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FREQUENCY OF DIABETES IN PATIENTS PRESENTING WITH CHRONIC OBSTRUCTIVE PULMONARY DISEASE

Original Research

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ABSTRACT

Background: Chronic obstructive pulmonary disease (COPD) is increasingly recognized as a systemic condition with multiple comorbidities, including diabetes mellitus. The co-existence of these diseases can significantly affect patient outcomes, yet regional data quantifying their association remains limited. Understanding the burden of diabetes among COPD patients is essential for integrated disease management, especially in resource-constrained settings where early identification and preventive counseling can reduce complications and improve quality of life.

Objective: To determine the frequency of diabetes mellitus among patients diagnosed with chronic obstructive pulmonary disease.

Methods: A cross-sectional study was conducted at the Department of Pulmonology, Ayub Teaching Hospital, Abbottabad, from September 1, 2024, to February 28, 2025. A total of 121 patients, both male and female, aged between 45 and 70 years, and clinically diagnosed with COPD were included. Diabetes mellitus was diagnosed using fasting blood glucose levels >126 mg/dL or HbA1c >6.5%, or a prior history of antidiabetic medication use. Demographic and clinical data were collected using a structured questionnaire. Data were analyzed using SPSS version 26. Frequencies, means, and standard deviations were calculated, and chi-square tests were used for statistical associations, with a significance level of $p<0.05$.

Results: The mean age of participants was 58.90 ± 6.70 years, with a mean BMI of 25.11 ± 1.00 kg/m² and average COPD duration of 7.81 ± 2.75 years. Most participants (68.6%) were over 55 years of age, and 51.2% were female. Diabetes mellitus was identified in 26 patients (21.0%). No statistically significant association was observed between diabetes and baseline characteristics such as age, gender, BMI, disease duration, education, smoking, or profession.

Conclusion: A considerable proportion of COPD patients were found to have diabetes mellitus. Although certain trends, such as older age and longer disease duration, were noted among diabetic patients, no statistically significant correlations were established, underscoring the need for broader, multicentric investigations.

Keywords: Chronic Obstructive Pulmonary Disease, Diabetes Mellitus, Fasting Blood Glucose, Glycosylated Hemoglobin, Inflammation, Spirometry, Systemic Disease.

INTRODUCTION

Chronic obstructive pulmonary disease (COPD) is a progressive respiratory condition that imposes a significant global health burden, with its prevalence steadily rising. By the year 2030, COPD is projected to become the third leading cause of mortality worldwide, accounting for an estimated six million deaths annually (1). Alarmingly, approximately 90% of these fatalities are anticipated to occur in developing countries, where healthcare infrastructure is often under-resourced (2). Asia, which accommodates over one-third of the global population, bears a disproportionate burden by contributing to more than 60% of global COPD-related deaths (3). This increasing trend in morbidity and mortality is largely attributed to factors such as rampant tobacco consumption, longer life expectancy, and elevated environmental pollution, particularly in low- and middle-income nations (4). Despite the well-established role of smoking in COPD pathogenesis, the influence of comorbidities in the disease's trajectory has drawn growing attention in recent years. Emerging evidence suggests a potential link between COPD and a range of comorbid conditions through shared inflammatory pathways (5). Chronic systemic and pulmonary inflammation, a hallmark of COPD, has been identified as a contributing factor in the development of malignancies, cardiovascular diseases, and metabolic disorders. While past therapeutic strategies predominantly focused on respiratory-specific outcomes like exacerbation frequency, there is now a greater emphasis on overall mortality and quality of life as key endpoints in evaluating treatment efficacy (6). This shift in clinical focus underscores the complex interplay between COPD and associated comorbidities, including but not limited to coronary artery disease, osteoporosis, cerebrovascular accidents, and lung cancer (7).

