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Original Research Article

Influence of Body Mass Index on Quality of Life among COPD Patients

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Abstract

Background: Body mass index is increasingly recognized as an important determinant of clinical outcomes and quality of life in patients with chronic obstructive pulmonary disease.

Objective: To evaluate BMI distribution and its association with quality of life and airflow limitation severity among COPD patients.

Methods: A cross-sectional study was conducted among 210 COPD patients in whom BMI categories were assessed along with St George's Respiratory Questionnaire scores, airflow limitation severity, and clinical predictors. Multiple linear regression analysis was performed to identify independent determinants of quality of life.

Results: Obese (44.8%) and overweight (30.0%) categories constituted the majority of participants, while underweight patients showed significantly higher symptom, activity, impact, and total SGRQ scores indicating poorer quality of life. BMI and FEV1 were significant independent predictors of SGRQ total score, whereas female gender, biomass exposure, smoking, and hospitalization history were associated with worse outcomes.

Conclusion: BMI plays a significant role in determining quality of life in COPD patients, with underweight individuals demonstrating the greatest impairment. Comprehensive management strategies incorporating nutritional assessment and lifestyle interventions are essential to improve patient outcomes.

Keywords: Chronic obstructive pulmonary disease, Body mass index, Quality of life, SGRQ.

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Introduction

Chronic obstructive pulmonary disease (COPD) is a progressive respiratory disorder characterized by persistent airflow limitation, chronic respiratory symptoms, and systemic manifestations that significantly impair patients' quality of life. It is a leading cause of morbidity and mortality worldwide, with an increasing disease burden particularly in low- and middle-income countries due to aging populations, tobacco exposure, air pollution, and occupational hazards [1]. Beyond respiratory impairment, COPD is increasingly recognized as a multisystem disease with profound metabolic and nutritional consequences that influence disease progression and patient-reported outcomes.

Body mass index (BMI) has emerged as an important clinical indicator in COPD, reflecting both nutritional status and systemic involvement of the disease. Abnormal BMI, particularly undernutrition and obesity, is commonly observed among COPD patients and is associated with altered respiratory mechanics, reduced exercise tolerance, and increased symptom burden [2]. Low BMI in COPD often reflects muscle wasting, systemic inflammation, and increased resting energy expenditure, all of which contribute to reduced functional capacity and poorer health-related quality of life (HRQoL) [3].

Conversely, obesity may exacerbate dyspnea, limit physical activity, and negatively impact psychosocial well-being despite sometimes preserved lung function [4]. Quality of life assessment has become a central component of COPD management, complementing spirometric measurements by capturing the patient's subjective experience of disease impact. Validated tools such as the St George's Respiratory Questionnaire (SGRQ) and COPD Assessment Test (CAT) have demonstrated strong associations with disease severity, symptom burden, and functional limitations [5]. Recent evidence suggests that nutritional status, as reflected by BMI, plays a

significant role in determining HRQoL scores independent of airflow limitation, highlighting the importance of holistic patient assessment [6]. Several studies have reported that underweight COPD patients experience poorer quality of life due to increased fatigue, reduced muscle strength, frequent exacerbations, and higher levels of anxiety and depression [7]. The association between low BMI and diminished HRQoL is further supported by findings that cachexia and sarcopenia are linked to worse symptom control and increased healthcare utilization [8]. At the same time, obesity in COPD has been associated with reduced mobility, social isolation, and impaired daily functioning, indicating that both extremes of BMI adversely affect quality of life through different mechanisms [9]. Despite growing recognition of the BMI–quality of life relationship in COPD, existing literature shows considerable variability in findings, influenced by differences in population characteristics, disease severity, and assessment tools. Moreover, data from cross-sectional studies in diverse clinical settings remain limited, particularly regarding the distribution of BMI categories and their relationship with demographic and clinical factors influencing quality of life [10]. Understanding these associations is crucial for developing targeted interventions aimed at nutritional optimization and comprehensive disease management.

Therefore, the present cross-sectional study was undertaken to assess the BMI of patients with COPD, examine its distribution, and evaluate its relationship with various factors influencing quality of life. By elucidating the role of BMI as a predictor of quality of life, this study seeks to contribute evidence that may inform individualized management strategies and improve overall patient outcomes.

Material and Methods

This cross-sectional observational study was conducted among patients diagnosed with chronic obstructive pulmonary disease (COPD) attending an outpatient respiratory clinic of a tertiary care hospital. The primary objective was to assess body mass index (BMI), its distribution, and its relationship with factors influencing the quality of life among COPD patients.

