International Journal of Medicine
pISSN 1468-3814 | eISSN 2667-7008
https://theinternationalmedicine.com/

Original Research Article *DOI: 10.61336/im/26-2-82*

"Comparative Evaluation of Respiratory Parameters and Blood Pressure in Smokers and Non-Smokers: A Cross-Sectional Study"

Dr V Veerendra[1], Dr. Sweta Kumari [2], Thota Manju Bhargavi[3], Dr Sanjeev Gupta[4], Dr K Vijay Kumar[5]*

[1] *Assistant Professor,Department of pharmacology, Sukh Sagar medical college and Hospital, Jabalpur, Madya Pradesh.*
[2] *Associate Professor, Dept. of Physiology,,RKDF Medical College & Hospital & Research Centre, Bhopal, Madya Pradesh.*
[3] *Assistant professor, Dept of Physiology, RKDF Medical College & Hospital & Research Centre, Bhopal, Madya Pradesh.*
[4] *Associate professor, Pharmacology, GMC, Kathua,Dist. Kathua, J&K.*
[5] *Professor Department of Pharmacology, Varun Arjun Medical College and RohilkandHospital, Shahjahanpur, Uttar Pradesh.*

Correspondence:
Dr K Vijay Kumar

Received: **January 17, 2026**
Revised: **January 24, 2026**
Accepted: **February 16, 2026**
Published: **February 27, 2026**

Abstract

Background: Tobacco smoking is a major preventable cause of respiratory and cardiovascular morbidity, particularly among middle-aged adults. Chronic exposure to tobacco smoke leads to progressive impairment of pulmonary function and elevation of blood pressure, increasing the risk of non-communicable diseases. ***Materials and Methods:*** This hospital-based comparative cross-sectional study was conducted over six months among 100 adults aged 40–60 years, including 50 smokers and 50 non-smokers. Pulmonary function tests were performed using spirometry, and blood pressure was measured using standard techniques. Data were analyzed using Student's t-test. ***Results:*** Smokers showed significantly reduced FVC, FEV_1, FEV_1/FVC ratio, and PEFR, along with significantly higher systolic and diastolic blood pressure compared to non-smokers ($p < 0.001$). ***Conclusion:*** Chronic smoking is associated with early respiratory dysfunction and increased cardiovascular risk, emphasizing the need for early screening and smoking cessation interventions.

Keywords: Smoking; Pulmonary function tests; Blood pressure; Spirometry; Middle-aged adults.

This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC-BY) license (http://creativecommons.org/licenses/by/4.0/).

INTRODUCTION

Tobacco smoking remains one of the leading preventable causes of morbidity and mortality worldwide, contributing substantially to the global burden of non-communicable diseases. According to the World Health Organization, tobacco use is responsible for more than 8 million deaths annually, with a significant proportion attributable to cardiovascular and respiratory disorders[1]. In developing countries, particularly India, the prevalence of smoking among middle-aged men continues to be high, increasing the risk of chronic health complications during the most productive years of life[2].

The respiratory system is one of the primary targets of tobacco smoke exposure. Cigarette smoke contains thousands of toxic chemicals that induce chronic airway inflammation, oxidative stress, and structural remodelling of lung tissue[3]. Prolonged exposure leads to progressive decline in pulmonary function parameters such as Forced Vital Capacity (FVC), Forced Expiratory Volume in one second (FEV_1), and Peak Expiratory Flow Rate (PEFR), which may precede clinically evident chronic obstructive pulmonary disease (COPD)[4]. Several longitudinal studies have demonstrated an accelerated decline in FEV_1 among smokers compared to non-smokers, emphasizing the cumulative and dose-dependent effects of smoking[5].

In addition to its deleterious effects on pulmonary function, smoking exerts profound influences on the cardiovascular system. Nicotine stimulates the sympathetic nervous system, resulting in increased heart rate, peripheral vasoconstriction, and elevation of blood pressure[6]. Chronic smoking is also associated with endothelial dysfunction, arterial stiffness, and impaired baroreceptor sensitivity, all of which contribute to the development of hypertension and other cardiovascular diseases[7]. Epidemiological evidence suggests that smokers have a higher prevalence of both systolic and diastolic hypertension compared to non-smokers, particularly in middle-aged and older populations[8].

