measures airflow into the lungs. It estimates the breathing pattern, that is, how much air is inhaled and exhaled within the time frame. Spirometry assesses pulmonary conditions such as asthma, chronic obstructive pulmonary disease (COPD), lung fibrosis, and cystic fibrosis. India is a youth-populated nation, having almost 34% population in the age group of 15-34 years.³⁷ The growing number of young smokers will have substantial future public health implications. With these views, the present study was conducted to ascertain the respiratory health status of educated young adult smokers and non-smokers.

Materials and Methods

Protocols and sampling

The survey was conducted randomly through personal interviews with a pre-framed questionnaire and screening related to the objectives of our study. The pre-set questions of IUATLD (International Union against Tuberculosis and Lung disease) were adopted to gain information about the individual's respiratory health. Some more questions relevant to the study objective were also framed and

standardized (SM). The study was undertaken during the period July 2018 to May 2019. Based on the smoking practices, candidates were categorized into two groups, i.e., smokers (smoking continuously for a minimum of one year) and non-smokers. The questions about smoking adoption, daily smoking behaviour, care during smoking, disposal of the smoking materials, smoking expenditure, and problematic respiratory symptoms were asked to the smokers. After that, a comparative lung function test (LFT) of the selected smokers and non-smokers was conducted using a PC-based spirometer (Model: Nano, Medikro Oy, Finland) to know their lung performances. For lung function test, various spirometric indices are measured i.e., forced vital capacity (FVC, the total volume of air can forcefully exhale from the lungs after deepest inhalation), forced expiratory volume in one second (FEV1, is defined the what volume of air expired in one second after an utmost inhalation), percentage forced expiratory volume in one second (FEV1%, is represent the FEV1/FVC ration in percentage, that can be exhaled in one second) and peak expiratory flow rate (PEFR, is an individual's highest speed of exhalation, used to monitor an individual's ability to breathe out air). Before performing the lung function test (LFT), the following criteria were maintained.

1. Not tightly clothed during the test.
2. Not take a hefty meal within two hours prior to the test.
3. No strenuous work before the test.
4. Last smoking was at least one hour before the test.
5. No alcohol consumption at least four hours before the test.
6. No vigorous exercise before 30 min of the test.

Upholding all the above-mentioned criteria, an individual for the LFT was selected. The present study was conducted among young adult undergraduate, postgraduate, and research scholars (age group 18 to 30) male students of different academic departments in Visva-Bharati, Santiniketan, West Bengal, India. The survey was done on 521 individuals to obtain respiratory information. Among 521 individuals, 248 (47.6%)

were identified as smokers, and 273 (52.4%) were non-smokers. A spirometric lung function test (LFT) was possible to conduct among 196 (79.03%) smokers and 217 (79.49%) non-smokers.

Statistical Analysis

The descriptive statistical analysis was performed to get the means, standard deviation, and frequency percentage the odds ratio was calculated to measure the association between smokers and non-smokers health outcomes. The t-test was performed to compare means with control variables, and two-way ANOVA was executed to find out the possible effects of independent variables, body mass index (BMI) (underweight, normal, overweight and obese) and smoking status (smokers, non-smokers) on different spirometric indices (dependent variable). The statistical analyses were carried out by SPSS ver. 20 and Microsoft Excel 2010.

Results

The main reason behind life's first-time smoking was 'curiosity,' covering about 72% of smokers who started smoking due to this category and followed by 'to show smartness' was the reason in 20.46% of smokers (Fig. 1a). About 70% of the smokers started their first-time smoking at the age of 16 to 20 (Fig. 1b). 51.68% of smokers consume their day's first smoke within half an hour after waking up in the morning (Fig. 1c). A notable smoking pattern was found between the early smokers (day's first smoking within 30 min) and the late smokers (day's first smoking after 30 min). Smoking patterns indicated that most early smokers were heavy smokers (smoking >10 units), which is the marker of addiction. Whereas the late smokers were not identified as heavy smokers. Among the heavy smokers, about 48% smoked 11 to 15 units per day, 24% smoked 15 to 20 units per day, and 27% smoked more than 20 units per day (Fig. 1d). About 58% of smokers used filtered smoking units (cigarette), about 4% of smokers used non-filtered smoke units (Bidi), whereas, 38% of consumers were both filtered and non-filtered user (Fig. 1e). Among the surveyed populations, about 84% of smokers knew the effect of their non-smokers passive smoking. In contrast, only 21% of non-smokers understand the impact of passive smoking (Fig. 1f).