A total of 210 participants with confirmed COPD were included in the study. The diagnosis of COPD was established based on clinical history, spirometric evidence of airflow limitation, and physician confirmation in accordance with established respiratory guidelines. Patients aged 40 years and above with stable COPD who provided informed consent were included, whereas individuals with acute exacerbations, active pulmonary infections, malignancy, severe cardiac disease, or other chronic illnesses significantly affecting nutritional status were excluded from the study. Data collection was performed using a structured case record form that included socio-demographic details, smoking history, disease duration, comorbid conditions, and treatment profile. Anthropometric measurements were obtained using standardized procedures. Body weight was measured using a calibrated digital weighing scale, and height was measured using a stadiometer. BMI was calculated as weight in kilograms divided by height in meters squared (kg/m^2) and categorized according to World Health Organization classification. Quality of life was assessed using a validated COPD-specific questionnaire administered through face-to-face interviews by trained investigators. Clinical parameters such as dyspnea grade, physical activity level, and medication adherence were recorded from patient interviews and medical records.

All collected data were entered into a secured database and verified for completeness prior to analysis. Statistical analysis was carried out using the Statistical Package for the Social Sciences (SPSS) software version 26.0. Continuous variables were expressed as mean ± standard deviation, while categorical variables were presented as frequencies and percentages. The distribution of BMI categories among COPD patients was analyzed, and comparisons between BMI groups and quality of life scores were performed using one-way analysis of variance (ANOVA) or independent sample t-test where appropriate. Associations between categorical variables were evaluated using the Chi-square test. Correlation analysis was performed to assess the relationship between BMI and quality of life scores. Multivariate linear regression analysis was conducted to identify independent predictors influencing quality of life after adjusting for potential confounding variables. A p-value of less than 0.05 was considered statistically significant.

Ethical clearance for the study was obtained from the Institutional Ethics Committee prior to commencement. The study adhered to the ethical principles outlined in the Declaration of Helsinki. Written informed consent was obtained from all participants before enrollment, and confidentiality of patient information was maintained throughout the research process.

Results

A total of 210 COPD patients were evaluated for BMI distribution and its relationship with quality of life and airflow limitation severity. Table 1 shows that the majority of participants were categorized as obese (94, 44.8%) followed by overweight (63, 30.0%), while normal BMI and underweight categories constituted 34 (16.2%) and 19 (9.0%)

respectively. The overall mean BMI of the study population was 24.61±3.8 kg/m², indicating a predominance of higher BMI categories in this cohort. Table 2 demonstrates the relationship between BMI categories and the components of SGRQ scores. Underweight patients exhibited the highest symptom score (56.24±13.6), activity score (84.15±18.2), impact score (60.72±14.1) and total score (66.35±11.8), suggesting poorer quality of life compared to other BMI groups.

Normal BMI participants showed comparatively lower total SGRQ scores (44.62±12.7), while overweight (38.94±13.5) and obese individuals (39.76±12.2) demonstrated relatively better quality of life outcomes. Statistically significant differences were observed across BMI groups for symptom, activity, impact and total SGRQ scores ($p<0.001$). Table 3 describes the distribution of airflow limitation severity across BMI categories. Very severe airflow limitation was predominantly observed among underweight participants (8 cases), whereas mild airflow limitation was more frequent among obese patients (10 cases). Moderate airflow limitation constituted the largest subgroup across BMI categories, with overweight (39 cases) and obese participants (47 cases) forming the majority. The association between BMI and airflow limitation severity was statistically significant ($p<0.001$), indicating a trend toward lower BMI with increasing disease severity. Table 4 presents the multiple linear regression analysis evaluating predictors of total SGRQ score. BMI showed a significant negative association with total SGRQ score ($B = -0.872$, $p<0.001$), indicating that higher BMI was associated with better quality of life scores.

FEV1 also demonstrated a significant inverse relationship ($B = -0.215$, $p<0.001$). Female gender, biomass smoke exposure, smoking status, and hospitalization history were significant positive predictors of higher SGRQ scores, reflecting poorer quality of life. Non-working status and rural residence were associated with lower SGRQ scores, and the overall model demonstrated good explanatory power with an adjusted R^2 of 0.548 and ANOVA F value of 26.82 ($p<0.001$).

Table 1: Distribution of BMI among the study subjects (n=210)

BMI (kg/m²)	N	%
Underweight (<18.5)	19	9.0
Normal (18.5–22.9)	34	16.2
Overweight (23.0–24.9)	63	30.0
Obese (≥25)	94	44.8
Mean ± SD	24.61 ± 3.8	

Table 2: Relation between BMI and components of SGRQ of study subjects (n=210)

Components of SGRQ	Underweight (n=19)	Normal (n=34)	Overweight (n=63)	Obese (n=94)	P value
Symptom score	56.24±13.6	41.15±11.2	40.48±14.1	39.67±13.5	<0.001
Activity score	84.15±18.2	63.28±17.4	52.11±17.9	54.02±15.8	<0.001
Impact score	60.72±14.1	34.91±13.7	29.63±14.2	31.52±14.9	<0.001
Total score	66.35±11.8	44.62±12.7	38.94±13.5	39.76±12.2	<0.001

Table 3: Relation of BMI with airflow limitation severity (n=210)

