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Original Research Article

Comparison of Clinico- Demographic and Lung Spirometry Profile Between Non- Smoker versus Smoker COPD Patients

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Abstract:

Introduction: Chronic Obstructive Pulmonary Disease (COPD) is a major cause of morbidity and mortality worldwide, with smoking being the leading risk factor. However, non-smokers, particularly those exposed to biomass fuel, occupational hazards, or second-hand smoke, also contribute significantly to the disease burden. This study aims to compare the clinico-demographic and lung spirometry profiles between non-smoker and smoker COPD patients, highlighting the differences in risk factors, symptom presentation, and disease severity.

Materials and Methods: This cross-sectional study was conducted at a tertiary care center, including 200 COPD patients diagnosed through clinical features and spirometry. Patients were divided into two groups: smokers and non-smokers. Data on clinical symptoms, demographic factors, and lung function (via spirometry and GOLD classification) were collected. Non-smokers were those exposed to biomass or occupational risks, while smokers had a smoking history of at least 10 pack-years. Statistical analyses were performed to compare the two groups, with a p-value <0.05 considered significant.

Results: In our study, 67% of the COPD patients were smokers, and 33% were non-smokers. The majority of smokers (99 out of 134) were classified as GOLD 3, with 17 in GOLD 4, while non-smokers were primarily in GOLD 3 (39 out of 66), with only 2 in GOLD 4 ($p < 0.001$). Non-smokers had significant risk factors like biofuel exposure (71.2%), second-hand smoke (15.2%), and underlying causes (13.6%). Smokers experienced more severe symptoms, including cough (102 out of 134), sputum (73), and chest tightness (42), compared to non-smokers (p-values ranging from 0.011 to 0.034). Additionally, 116 smokers had 3-5 acute exacerbations compared to 44 non-smokers ($p = 0.001$). Smokers also had a higher mean CAT score (31.43 ± 4.204) than non-smokers (29.17 ± 4.508, $p = 0.001$). Lastly, socioeconomic status showed a significant difference, with most smokers from lower classes ($p < 0.001$).

Conclusion: Our study demonstrates significant differences between smoker and non-smoker COPD patients, with smokers exhibiting more severe lung function impairment, higher symptom burden, and frequent exacerbations. Non-smokers were primarily affected by biofuel exposure and environmental factors, indicating the need for targeted interventions in both groups to manage and prevent COPD.

Keywords: COPD, smoker, non-smoker, spirometry, biofuel exposure.

Introduction

Chronic Obstructive Pulmonary Disease (COPD) is one of the leading causes of morbidity and mortality worldwide, affecting millions of individuals. [1] Cigarette smoking stands as the primary risk factor contributing to the development of COPD. [2] This debilitating condition is characterized by chronic inflammation and irreversible airflow obstruction, leading to significant structural changes in the lung. Traditionally, the focus of COPD research centered on smoking as the predominant risk factor; however, recent studies have shed light on the substantial role of non-smokers in COPD pathogenesis. Approximately 50% of COPD cases globally are attributed to smoking, while a notable 10%-12% of individuals diagnosed with COPD have never smoked. [3] The clinico-demographic profile of COPD patients encompasses a wide range of variables, including age, gender, socioeconomic status, comorbidities, and symptomatology. Non-smoker COPD patients often present with distinct demographic character istics compared to their smoking counterparts. Studies have suggested that non-smoker COPD

patients tend to be older at the time of diagnosis, with a higher prevalence among females. [4] Additionally, non-smoker COPD patients may exhibit a different distribution of comorbidities, with a potentially greater burden of cardiovascular diseases and genetic predispositions playing a more prominent role in disease pathogenesis. [5] In our study, the aim is to evaluate the clinico-demographic characteristics and lung function profiles between non-smoker and smoker COPD patients. The objectives include comparing clinical symptoms, demographic profiles, and spirometry indices to understand the impact of smoking on COPD progression.

Materials and Methods:

This cross-sectional observational study was conducted at a tertiary care center to compare the clinico-demographic and lung spirometry profiles of non-smoker and smoker COPD patients. The study included 200 patients who were diagnosed with COPD based on clinical features and lung function tests. Patients were recruited from both the outpatient and inpatient departments, ensuring a diverse sample population. Ethical approval was obtained from the Institutional Ethical Committee before the initiation of the study, and informed consent was taken from all participants.