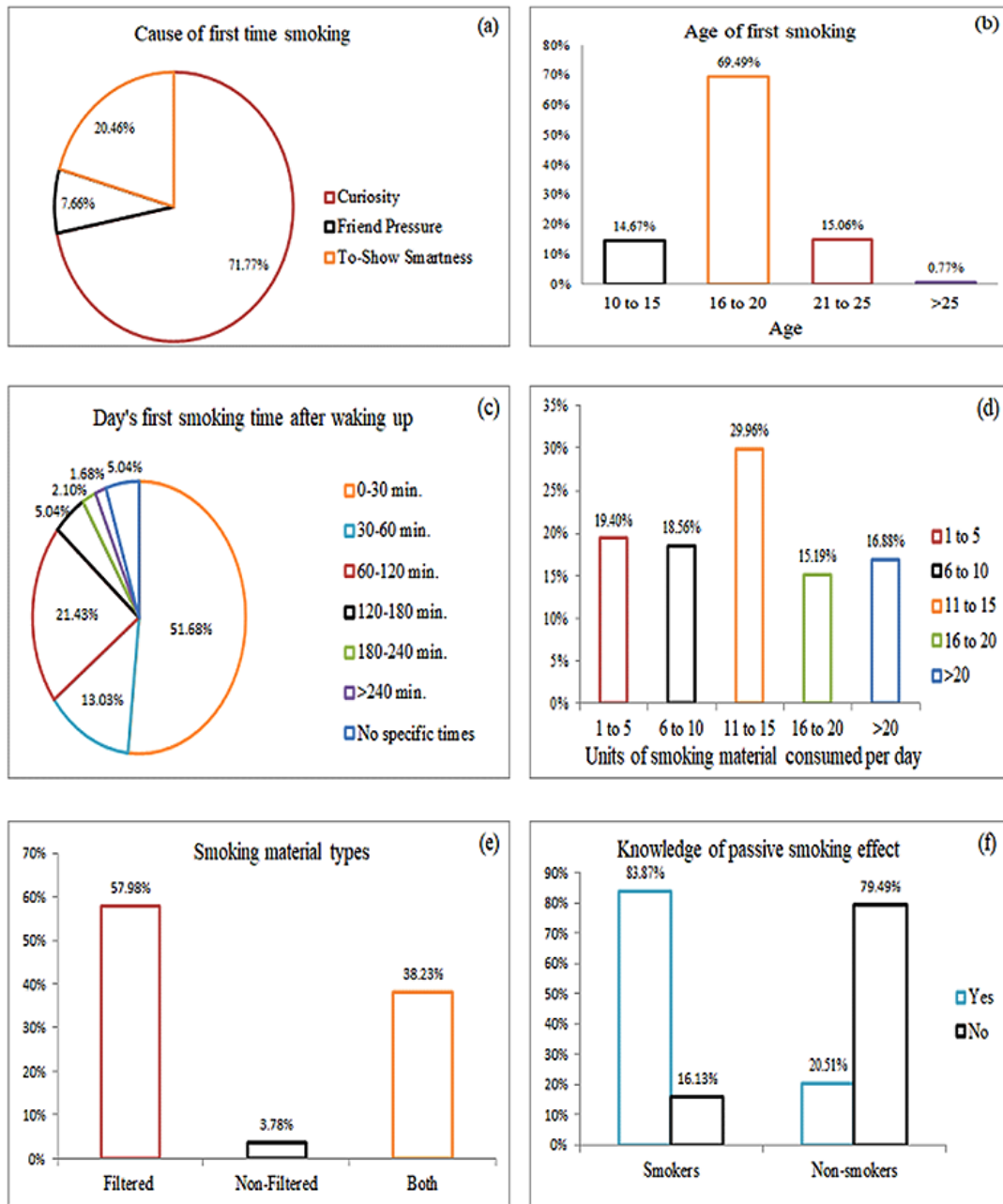


Fig. 1: Showing cause of first-time smoking (a), age of first smoking (b), day's first smoking time after waking up (c), daily consumption unit of smoking materials (d), smoking materials type (e) and knowledge of passive smoking effect (f).