Comorbidities in COPD may either be part of the natural disease progression or result from independent pathological conditions that exacerbate respiratory compromise, such as acute infections (8). Older adults, who are more frequently diagnosed with COPD, are particularly susceptible to multiple chronic illnesses, which collectively contribute to increased healthcare utilization, extended hospital stays, and heightened mortality risk—even from non-respiratory causes (9). Furthermore, the presence of concurrent illnesses has been shown to significantly impact the clinical outcomes, hospital readmission rates, and overall well-being of COPD patients. A notable UK-based study found that individuals with COPD faced a fivefold increased risk of developing coronary artery disease, a threefold higher risk of stroke, and a twofold rise in diabetes incidence compared to the general population (10,11). Among these comorbidities, diabetes mellitus has emerged as a critical area of concern. Diabetic patients, owing to their impaired immune responses and delayed tissue healing, are more vulnerable to infections of various origins. When compounded by chronic pulmonary dysfunction in COPD, this susceptibility escalates the risk of severe complications such as sepsis and pneumonia, leading to deteriorated health outcomes and diminished quality of life. Despite the clinical relevance of this intersection, there is a paucity of regional and national data quantifying the prevalence of diabetes in individuals with COPD. Addressing this knowledge gap is essential for guiding integrated care strategies and comorbidity-focused interventions. Therefore, the current study was undertaken to evaluate the frequency of diabetes mellitus in patients with chronic obstructive pulmonary disease, aiming to contribute to early recognition and management of this high-risk comorbidity in clinical settings.

METHODS

A descriptive cross-sectional study was conducted in the Department of Pulmonology at Ayub Teaching Hospital, Abbottabad, over a six-month period from September 1, 2024, to February 28, 2025. Ethical approval was obtained from the College of Physicians and Surgeons Pakistan (CPSP), and all participants provided written informed consent after being fully briefed on the study's purpose, procedures, and potential risks. The study population consisted of male and female patients aged between 45 and 70 years who were clinically and spirometrically diagnosed with chronic obstructive pulmonary disease (COPD). COPD diagnosis was established based on the presence of clinical symptoms such as chronic productive cough and dyspnea, along with spirometry findings showing a post-bronchodilator FEV1/FVC ratio of less than 70%, consistent with GOLD guidelines. Patients with other pulmonary conditions that could confound the diagnosis or outcomes were excluded. These included individuals diagnosed with pulmonary fibrosis, hypersensitivity pneumonitis, pleural effusion, occupational lung diseases, and malignant diseases involving the lungs or pleura. The sample size was calculated using the World Health Organization sample size calculator, using an anticipated prevalence of diabetes mellitus in COPD patients of 19%, a 95% confidence interval, and a 7% margin of error. This yielded a sample size of 121 patients, who were recruited through non-probability consecutive sampling (12).

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Each patient underwent a detailed clinical evaluation including history taking, physical examination, and a comprehensive panel of investigations to rule out alternative causes of reduced pulmonary function. The diagnostic workup included complete blood counts, renal function tests, electrocardiogram, echocardiography, chest X-ray, high-resolution computed tomography (HRCT), and spirometry. Once COPD was confirmed, diabetes mellitus status was assessed through fasting blood glucose (FBS), random blood sugar (RBS), and glycated hemoglobin (HbA1c) levels. Diabetes was diagnosed in patients with fasting glucose >126 mg/dL, HbA1c >6.5%, or a documented history of taking antidiabetic medications for at least six months, as per the American Diabetes Association guidelines. Sociodemographic information was also collected, including age, sex, level of education, occupation, household income, area of residence, and socioeconomic status. Data were entered into a predesigned and standardized questionnaire while ensuring strict adherence to confidentiality and data protection protocols. Statistical analysis was performed using SPSS version 26. The normality of continuous data was assessed using the Shapiro-Wilk test. Numerical variables such as age, FBS, RBS, and HbA1c were expressed as mean ± standard deviation or median (interquartile range), depending on distribution. Categorical variables, including gender, smoking status, employment, and pet ownership, were presented as frequencies and percentages. Stratification was carried out for variables such as age, gender, smoking status, employment status, and pet ownership to examine associations with diabetes mellitus. The chi-square test, Fisher's exact test, or post-stratification analysis was applied where appropriate, and a p-value of less than 0.05 was considered statistically significant. Results were presented in both tabular and graphical formats for clarity and interpretability.