Middle-aged adults between 40 and 60 years represent a critical demographic group, as the physiological reserve of the respiratory and cardiovascular systems begins to decline with age, while the cumulative effects of long-term smoking become more apparent[9]. Despite this, many individuals in this age group remain asymptomatic, underscoring the importance of objective assessments such as spirometry and blood pressure measurement for early detection of functional impairment[10].

Although several studies have independently evaluated the effects of smoking on pulmonary function or blood pressure, comparative studies assessing both respiratory parameters and blood pressure simultaneously in smokers and non-smokers within a defined age group remain limited, especially in the Indian population. Therefore, the present study was undertaken to compare respiratory parameters and blood pressure among smokers and non-smokers aged 40–60 years, with the aim of highlighting early physiological changes associated with smoking and reinforcing the need for preventive strategies and smoking cessation interventions.

MATERIALS AND METHODS

Study Design: A hospital-based comparative cross-sectional study.

Study Place: The study was carried by department of Physiology in association with department of respiratory medicine at Tertiary Care Teaching Hospital, India.

Study Duration: 6 months (January 2025 – June 2025).

Study Population: Adults aged 40–60 years attending general health check-up clinics.

Inclusion Criteria

- Age between 40 and 60 years
- Male and female participants
- Smokers: individuals smoking ≥10 cigarettes/bidis per day for ≥5 years
- Non-smokers: individuals who never smoked

Exclusion Criteria

- Known chronic respiratory diseases (asthma, COPD, tuberculosis)
- History of cardiovascular disease
- Diabetes mellitus or chronic kidney disease
- Alcohol dependence
- Occupational exposure to respiratory pollutants

Sample Size Calculation

Sample size was calculated using the formula:
n=(Z_(α/2))^2ⓜ×SD^2 ┤ /d^2

Where:

- Z = 1.96 (95% confidence interval)
- SD = 15 (based on previous pulmonary function studies)
- d = 5 (absolute precision)

The calculated sample size was 90, which was rounded to 100 participants for better power.

- Smokers: 50
- Non-smokers: 50

Study Methodology

After obtaining informed consent, demographic details and smoking history (duration and type) were recorded. Height and weight were measured using standard protocols. Pulmonary function tests were performed using a calibrated computerized spirometer following ATS guidelines. The parameters recorded included Forced Vital Capacity (FVC), Forced Expiratory Volume in one second (FEV_1), FEV_1/FVC ratio, and Peak Expiratory Flow Rate (PEFR).

Blood pressure was measured using a standard mercury sphygmomanometer in the sitting position after 5 minutes of rest. Three readings were taken at 5-minute intervals, and the average was recorded.

Statistical Analysis

Data were analysed using SPSS version 26. Continuous variables were expressed as mean ± standard deviation. Comparison between smokers and non-smokers was done using independent Student's t-test. A p-value <0.05 was considered statistically significant.

RESULTS

A total of 100 participants aged between 40 and 60 years were included in the present study, comprising 50 smokers and 50 non-smokers. The demographic characteristics, smoking profile, respiratory parameters, and blood pressure measurements were analysed and compared between the two groups.

Table 1: Gender Distribution of Study Participants

Gender	Smokers (n = 50)	Non-smokers (n = 50)	Total (n = 100)
Male	40 (80%)	18 (36%)	58 (58%)
Female	10 (20%)	32 (64%)	42 (42%)

A clear male predominance was observed among smokers, whereas females constituted the majority in the non-smoker group. This distribution reflects prevailing tobacco use patterns and provides a meaningful comparison for assessing the impact of smoking on respiratory and cardiovascular parameters.

Table 2: Age Group Distribution of Study Participants

Age Group (years)	Smokers (n = 50)	Non-smokers (n = 50)	Total (n = 100)
40–45	10 (20%)	12 (24%)	22 (22%)
46–50	14 (28%)	15 (30%)	29 (29%)
51–55	16 (32%)	13 (26%)	29 (29%)
56–60	10 (20%)	10 (20%)	20 (20%)

The mean age of smokers and non-smokers was comparable, indicating appropriate age matching between the groups. Males predominated in both groups, with a higher proportion observed among smokers. This reflects the higher prevalence of smoking among males in this age group.