Showing social responsibility during commuting, about 64% of smokers did not smoke on public transport (Fig. 2a). But, when smokers were associated with their non-smoker friends, about 73% of smokers did not show their social responsibility

to avoid smoking there (Fig. 2b). In this survey, we noticed that about 40% of the non-smoker's population have smoker friends. Only 11% of the smoker community have friendships with non-smoker individuals (Fig. 2c). When

outlining the family history of smoking, about 61% of non-smokers and 48% of smokers belonged to the 'no smoking' family (Fig. 2d). About 57% of smokers used ash-tray for disposing of smoked ash and butts, whereas about 18% of smokers just threw the waste carelessly (Fig. 2e). The weekly expenditure for the smoking materials varied from INR 10 to

>200 rupees among the smokers. About 26%, 24%, and 21% of smokers spent an amount of INR 100 to 150, 10 to 50, and >200 weekly, respectively (Fig.2f).

Anthropometric data on BMI showed that 43.54% of smokers and 32.97% of non-smokers were at risk (Table 1).

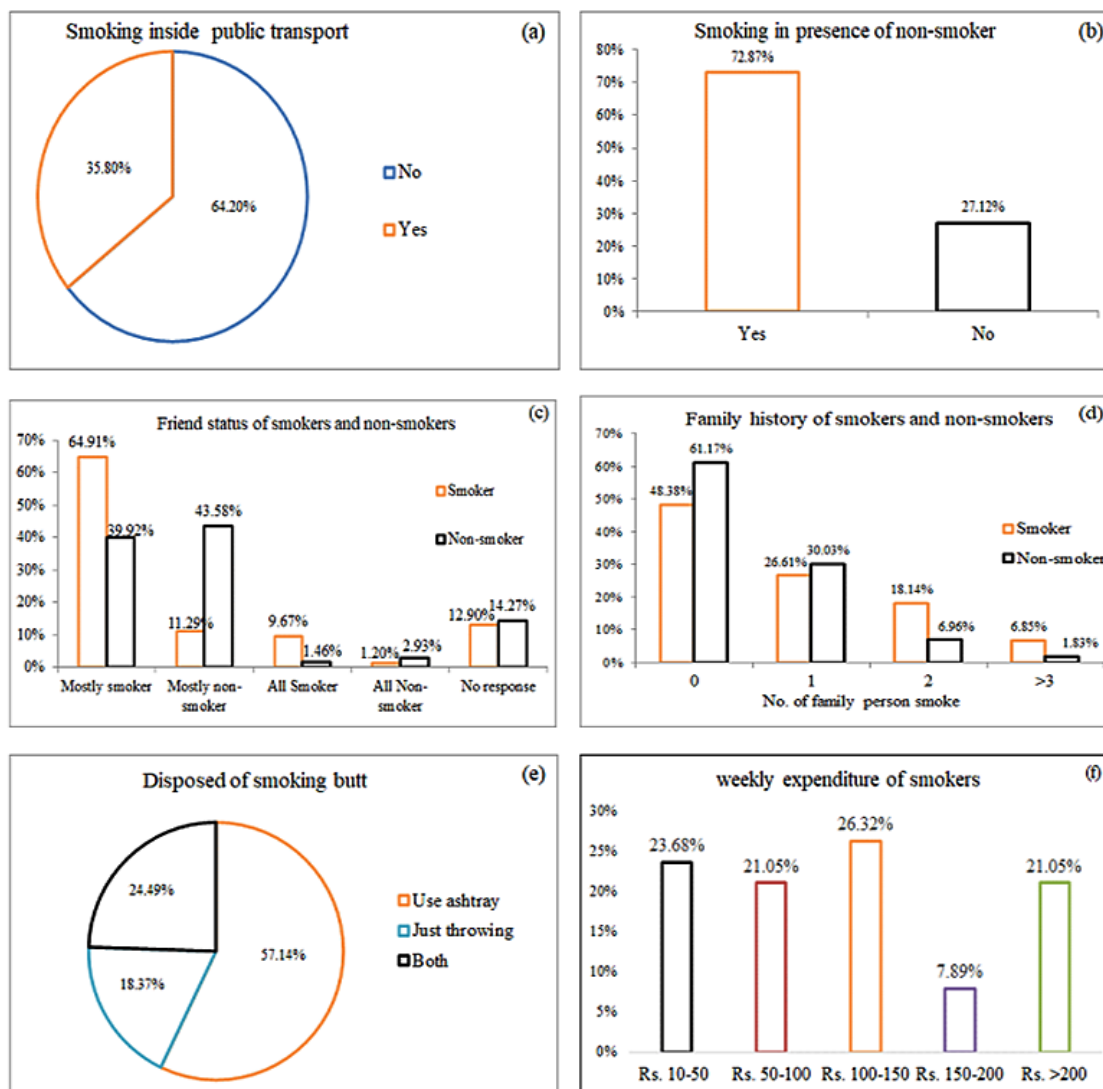


Fig. 2: Showing smoker number inside public transport (a), smoking in presence of non-smoker (b), friend circle of smokers and non-smokers (c), family history of smokers and non-smokers (d), disposal of smoking wasteusing butt (e) and weekly expenditure of smoker (f).