Patients were categorized into two groups: non-smokers and smokers. The inclusion criteria were patients above 18 years diagnosed with COPD through clinical history, spirometry, and chest X-rays. Patients who were under 18 years or who did not provide consent were excluded. Non-smokers were defined as individuals who had never smoked or were exposed to biomass fuel or occupational hazards, while smokers were defined as those with a history of smoking at least 10 pack-years of cigarettes or bidis. Data collection involved detailed patient interviews to assess their clinical history, symptoms, and past exposure to risk factors. Spirometry was performed on all patients to classify them according to the GOLD criteria, and additional demographic information such as age, gender, socioeconomic status, and educational background was recorded. The collected data were analyzed to identify differences between non-smoker and smoker COPD patients, focusing on lung function, symptoms, and risk factors. Statistical analyses were conducted to determine the significance of observed differences, with a p-value of less than 0.05 considered significant.

Results

In our study, the results show a distribution of COPD patients based on their smoking status. A majority of the patients were smokers, accounting for 67%, while non-smokers comprised 33%. This data suggests a significant link between smoking and the increased prevalence of COPD among patients. In our study, the age distribution of COPD patients was compared based on their smoking status. Among non-smokers, the majority were aged 40-50 years (31 patients), whereas smokers were predominantly aged 51-60 years (53 patients). The overall mean age was higher in smokers (59.73 ± 9.2 years) compared to non-smokers (55.77 ± 11.11 years), with a statistically significant difference (p-value 0.009). In our study, most non-smokers were females, while smokers were predominantly males, with COPD significantly more common in males (p-value < 0.001), highlighting a strong link between smoking and COPD in males. The occupational distribution of COPD patients shows that non-smokers were mainly housewives, while smokers were predominantly farmers and wage workers. Most smokers were from rural areas (72.4%), while non-smokers were predominantly from urban areas (69.7%), suggesting geographical factors may influence smoking status and COPD incidence. In our study, most smokers were illiterate (108 out of 134), while non-smokers had a higher proportion of literates (37 out of 66). This difference in education status was statistically significant (p-value < 0.001).

In our study, most smokers were from the lower socioeconomic status (68 out of 134), while non-smokers were more evenly distributed, with 24 from the upper-lower class. This socioeconomic difference between smokers and non-smokers was statistically significant (p-value < 0.001). The smokers reported higher frequencies of symptoms, including cough (102 out of 134), sputum (73), fever (83), and chest tightness (42), compared to non-smokers. All symptoms showed statistically significant differences between the groups (p-values ranging from 0.011 to 0.034). (Table 1)

Table 1: Comparing Symptoms distribution of patients as per smoking status in COPD patients

Symptoms	Groups		Total	P value
	Non-smokers	Smokers		
Cough	52	102	154	0.034
Sputum	30	73	104	0.021
Fever	35	83	118	0.011
Chest Tightness	15	42	57	0.012

The smokers experienced more severe shortness of breath, with the majority in mMRC Grade 2 (86 out of 134), while non-smokers were more evenly distributed across grades. This difference in breathlessness severity between smokers and non-smokers was statistically significant (p-value = 0.001).

Table 2: Comparing Shortness of breath as per smoking status in COPD patients

Shortness of breath	Non-smokers (n)	Smokers (n)	Total	P value
mMRC Grade 1	14	6	20	0.001
mMRC Grade 2	40	86	126	
mMRC Grade 3	8	32	40	
mMRC Grade 4	4	10	14	
Total	66	134	200	

In our study, smokers had more frequent acute exacerbations, with 116 out of 134 experiencing 3-5 episodes, compared to 44 out of 66 non-smokers. This difference was statistically significant (p-value = 0.001). Additionally, smokers had a higher mean CAT score of 31.43 ± 4.204, while non-smokers had a mean score of 29.17 ± 4.508, with a statistically significant difference (p-value = 0.001).