Table 3: Smoking Profile of Smokers

Smoking Variable	Value
Duration of smoking (years)	18.6 ± 6.2
Cigarette smokers, n (%)	30 (60%)
Bidi smokers, n (%)	20 (40%)

Among smokers, the mean duration of smoking was nearly two decades. Cigarette smoking was more common than bidi smoking, indicating urban lifestyle influence. Longer duration of smoking was associated with greater impairment in respiratory parameters.

Table 4: Comparison of Respiratory Parameters Between Smokers and Non-Smokers

Parameter	Smokers (Mean ± SD)	Non-smokers (Mean ± SD)	p-value
FVC (L)	2.81 ± 0.48	3.42 ± 0.52	<0.001
FEV_1 (L)	2.01 ± 0.39	2.89 ± 0.46	<0.001
FEV_1/FVC (%)	71.5 ± 6.8	84.2 ± 5.9	<0.001
PEFR (L/min)	372.6 ± 54.3	468.9 ± 60.1	<0.001

Smokers demonstrated a significant reduction in all measured pulmonary function parameters compared to non-smokers. Forced Vital Capacity (FVC), Forced Expiratory Volume in one second (FEV_1), FEV_1/FVC ratio, and Peak Expiratory Flow Rate (PEFR) were markedly lower in smokers, indicating early obstructive changes in the airways.

Table 5: Comparison of Blood Pressure Parameters Between Smokers and Non-Smokers

Parameter	Smokers (Mean ± SD)	Non-smokers (Mean ± SD)	p-value
Systolic BP (mmHg)	138.4 ± 12.6	124.7 ± 10.9	<0.001
Diastolic BP (mmHg)	88.2 ± 8.1	80.3 ± 7.4	<0.001

Both systolic and diastolic blood pressure values were significantly higher in smokers compared to non-smokers. The elevated blood pressure observed among smokers suggests increased cardiovascular risk associated with chronic nicotine exposure.

DISCUSSION

The present comparative study evaluated the effect of smoking on respiratory parameters and blood pressure among adults aged 40–60 years. A total of 100 participants were included, equally divided into smokers and non-smokers, allowing meaningful comparison between the two groups. The demographic distribution showed a clear male predominance among smokers and female predominance among non-smokers, reflecting established tobacco-use patterns reported in epidemiological studies from India and other developing countries.

In the present study, 80% of smokers were males, while 64% of non-smokers were females. This finding is consistent with reports by Sreeramareddy et al. (2018), [11] who observed significantly higher smoking prevalence among middle-aged men compared to women in South Asia. Cultural factors, occupational stress, and social acceptance of smoking among males have been cited as key contributors to this gender disparity. The comparable age distribution between smokers and non-smokers minimized age-related confounding, ensuring that observed physiological differences could be primarily attributed to smoking exposure.

The mean duration of smoking in the present study was 18.6 ± 6.2 years, indicating long-term exposure to tobacco smoke. Cigarette smoking was more prevalent than bidi smoking, suggesting urban lifestyle influence. Similar trends were reported by Gupta et al. (2019), [12] who demonstrated that prolonged smoking duration is associated with progressive deterioration of pulmonary function, irrespective of the form of tobacco used.

The present study demonstrated a statistically significant reduction in all measured pulmonary function parameters among smokers compared to non-smokers. Forced Vital Capacity (FVC) and Forced Expiratory Volume in one second (FEV_1) were markedly lower in smokers,

indicating reduced lung volumes and airflow limitation. These findings are in agreement with the classical longitudinal study by Fletcher and Peto (1977), [13] who documented accelerated decline in FEV_1 among chronic smokers.

The significantly reduced FEV_1/FVC ratio observed in smokers suggests early obstructive airway changes. Similar observations were reported by Mannino et al. (2007), [14] who highlighted smoking as the principal risk factor for airflow obstruction even before the onset of clinically diagnosed chronic obstructive pulmonary disease (COPD). Chronic inhalation of tobacco smoke leads to airway inflammation, mucous gland hypertrophy, and loss of elastic recoil, resulting in progressive airflow limitation (Barnes et al., 2016) [15].

Peak Expiratory Flow Rate (PEFR) was also significantly reduced among smokers in the present study. Reduced PEFR reflects increased airway resistance and bronchial narrowing, consistent with findings by Jindal et al. (2012) [16], who reported impaired peak flow values in asymptomatic smokers. These changes underscore the importance of spirometric screening in middle-aged smokers for early detection of respiratory impairment.

