

# The Impact of Smoking on Respiratory Function in Patients with Respiratory Disorders

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## ABSTRACT

### Background

Respiratory diseases pose a significant challenge to global health, with smoking being a key risk factor. Chronic respiratory conditions like chronic obstructive pulmonary disease (COPD) and asthma are particularly affected by smoking, which accelerates the decline in lung function.

### Objectives

The study aims to compare the respiratory function outcomes between smokers and non-smokers with respiratory disorders and to determine the impact of age, gender and BMI on the lung function.

### Methods

Pulmonary function test (PFT) data of 438 patients from King Abdulaziz University Hospital (KAUH) was retrospectively studied. Spirometry measurements were FVC Actual, FEV1 Actual, and FEV1/FVC ratio. The descriptive statistics and multivariate analysis (MANOVA) were applied to analyse data using SPSS version 27.

### Results

Of all the participants, only 7.3% were smokers, while remaining 92.7% were non-smokers. Although, the FEV1/FVC ratio was slightly lower in non-smokers ( $p=0.021$ ) as compared to smokers in diseased participants, but most spirometry measures showed non-significant statistical difference ( $p>0.05$ ) between the groups. Whereas, there was a significant statistical difference ( $p<0.05$ ) for FEV1 and FEV1/FVC when gender-based comparison was observed.

### Conclusion

Significant effect of smoking was seen in some lung function effects when analyzed by gender and BMI. Differences between smokers and non-smokers were not significant throughout normal and diseased groups except FEV1/FVC.

### Keywords

Smoking, Respiratory function, Pulmonary Function Test, Spirometry

## INTRODUCTION

Respiratory diseases are a major health challenge worldwide, causing high rates of illness and death, especially in people who have been exposed to risks like smoking for a long time [1]. Chronic respiratory disease (CRD) refers to a group of lung and airway conditions, including COPD, asthma, pneumoconiosis, interstitial lung disease (ILD), and pulmonary sarcoidosis. In 2019, CRD was the third leading cause of death worldwide, placing a heavy burden on healthcare systems and increasing costs [2]. The World Health Organization reports that respiratory infections remain a major cause of mortality, especially in low-income regions where limited access to healthcare and inadequate preventive measures worsen outcomes [3].

Both COPD and asthma burden global health substantially. COPD affects approximately 251 million people, especially in areas where smoking and air pollution are prevalent because these factors trigger exacerbations and hospital admissions. Asthma affects nearly 300 million people worldwide and often compromises daily functioning and quality of life [4]. Respiratory

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illnesses arise from both genetic and environmental factors. Environmental contributors include air pollution, allergens, tobacco smoke, and occupational exposure to harmful substances such as dust and chemicals [5].

Smoking takes a heavy toll on the lungs and is therefore a major focus in respiratory care. Pulmonary function tests (PFTs) are commonly used to assess lung health by measuring lung volume, capacity, and ventilatory performance. Research shows that even smokers without overt symptoms may demonstrate early pulmonary damage years before overt COPD or related disorders become clinically apparent. Compared with non-smokers, smokers often show lower forced expiratory volume in one second (FEV1) and forced vital capacity (FVC), highlighting the need for early detection, preventive intervention, and smoking cessation [6,7].

Comparative analyses of pulmonary function reveal important disparities between smoking and non-smoking populations, with tobacco users showing accelerated deterioration in respiratory efficiency [8,9]. Clinical evidence further indicates that smoking cessation can improve lung function parameters and attenuate disease progression in COPD, whereas continued smoking aggravates respiratory muscle dysfunction and compromises pulmonary capacity [10,11].

This research is significant because smoking is a well-known risk factor for various respiratory diseases, yet its specific impact on respiratory function across different demographic groups (age, gender, BMI) and disease types (SOB, COPD, asthma) is not fully understood. By conducting a retrospective analysis using data from patients, this study will provide a comprehensive assessment of how smoking affects respiratory function in patients with respiratory disorders. Less is known about how smoking influences healthy individuals' lung function. By including healthy controls, this study will provide insights into baseline lung function differences between smokers and non-smokers.

Objectives:

1. To compare the respiratory function outcomes between smokers and non-smokers among patients with and without respiratory disorders.
2. To evaluate how age, gender, and BMI impact respiratory function.

## METHODS

### Study Design

This was a retrospective cohort study.

### Participants

Data was obtained from pre-existing medical records at KAUH. The data of all the participant's undergone pulmonary function test using the spirometry at KAUH were included in the study and missing key data on respiratory function or smoking status were excluded. The data included the spirometry data (FVC Actual, FEV1 Actual, FEV1/FVC Actual), participant's age, BMI, diagnosis and their smoking status. A total of 438 participants data was used in the study.

### Procedure

This study was approved by the Institutional Review Board of King Abdulaziz University. Since it relied on existing medical records, the ethics committee waived the need for individual consent. To protect patient privacy, all data were anonymized before analysis.