Table 1: Anthropometry of smokers and non-smokers with risk co-morbidity

Classification	Body Mass Index (BMI)	Smokers (%)	Non- Smokers (%)	Risk of co-morbidity
Underweight	<18.5	11.29	9.89	Low (But increase risk of other clinical problems)
Normal range	18.5-22.9	56.45	67.03	Average
Overweight (≥23)				
At risk	23 - 24.9	17.74	13.19	Increase
Obese 1	25 – 29.9	13.30	9.52	Moderate
Obese 2	> 30	1.21	0.37	Severe

The Asia-Pacific perspective: redefining obesity and its treatment.²⁰

Among non-respiratory symptoms, chest pain, allergic skin, and itchiness of the eyes were common issues in smokers and non-smokers. The odds ratio (OR) of the respiratory symptoms like wheezing breath (OR = 3.8603), sore throat

(OR = 2.1534), waking due to night cough (OR = 3.2436), and morning phlegm (OR = 4.4167) varied significantly in smokers as compared to non-smokers (Table 2).

Table 2: Prevalence of non-respiratory and respiratory health symptoms in young adults

Symptoms	Smokers (%)	Non-Smokers (%)	Odds Ratio (95% CI)	Z-statistics	Significance (p)
Frequent sneezing	52.63	67.28	0.68 (0.43 to 1.08)	1.639	0.1013
Nose irritation and watering	31.57	42.99	1.15 (0.69 to 1.89)	0.536	0.5921
Wheezing breath	13.15	6.54	3.86 (1.74 to 8.54)	3.333	0.0009
Sore throat	26.31	18.69	2.15 (1.17 to 3.94)	2.484	0.0130
Shortness of breath after heavy exercise	21.05	17.76	1.23 (0.49 to 3.11)	0.45	0.65
Awaking due to night cough	26.32	22.43	3.24(1.82 to 5.76)	4.010	0.0001
Morning phlegm	18.42	11.21	4.41(1.9 to 10.10)	3.522	0.0004

[CI - Confidence Interval]

In the spirometric lung function test (LFT), the mean tidal volume remained the same for both smokers (0.72± 0.28) and non-smokers (0.72 ± 0.35). Mean values of spirometric parameters like of FVC, FEV₁, FEV₁%, and PEF_R were slightly higher in non-smokers than in smokers (Table 3). LFT revealed that 25.23%, 28.03%, and 18.03% of non-smokers were underperforming, and 26.32%, 28.95%, and

21.05% of smokers were underperforming than the predicted scores FVC, FEV₁, and FEV₁% respectively (Table 4). Two-way ANOVA analysis showed a non-significant effect of independent variables, BMI and smoking status on spirometric indexes. Pairwise comparison among different BMI status groups showed a significant difference of FEV₁% only between normal and overweight individuals.

Table 3: Smokers and non-smokers' spirometry mean and standard deviation with the significance level

Parameters	Non-Smokers (Mean \pm SD)	Smokers (Mean \pm SD)	Significance level
TV [Liters]	0.72 \pm 0.35	0.72 \pm 0.28	0.946
FVC [Liters]	3.83 \pm 0.45	3.81 \pm 0.44	0.725
FEV ₁ [Liters]	3.21 \pm 0.43	3.17 \pm 0.41	0.579
FEV ₁ /FVC [%]	82.73 \pm 8.20	82.01 \pm 7.88	0.635
PEFR [Liters/Second]	6.90 \pm 1.44	6.73 \pm 1.01	0.420

[SD – Standard Deviation]

Table 4: Reduction of performances based on spirometry indices

Reduced parameters	Non-Smokers (%)	Smokers (%)
FVC	25.23	26.32
FEV1	28.03	28.95
FEV1/FVC%	18.03	21.05