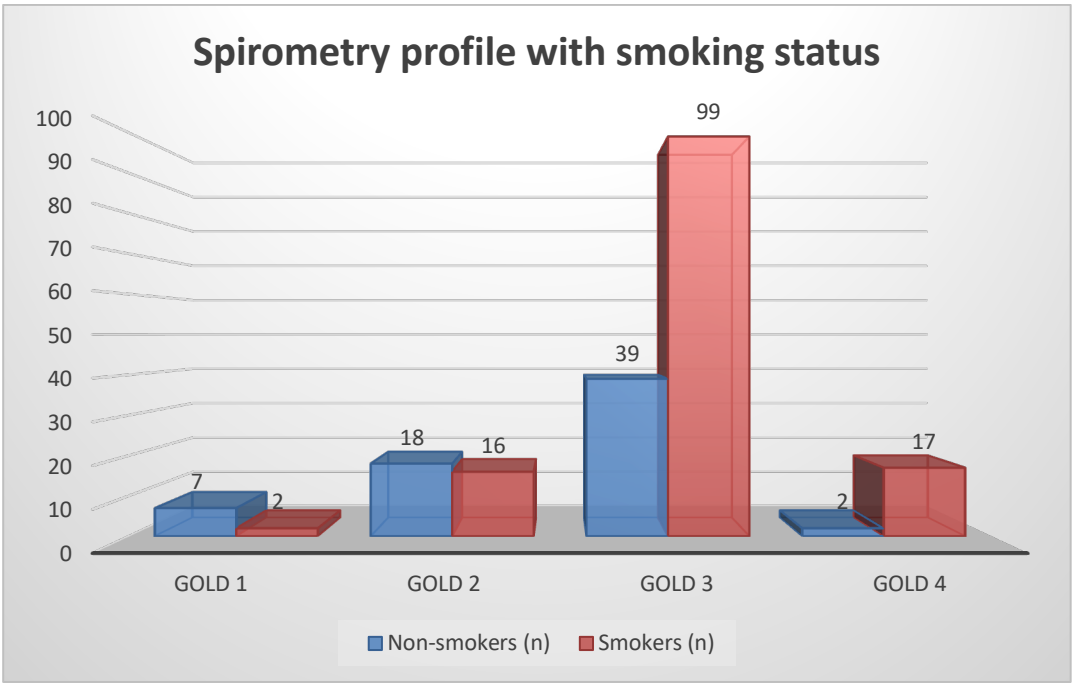

Figure 1: Spirometry profile with smoking status

In our study, the spirometry profile of COPD patients revealed that smokers were more likely to be in the severe stages, with 99 out of 134 in GOLD 3 and 17 in GOLD 4, while non-smokers were primarily in GOLD 3 (39 out of 66), with only 2 in GOLD 4 and 7 in GOLD 1, showing a statistically significant difference (p-value < 0.001). For non-smokers, the major risk factor for COPD was exposure to biofuel, affecting 71.2% of the group, followed by second-hand smoke exposure (15.2%) and underlying causes like respiratory diseases (13.6%). This highlights that even without smoking, non-smokers are exposed to significant risk factors that contribute to COPD development.

Discussion

The majority of COPD patients in our study are smokers, making up 67% of the total, while non-smokers constitute 33%. This indicates a strong association between smoking and COPD prevalence, consistent with findings from other studies. For instance, Bajpai et al. [4] (2020) reported that a significant proportion of COPD patients were smokers, highlighting the critical role of smoking in the development of the disease. Similarly, Sinha et al. [6] (2017) found that smoking was significantly associated with the occurrence of COPD, with the majority of their COPD patients being smokers. Alamgir et al. [7] (2021) demonstrated that smoking was a major risk factor, with smokers exhibiting significantly lower lung function and more severe disease progression compared to non-smokers. The mean age of COPD patients in our study was found to be 58.43 years, with smokers having a significantly higher mean age (59.73 years) compared to non-smokers (55.77 years). This trend is consistent with the findings of

Bajpai et al. [4] (2020), who reported a higher mean age among smokers (59.29 years) compared to non-smokers (53.90 years) in their study on the clinical, demographic, and radiological profile of COPD patients. Similarly, Sinha et al. [6] observed that the mean age of COPD patients was 57.13 years, indicating that COPD is more prevalent in older age groups. The association between older age and COPD is likely due to the cumulative effect of long-term exposure to risk factors such as smoking and environmental pollutants, which contribute to the development and progression of the disease over time.

The occupation distribution in COPD patients shows a distinct pattern between smokers and non-smokers. Our study indicates that non-smokers are predominantly housewives (71.2%), whereas smokers are mainly farmers and wage workers. This suggests that occupational factors might influence smoking habits and consequently, the risk of developing COPD. Supporting this, Zhang et al. [8] and Bajpai et al. [4] highlighted similar trends where smokers with COPD were largely engaged in labour-intensive occupations, underscoring the potential occupational exposure to dust and pollutants as additional risk factors for COPD among smokers.

Geographical distribution data reveals that a higher proportion of smokers (72.4%) reside in rural areas, while non-smokers are more likely to live in urban areas (69.7%). This finding aligns with the studies by Sze et al. [9] (2022) and Alamgir et al. [7] (2021), which also reported a higher prevalence of smokers in rural regions. The rural smoking prevalence might be attributed to limited access to smoking cessation programs and higher exposure to biomass fuel, a common practice in rural settings, which contributes to COPD development in non-smokers.

Regarding education status, our study found that the majority of smokers with COPD are illiterate (80.6%), while a higher proportion of non-smokers are literate (56.1%). This suggests a potential link between lower educational levels and higher smoking rates. The studies by Sinha et al. [6] and Bajpai et al. [4] (2019) corroborate this, indicating that educational interventions could play a crucial role in smoking prevention and COPD management.