### Data Analysis

Data was entered and analyzed through SPSS version 27. First of all, normality of the data was checked so that the tests could be decided. Descriptive statistics was applied and Multivariate Analysis (MANOVA) was conducted. The statistical significance was considered for p-values below 0.05.

## RESULTS

A total of 438 participants were included in the study with a mean age of  $47.15 \pm 17.06$  years and a mean body mass index (BMI) of  $29.66 \pm 7.73$  kg/m<sup>2</sup>. The frequency distribution of demographic characteristics is presented in Table 1.

The Shapiro–Wilk test was conducted to assess the normality of respiratory function variables. The results indicated that the data were normally distributed ( $p > 0.05$ ), therefore parametric multivariate analyses were applied. Multivariate analyses were conducted to examine differences in respiratory function outcomes across smoking status, gender, BMI, and diagnostic categories. Overall, most respiratory function parameters did not demonstrate statistically significant differences across groups.

Comparison between smokers and non-smokers showed no significant differences in FVC or FEV1 measures

Table 2. However, among participants with respiratory disorders, the FEV1/FVC ratio was significantly lower in smokers ( $p = 0.021$ ), suggesting a potential negative effect of smoking on airway function Table 3. Gender-based comparisons revealed significant differences in respiratory function outcomes Male participants exhibited higher FEV1 actual values ( $p = 0.001$ ), whereas female participants demonstrated a significantly higher FEV1/FVC ratio ( $p = 0.004$ ) Table 4.

Analysis across BMI categories indicated significant difference FEV1 actual values ( $p = 0.003$ ), with lower values observed in participants with severe obesity, while other respiratory parameters did not vary significantly Table 5. Finally, comparison between normal and diseased participants revealed a significant difference in FEV1 % predicted ( $p = 0.047$ ), while no significant differences were observed in other respiratory function measures Table 6.

**Table 1: Frequency Distribution of Demographics**

		N	%
Gender of Participants	Male	146	33.3%
	Female	292	66.7%
Smoking Status of Participants	Non-Smoker	406	92.7%
	Smoker	32	7.3%
BMI of Participants	Underweight	13	3.0%
	Healthy Range	113	25.8%
	Overweight	123	28.1%
	Obesity	150	34.2%
	Severe Obesity	39	8.9%
Respiratory Disorder diagnosis	Normal	63	14.4%
	Diseased	375	85.6%
FEV1/FVC actual category	Obstructive Lung Disease	49	11.2%
	Normal Lung Function	389	88.8%

**Table 2: Effect of respiratory function outcomes between smokers and non-smokers participants using Multivariate analysis**

	Smoking Status of Participants	N	Mean $\pm$ SD	p value
FVC Actual	Non-Smoker	406	2.862 $\pm$ 5.087	.907
	Smoker	32	2.968 $\pm$ 1.077	
FEV1 Actual	Non-Smoker	406	2.140 $\pm$ .878	.240
	Smoker	32	2.330 $\pm$ .912	
FEV1/FVC Actual	Non-Smoker	406	82.231 $\pm$ 10.724	.061
	Smoker	32	78.500 $\pm$ 11.881	

**Table 3: Comparison of the respiratory function outcomes between smokers and non-smokers among patients with respiratory disorders using Multivariate analysis**

Diagnosis of Participants	Diagnosis of Participants	Smoking Status	N	Mean $\pm$ SD	p value
Normal	FVC Actual	Non-Smoker	59	2.527 $\pm$ 1.199	.374
		Smoker	4	1.985 $\pm$ .332	
	FEV1 Actual	Non-Smoker	59	2.045 $\pm$ .942	.487
		Smoker	4	1.712 $\pm$ .298	
	FEV1/FVC Actual	Non-Smoker	59	82.050 $\pm$ 10.981	.435
		Smoker	4	86.500 $\pm$ 10.630	
Diseased	FVC Actual	Non-Smoker	347	2.919 $\pm$ 5.479	.856
		Smoker	28	3.108 $\pm$ 1.075	
	FEV1 Actual	Non-Smoker	347	74.09 $\pm$ 20.56	.127
		Smoker	28	73.571 $\pm$ 20.509	
	FEV1/FVC Actual	Non-Smoker	347	82.262 $\pm$ 10.695	.021
		Smoker	28	77.357 $\pm$ 11.776	

**Table 4: Effect of respiratory function outcomes between male and female participants using Multivariate analysis**

	Gender of Participants	N	Mean $\pm$ SD	p value
FVC Actual	Male	146	3.297 $\pm$ 1.206	.198
	Female	292	2.656 $\pm$ 5.939	
FEV1 Actual	Male	146	2.644 $\pm$ 1.058	.001
	Female	292	1.908 $\pm$ .653	
FEV1/FVC Actual	Male	146	79.828 $\pm$ 12.020	.004
	Female	292	83.024 $\pm$ 10.055	