RESULTS

The study enrolled 121 patients diagnosed with chronic obstructive pulmonary disease (COPD), with a mean age of 58.90 ± 6.70 years. The average body mass index (BMI) was 25.11 ± 1.00 kg/m², and the mean disease duration was 7.81 ± 2.76 years. A majority of participants (n = 83, 68.6%) were older than 55 years, and females slightly outnumbered males, comprising 51.2% (n = 62) of the cohort. The proportion of patients with a disease duration exceeding seven years was 52.9% (n = 64). A positive history of smoking was reported by 45 patients (37.2%), while 29 participants (24.0%) had a family history of diabetes mellitus. Bird or pet ownership was reported by 24 participants (19.8%). More than half of the participants (56.2%) were salaried professionals, and 55.4% resided in rural areas. In terms of educational attainment, 24.8% had no formal education, 49.6% had completed matriculation or below, and 25.6% had education above matriculation. The overall prevalence of diabetes mellitus among COPD patients was found to be 21.0% (n = 26). However, no statistically significant associations were identified between diabetes mellitus and various baseline characteristics, including age group (p = 0.302), gender (p = 0.887), BMI (p = 0.210), disease duration (p = 0.912), or pet/bird ownership (p = 0.640). Among patients with a BMI ≤ 25, 25.8% were diabetic compared to 16.4% among those with BMI > 25. Similarly, diabetes was slightly more prevalent among those with disease duration over 7 years (21.9%) than those with shorter disease history (21.1%), though the difference was statistically insignificant. The study also explored the association of diabetes mellitus with participants' smoking history, occupational status, and educational background. Among smokers, 12 (26.7%) were diabetic, compared to 14 (18.4%) among non-smokers; however, this difference was not statistically significant (p = 0.402). Similarly, diabetes was present in 15 (22.1%) salaried individuals and 11 (20.8%) participants engaged in business-related professions, with no significant association observed (p = 1.000). With respect to educational attainment, diabetes was reported in 7 (23.3%) participants without formal schooling, 13 (21.7%) with matriculation or below, and 6 (19.4%) who had education beyond matric, again showing no statistically significant difference (p = 0.930). These findings further reinforce the absence of significant associations between diabetes and various clinicodemographic parameters in the studied COPD cohort.

Table 1: Baseline characteristics of study participants (n = 121)

Parameters		Frequency	Percent
Age (years)	55 or below	38	31.4
	More than 55	83	68.6
Gender	Male	59	48.8
	Female	62	51.2
BMI (kg/m^2)	25.0 or below	66	54.5
	More than 25.0	55	45.5
COPD duration (years)	7 or below	57	47.1
	more than 7	64	52.9

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Parameters		Frequency	Percent
Profession	Salaried	68	56.2
	Business	53	43.8
Smoking	Yes	45	37.2
	No	76	62.8
Family Hx of DM	Yes	29	24.0
	No	92	76.0
Residence	Rural	67	55.4
	Urban	54	44.6
Education	No formal schooling	30	24.8
	Matric or below	60	49.6
	Above matric	31	25.6
Birds/Pets	Yes	24	19.8
	No	97	80.2

Table 2: Stratification of diabetes mellitus with baseline parameters (n = 121)

		Diabetes mellitus		Total	P value
		Yes (n = 26)	No (n = 95)		
Age (years)	55 or below	6	32	38	0.302
		15.8%	84.2%	100.0%	
	More than 55	20	63	83	
		24.1%	75.9%	100.0%	
Gender	Male	13	46	59	0.887
		22.0%	78.0%	100.0%	
	Female	13	49	62	
		21.0%	79.0%	100.0%	
BMI (kg/m^2)	25.0 or below	17	49	66	0.210
		25.8%	74.2%	100.0%	
	More than 25.0	9	46	55	
		16.4%	83.6%	100.0%	
Disease duration (years)	7 or below	12	45	57	0.912
		21.1%	78.9%	100.0%	
	More than 7	14	50	64	
		21.9%	78.1%	100.0%	
Birds/ Pets history	Yes	6	18	24	0.640
		25.0%	75.0%	100.0%	
	No	20	77	97	
		20.6%	79.4%	100.0%	