In addition to respiratory dysfunction, the present study revealed significantly higher systolic and diastolic blood pressure values among smokers compared to non-smokers. This finding aligns with studies by Primatesta et al. (2001), [17] which demonstrated a positive association between smoking and elevated blood pressure. Nicotine-induced sympathetic activation leads to vasoconstriction, increased heart rate, and transient elevation of blood pressure (Benowitz et al., 2010). [18]

Chronic smoking also contributes to endothelial dysfunction, arterial stiffness, and impaired nitric oxide bioavailability, which play a crucial role in the development of sustained hypertension (Messner et al., 2014) [14]. The elevated blood pressure observed in smokers in the present study highlights the increased cardiovascular risk associated with long-term tobacco use, particularly in middle-aged individuals.

CONCLUSION

The present study confirms that chronic smoking is associated with significant deterioration in lung function and elevation of blood pressure among adults aged 40–60 years. Early screening using spirometry and blood pressure monitoring, along with targeted smoking cessation interventions, may help reduce the long-term burden of smoking-related cardiopulmonary diseases.

REFERENCES

1. World Health Organization. WHO global report on trends in prevalence of tobacco use 2000–2025. 4th ed. Geneva: World Health Organization; 2023.
2. GBD 2019 Tobacco Collaborators. Spatial, temporal, and demographic patterns in prevalence of smoking tobacco use and attributable disease burden in 204 countries and territories, 1990–2019. Lancet. 2021;397(10292):2337–60.
3. U.S. Department of Health and Human Services. The health consequences of smoking—50 years of progress: A report of the Surgeon General. Atlanta: CDC; 2014.
4. Fletcher C, Peto R. The natural history of chronic airflow obstruction. BMJ. 1977;1(6077):1645–8.
5. Mannino DM, Buist AS. Global burden of COPD: risk factors, prevalence, and future trends. Lancet. 2007;370(9589):765–73.
6. Benowitz NL. Nicotine addiction. N Engl J Med. 2010;362(24):2295–303.
7. Messner B, Bernhard D. Smoking and cardiovascular disease: mechanisms of endothelial dysfunction and early atherogenesis. Arterioscler Thromb Vasc Biol. 2014;34(3):509–15.
8. Primatesta P, Falaschetti E, Gupta S, Marmot MG, Poulter NR. Association between smoking and blood pressure: evidence from the Health Survey for England. Hypertension. 2001;37(2):187–93.
9. Janssens JP. Aging of the respiratory system: impact on pulmonary function tests and adaptation to exertion. Clin Chest Med. 2005;26(3):469–84.
10. Pellegrino R, Viegi G, Brusasco V, Crapo RO, Burgos F, Casaburi R, et al. Interpretative strategies for lung function tests. Eur Respir J. 2005;26(5):948–68.
11. Sreeramareddy CT, Pradhan PMS, Sin S. Prevalence, distribution, and social determinants of tobacco use in India. BMJ Open. 2018;8(6):e020409.
12. Gupta D, Aggarwal AN, Jindal SK. Pulmonary function abnormalities in smokers and non-smokers. Indian J Chest Dis Allied Sci. 2019;61(3):161–6.
13. Fletcher C, Peto R. The natural history of chronic airflow obstruction. BMJ. 1977;1(6077):1645–8.
14. Mannino DM, Buist AS. Global burden of COPD: risk factors, prevalence, and future trends. Lancet. 2007;370(9589):765–73.
15. Barnes PJ. Inflammatory mechanisms in patients with chronic obstructive pulmonary disease. J Allergy Clin Immunol. 2016;138(1):16–27.
16. Jindal SK, Aggarwal AN, Chaudhry K. Tobacco smoking in India: prevalence, patterns, and predictors. Indian J Med Res. 2012;136(5):730–8.
17. Primatesta P, Falaschetti E, Gupta S, Marmot MG, Poulter NR. Association between smoking and blood pressure. Hypertension. 2001;37(2):187–93.
18. Benowitz NL. Cigarette smoking and cardiovascular disease. Prog Cardiovasc Dis. 2010;52(5):375–86.