Discussion

Compulsive smoking of the senior family members in front of the children affects their health by passive smoke and creates a curiosity in their tender minds about tobacco smoking. Parental smoking influences them to adopt early life smoking by pretending to be mature. Curiosity and peer pressure are the leading causes behind the early adoption of tobacco, as found in this and other studies.^{21,22,23} Curiosity was reported to be the most common cause of starting smoking, followed by peer smoking.²⁴ About 70% of smokers began their first-time smoking at the age of 16 to 20. Studies from general Indian students showed that most of them first smoked at 10 to 20 years of age.^{25,26,13} Family history of smoking is a well-known fact for early life initial of smoking.^{27,28,29,30} Consumption of the day's first smoke within half an hour after waking in the morning was a habit in 51.68% of smokers. According to Singh *et al.* (2015),³¹ 42% of Indian students feel the urge to smoke just after waking up in the morning. The urge of early smoke is associated with the risks of physical and psychological problems. Smoking just after waking up is an addictive behaviour or symptom called nicotine craving.³⁸ Smokers smoking early in the morning have a greater risk of developing lung, head, and neck cancer than other

smokers.³⁹ Smoking within 5 minutes of waking up is associated with a four fold increase in the odds of lifetime asthma.³² In our study, about 58% of the smokers used cigarettes, which is significantly high compared to the national level of 7.3%. In contrast, about 4% of smokers used Bidi compared to the national level of 14%.¹³ The average daily consumption of smoking materials directly affects lung function. Smoking destroys cilia, leads to a build-up of mucus in the airways, and inflammation that leads to respiratory illnesses. The airways contain air sacs called alveoli that are usually elastic.⁴⁰ Smoking loses elasticity and deflates air sacs, resulting in breathing discomfort and reduced lung function capacity (inhalation and exhalation).^{40,41} In our study, it was found that maximum smokers consumed 11-15 units of smoking materials. According to Saha *et al.* (2008),³³ the average daily consumption of cigarettes was 1-5 units for 41% population, followed by 6-10 units for 33% population. Passive smoking knowledge of smokers generally helps care for other non-smokers, but most smokers do not follow it. They know the health effects of smoking but could not quit it because of addiction, cheap and easy availability of smoking materials. The weekly expenditure for the smoking materials varied from 10 to >200

rupees among the smokers. In this study, 21% of young adult smokers spent about INR 700 to 800 monthly, whereas 16% of Nepali young adult student smokers spent about INR 1100 to 1200.³⁴ Investing more than -INR 700 monthly by students is wasting enough money on the Indian scenario. In India, the total attributable costs were INR 1773.4 billion from 2017 to 2018 for treating all diseases and deaths due to tobacco smoking for persons 35 years or older. The economic costs of tobacco use amount to approximately 1% of India's gross domestic product (GDP).⁴²

The smokers showed their social responsibility in public places and transport by not smoking inside. The odds ratio (OR) of the respiratory symptoms like wheezing breath, sore throat, waking due to night cough, and morning phlegm varied significantly to smokers compared to non-smokers. That indicates that smokers are more susceptible to health issues than non-smokers.

The spirometry index values of TV, FVC, FEV₁, FEV₁/FVC, and PEF_R declined in the smoker group compared to the non-smokers, indicating a better lung performance in the non-smokers group. Gold *et al.* (1996)³⁵ found that FEV₁/FVC decreased among adolescent smokers. The declination in pulmonary function parameters among smokers indicated that smoking is responsible for compromised lung function.³⁶

Conclusion

This study on the smoking behaviour of educated young adults revealed that 'curiosity,' 'showing smartness' and 'family history of smoking' were the

main critical factors for early adoption of smoking. Most of them started smoking at the age of 16 to 20 years. Heavy smokers smoke early in the morning, indicating their addiction. They smoke both filtered and non-filtered smoke units. Most smokers consume more than 10 cigarettes per day. Despite of knowing the harmfulness of passive smoking, most smokers smoke and did not care about their non-smoker friends. Different respiratory symptoms were significantly dominant in smokers compared to non-smokers. Spirometric lung performance of the adult smokers declined as compared to the non-smokers.

Limitations and Future Research of the Study

The present study was mainly based on the smoking habits, causes of smoking, and their effects on lung functions of young adult male smokers' and non-smokers' in a small area. The future scope of this study would be to work in large areas among various age groups, having males and females, and comparing their smoking habits, causes of smoking, and lung function variations.

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Conflicts of Interest

There are no conflicts of interest for any author.

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