Table 3: Diabetes Association Table

	Diabetes (Yes)	Diabetes (No)	P-Value
Smokers	12	33	0.401856
Non-Smokers	14	62	0.401856
Salaried	15	53	1
Business	11	42	1
No formal schooling	7	23	0.929924
Matric or below	13	47	0.929924
Above matric	6	25	0.929924

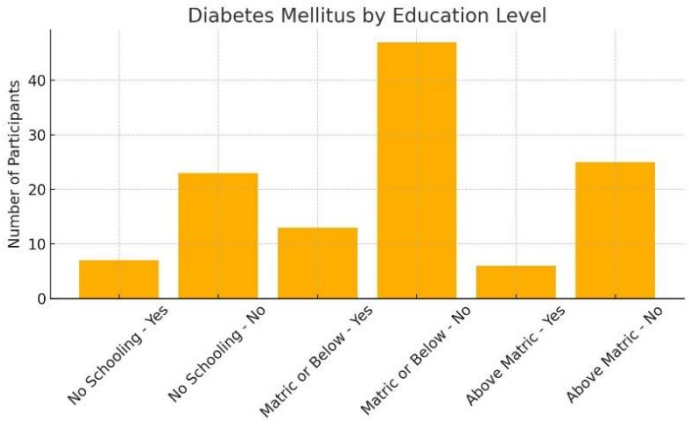


Figure 1 Diabetes mellitus by Education Level

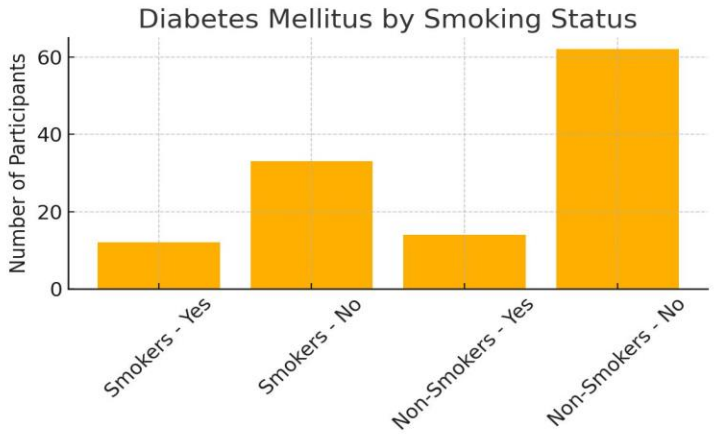
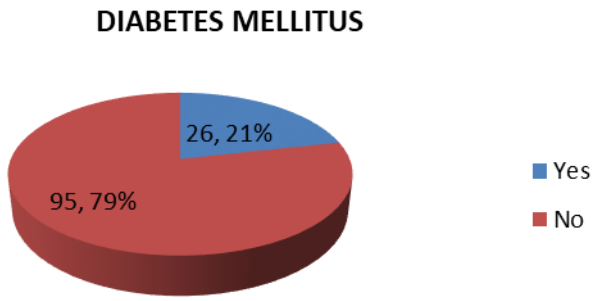


Figure 2 Diabetes Mellitus by Smoking Status



DISCUSSION

The present study observed a 21.0% prevalence of diabetes mellitus among patients diagnosed with chronic obstructive pulmonary disease (COPD), which is notably higher than the prevalence reported in several population-based epidemiological and pooled cohort studies, which range between 12.2% and 12.7% (13,14). These findings support the growing body of evidence indicating that diabetes mellitus, particularly type 2, is commonly associated with COPD and may co-occur more frequently in populations with increased age, obesity, and a history of smoking. In this study, more than two-thirds of participants were above 55 years of age, over one-third had a history of smoking, and a large proportion had prolonged disease duration and elevated BMI, reflecting a high-risk profile for metabolic disturbances. Previous literature has consistently highlighted the potential bidirectional relationship between diabetes and COPD, linking them through shared risk factors and common inflammatory pathways (15,16). It has been demonstrated that systemic inflammation, a hallmark of both conditions, involves mediators such as TNF-α, IL-6, and CRP, which exacerbate insulin resistance and pulmonary damage. Similarly, factors such as oxidative stress, hypoxia, and chronic bronchial obstruction have been reported to influence adipose tissue metabolism, promoting the release of pro-inflammatory cytokines and reducing protective adipokines like adiponectin (16). These mechanisms are implicated in the complex pathophysiology underlying the co-occurrence of COPD and type 2 diabetes.