Lastly, socioeconomic status analysis reveals that smokers with COPD predominantly belong to lower and lower-middle socioeconomic classes, whereas non-smokers include individuals from upper-lower and upper-middle classes. This socioeconomic disparity suggests that lower socioeconomic status may influence smoking habits and increase the risk of COPD. Studies by Alamgir et al. [7] (2021) and Sinha et al.[6] similarly highlight that socioeconomic factors significantly affect health behaviors and access to healthcare resources, thereby impacting COPD prevalence and outcomes among different socioeconomic groups. Symptoms such as cough, sputum production, fever, and chest tightness are significantly more common in smokers compared to non-smokers.

This indicates that smokers experience more severe COPD symptoms. Bajpai et al. [4] observed that smokers with COPD had a higher prevalence of these symptoms, which can be attributed to the direct irritant effects of tobacco smoke on the respiratory tract. Similarly, Sinha et al. [6] reported that cough and sputum production were significantly more frequent in smokers, emphasizing the chronic inflammatory response induced by smoking. Smoker's exhibit more severe shortness of breath (higher mMRC grades) compared to non-smokers, indicating a greater impact of smoking on the severity of COPD symptoms. In our study, a significant proportion of smokers presented with higher mMRC grades, which was consistent with findings from Bajpai et al. [4] (2020), who reported that smokers had worse dyspnea scores.

Smokers are more likely to be in severe GOLD stages (GOLD 3 and 4), indicating worse lung function, whereas non-smokers are more often in milder stages (GOLD 1 and 2). This observation is supported by several studies focusing on the spirometric profiles of COPD patients. Ji et al. [10] found that smokers exhibited more significant structural lung changes, such as increased emphysema and airway wall thickening, which contribute to worse lung function and higher GOLD stages. Anwar et al. [11] reported that non-smokers with COPD, particularly those exposed to biomass smoke, showed significant pulmonary function impairment but were less likely to be in the severe GOLD stages compared to smokers.

A study by Bajpai et al. [4] observed that smokers had more severe airflow limitation, with a greater proportion falling into GOLD stages 3 and 4. This is in contrast to non-smokers, who were predominantly in the milder stages (GOLD 1 and 2), reflecting less severe lung function decline. Ojuawo et al. [12] (2019) highlighted that never-smokers with COPD had better post-bronchodilator lung function parameters compared to ever-smokers, indicating a milder disease progression in non-smokers.

The second-hand smoke exposure, accounting for 15.2% of non-smoker COPD cases in our study, further underscores the risk of passive smoking in COPD development. Ji et al. [10] noted that non-smokers exposed to second-hand smoke exhibited significant lung function impairment and structural

changes akin to those seen in active smokers. Anwar et al. [11] identified second-hand smoke as a notable risk factor among non-smokers with COPD, contributing to their pulmonary function decline.

Bajpai et al. [4] reported that second-hand smoke exposure, while less prevalent than biomass exposure, still played a significant role in the etiology of COPD among non-smokers. Salvi et al. [13] (2020) and Alamgir et al. [7] (2021) both found that second-hand smoke was a significant risk factor for COPD in non-smokers, contributing to the overall disease burden. Shah et al. [14] (2021) and Rodríguez García et al. [15] (2023) also emphasized the detrimental effects of second-hand smoke on non-smokers, leading to COPD development. These studies collectively highlight the critical need for public health interventions to reduce exposure to biomass smoke and second-hand smoke to mitigate the risk of COPD among non-smokers.

One limitation of our study is the relatively small sample size, which may not be fully representative of the broader COPD patient population. Additionally, the cross-sectional design limits our ability to establish causality between exposures and COPD severity. The reliance on self-reported data for smoking habits and exposure to environmental pollutants could introduce recall bias, potentially affecting the accuracy of the findings.

Conclusion

In conclusion, our study found that an Environmental and occupational exposures are significant contributors to COPD among non-smokers, with biofuel smoke and second-hand smoke being primary risk factors. This highlights the need for public health interventions aimed at reducing exposure to these pollutants, particularly in rural areas where biofuel use is prevalent. Recognizing these risk factors is essential for understanding the broader etiology of COPD beyond smoking, emphasizing the importance of addressing environmental health.

The data also indicate that non-smoker COPD patients often experience less severe symptoms and better spirometric profiles compared to smokers, who typically present with more advanced disease stages and severe airflow limitations. Effective public health policies and education on the risks of biofuel and second-hand smoke exposure are crucial for reducing COPD incidence and improving patient outcomes.

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