**Table 5: Effect of respiratory function outcomes between Body mass Index of participants using Multivariate analysis**

	BMI Category	N	Mean $\pm$ SD	p value
FVC Actual	Underweight	13	2.679 $\pm$ 1.192	.773
	Healthy Range	113	2.929 $\pm$ 1.063	
	Overweight	123	2.682 $\pm$ .9369	
	Obesity	150	3.193 $\pm$ 8.272	
	Severe Obesity	39	2.109 $\pm$ .826	
FEV1 Actual	Underweight	13	2.270 $\pm$ 1.234	.003
	Healthy Range	113	2.355 $\pm$ .928	
	Overweight	123	2.187 $\pm$ .779	
	Obesity	150	2.070 $\pm$ .897	
	Severe Obesity	39	1.746 $\pm$ .681	
FEV1/FVC Actual	Underweight	13	82.769 $\pm$ 16.793	.268
	Healthy Range	113	79.982 $\pm$ 12.413	
	Overweight	123	82.357 $\pm$ 11.075	
	Obesity	150	82.833 $\pm$ 9.199	
	Severe Obesity	39	82.794 $\pm$ 8.169	

**Table 6: Effect of respiratory function outcomes between normal and diseased participants using Multivariate analysis**

	Diagnosis of Participants	N	Mean $\pm$ SD	p value
FVC Actual	Normal	63	2.492 $\pm$ 1.169	.510
	Diseased	375	2.933 $\pm$ 5.278	
FEV1 Actual	Normal	63	2.024 $\pm$ .917	.207
	Diseased	375	2.175 $\pm$ .874	
FEV1/FVC Actual	Normal	63	82.333 $\pm$ 10.930	.767
	Diseased	375	81.896 $\pm$ 10.840	

## DISCUSSION

The present study evaluated the relationship between smoking and respiratory function in patients with and without respiratory disorders. Overall, most spirometric parameters did not differ significantly between smokers and non-smokers; however, the FEV1/FVC ratio among diseased participants was significantly lower in smokers, suggesting greater airway obstruction in this subgroup. This finding is consistent with earlier reports showing that smoking is associated with declining ventilatory efficiency and obstructive changes in lung mechanics [8,9,14].

In the present study, most participants were female and the proportion of smokers was small. Although this distribution may limit broader generalization, it also reflects the importance of interpreting smoking-related respiratory impairment in the context of demographic characteristics. Guo et al. reported a markedly higher smoking prevalence among male participants and linked smoking with COPD-related deterioration in lung function [12]. Differences between that report and the present study may reflect cultural variation, referral patterns, and unequal group sizes.

Body mass index also appeared to influence respiratory performance. FEV1 differed significantly across BMI categories, with lower values in participants with severe obesity. This observation supports prior evidence that body habitus can modify respiratory mechanics and

may interact with smoking-related injury [13]. At the same time, the present findings suggest that the relationship is complex and may be mediated by age, sex, and comorbidity burden rather than smoking alone.

Gender-based analysis demonstrated significantly higher FEV1 values in males, whereas females showed a higher FEV1/FVC ratio. These results indicate that sex-related physiological differences may shape the measurable impact of smoking on spirometric outcomes. Previous studies have similarly noted that age, gender, and smoking status are major determinants of pulmonary function indices [9,14].

The clinical significance of the present findings lies in the observation that airway obstruction, as reflected by FEV1/FVC, may be more sensitive to smoking-related effects than isolated FVC or FEV1 values in mixed respiratory populations. This aligns with evidence that smoking cessation remains an essential therapeutic priority in patients with chronic respiratory disease because it can slow deterioration and improve functional status [15-18].

## CONCLUSION

Smoking showed a measurable adverse effect on selected lung function parameters, particularly the FEV1/FVC ratio among patients with respiratory disease. Although

most spirometric outcomes did not differ significantly between smokers and non-smokers, gender- and BMI-based analyses suggested that demographic and anthropometric factors modify respiratory performance. These findings support continued emphasis on smoking prevention, early respiratory assessment, and smoking cessation counseling in clinical practice.

## Limitations

The sample was unevenly distributed with respect to gender and smoking status, and the proportion of smokers was relatively small. The study also did not account for smoking intensity, occupational exposure, environmental pollutants, or pre-existing health conditions that could influence lung function. These factors may have reduced the ability to detect stronger smoking-related differences.

## Recommendations

Future studies should include larger and more balanced cohorts, quantify smoking exposure more precisely, and incorporate biomarkers such as cotinine or exhaled carbon monoxide. Longitudinal designs and disease-specific subgroup analyses may further clarify the effect of smoking on COPD, asthma, and other chronic respiratory disorders.



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