The findings from this study, while consistent with previous observations, also underscore the clinical implications of this comorbidity. Notably, diabetes has been associated with worse COPD outcomes, including prolonged hospital stays during acute exacerbations, higher mortality rates, and earlier hospital admissions (17,18). The observed frequency of diabetes in this cohort is aligned with studies showing that increasing severity of COPD corresponds with a higher likelihood of diabetes. This association is particularly relevant considering that hyperglycemia during COPD exacerbations may not only signal metabolic dysfunction but may also directly contribute to poorer prognosis (19). Despite the lack of statistically significant associations between diabetes and individual demographic variables such as smoking, educational level, and occupational status, the trends suggest a potential underlying influence of socioeconomic and lifestyle factors on disease expression. These variables, when analyzed in larger, more powered studies, may help identify modifiable determinants that contribute to disease clustering. The role of smoking cessation in reducing the risk of both COPD and diabetes has

been well-documented, with studies indicating risk reduction after a decade or more of abstinence (20). This highlights the necessity of integrated public health interventions addressing both respiratory and metabolic health.

One of the strengths of the current study is its focus on a high-risk population in a real-world clinical setting, using standardized diagnostic criteria for both COPD and diabetes. The inclusion of diverse demographic data allows for an initial exploration of potential risk modifiers. However, there are important limitations to acknowledge. The study employed a cross-sectional design, which restricts causal inference between COPD and diabetes. Furthermore, the sample size, while adequate for prevalence estimation, limits the power to detect subtle associations with other variables. Data on glycemic control levels, medication adherence, and COPD severity stages were not captured, which could provide deeper insights into the clinical impact of the comorbidity. Future studies should aim to incorporate longitudinal designs to explore temporal relationships and causal pathways, and assess the role of treatment regimens, particularly the use of corticosteroids, on glycemic outcomes in COPD patients. Larger sample sizes and multi-center collaboration could enhance generalizability and statistical power. Additionally, inclusion of inflammatory biomarkers and more granular metabolic data could illuminate the biological underpinnings of the observed associations. In conclusion, the observed frequency of diabetes among patients with COPD in this study aligns with global data and reinforces the need for routine metabolic screening in this population. Recognizing and managing this comorbidity is essential for optimizing clinical outcomes, reducing hospitalization risk, and improving the quality of life in patients burdened by both chronic conditions.

CONCLUSION

In conclusion, the findings of this study underscore the evolving understanding of chronic obstructive pulmonary disease as a systemic inflammatory condition rather than one confined solely to the lungs. The notable presence of diabetes mellitus among individuals with COPD highlights the importance of recognizing and addressing comorbidities that can influence disease progression and patient outcomes. While certain trends, such as older age, male gender, and longer disease duration, appeared more common among diabetic COPD patients, no statistically significant associations were established. These insights emphasize the need for integrated screening and management strategies in routine COPD care to improve overall health and reduce the burden of associated chronic conditions.

AUTHOR CONTRIBUTION

Author	Contribution
Muhammad Bilawal*	Substantial Contribution to study design, analysis, acquisition of Data Manuscript Writing Has given Final Approval of the version to be published
Bilawal Azhar	Substantial Contribution to study design, acquisition and interpretation of Data Critical Review and Manuscript Writing Has given Final Approval of the version to be published
Zia Qamar	Substantial Contribution to acquisition and interpretation of Data Has given Final Approval of the version to be published
Mohammad Yasin	Contributed to Data Collection and Analysis Has given Final Approval of the version to be published

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