Airflow limitation severity	Underweight (n=19)	Normal (n=34)	Overweight (n=63)	Obese (n=94)	P value
Mild	1	3	7	10	<0.001
Moderate	7	14	39	47	
Severe	3	12	17	33	
Very severe	8	5	0	4	

Table 4: Multiple linear regression analysis between predictors and total SGRQ score

Variables	B	Std. Error	Beta	t	P value	95% CI Lower	95% CI Upper
FEV1	-0.215	0.049	-0.204	-4.39	<0.001	-0.312	-0.118
BMI	-0.872	0.152	-0.261	-5.73	<0.001	-1.171	-0.573
Poor sleep	1.104	1.542	0.037	0.71	0.477	-1.934	4.14
Non-worker	-6.824	1.588	-0.233	-4.29	<0.001	-9.954	-3.69
Hospitalization history	2.904	1.288	0.098	2.25	0.026	0.366	5.44
Female gender	6.385	1.541	0.214	4.14	<0.001	3.347	9.42
Age (years)	0.164	0.059	0.119	2.78	0.006	0.048	0.28
Biomass smoke exposure	7.552	1.487	0.256	5.08	<0.001	4.621	10.48
Rural residence	-7.214	1.662	-0.244	-4.34	<0.001	-10.488	-3.94
Hindu religion	4.216	1.612	0.111	2.61	0.010	1.041	7.39
Smoker	3.742	1.429	0.133	2.62	0.009	0.927	6.55

Discussion

The present cross-sectional study evaluated 210 patients with chronic obstructive pulmonary disease and demonstrated that higher BMI categories predominated, with 94 (44.8%) participants classified as obese and 63 (30.0%) as overweight, while only 19 (9.0%) were underweight. The mean BMI of 24.61±3.8 kg/m² suggests a shift toward increased body weight among COPD patients, which has been increasingly reported in recent epidemiological studies highlighting the coexistence of obesity and chronic respiratory disease [11]. Despite this predominance of higher BMI, underweight patients showed markedly worse health-related quality of life, with significantly higher SGRQ total scores (66.35±11.8) compared to overweight (38.94±13.5) and obese individuals (39.76±12.2).

These findings support contemporary evidence that low BMI in COPD reflects systemic inflammation, muscle wasting, and reduced exercise tolerance, all of which contribute to impaired functional status and poor patient-reported outcomes [12]. The activity component of SGRQ was particularly elevated among underweight participants (84.15±18.2), indicating severe limitations in daily activities, which is consistent with reports suggesting that sarcopenia and reduced peripheral muscle strength are strong determinants of reduced physical capacity in COPD populations [13].

Airflow limitation severity demonstrated a clear association with BMI distribution in this study. Very severe airflow limitation was most common among underweight individuals (8 cases), whereas mild airflow limitation was more frequently observed among obese participants (10 cases). This pattern reflects the so-called “obesity paradox,” where higher BMI may be associated with relatively preserved lung function and improved survival compared to underweight patients with advanced disease [11,14]. Overweight and obese groups formed the largest proportion within the moderate airflow limitation category, suggesting that nutritional status may influence disease trajectory and symptom burden. Previous studies have proposed that increased fat mass may provide metabolic reserves that mitigate catabolic processes during disease progression, partially explaining the relatively better quality of life scores seen in higher BMI categories [12].

Multiple linear regression analysis in this study identified BMI (B=-0.872, $p<0.001$) and FEV1 (B=-0.215, $p<0.001$) as significant independent predictors of total SGRQ score, highlighting the combined influence of nutritional status and lung function on quality of life. The negative association between BMI and SGRQ score indicates that increasing BMI within a moderate range may be associated with improved perceived health status, a finding that aligns with recent observational data demonstrating better HRQoL outcomes among overweight COPD patients compared to underweight counterparts [15]. Female gender, biomass smoke exposure, and smoking were also associated with higher SGRQ scores, suggesting a multifactorial impact of environmental and demographic variables on disease burden. Biomass smoke exposure showed one of the strongest positive associations (B=7.552, $p<0.001$), emphasizing the importance of environmental risk factors in shaping quality of life outcomes in COPD. Additionally, hospitalization history and increasing age were significant contributors to worse SGRQ scores, reflecting cumulative disease severity and exacerbation burden over time.

Overall, the present findings reinforce the complex relationship between BMI and quality of life in COPD. While obesity may contribute to mechanical respiratory limitations, the markedly worse outcomes observed in underweight individuals suggest that malnutrition and muscle wasting remain critical determinants of poor prognosis. These results underscore the need for comprehensive COPD management strategies that integrate nutritional assessment, pulmonary rehabilitation, and individualized lifestyle interventions to optimize functional outcomes and improve patient quality of life.

Conclusion

The present study demonstrated that BMI is a significant predictor of quality of life among COPD patients, with underweight individuals experiencing the greatest impairment in symptom burden, activity limitation, and overall SGRQ scores. Higher BMI categories were associated with comparatively better quality of life outcomes, while airflow limitation severity and environmental exposures further influenced patient-reported health status. These findings highlight the importance of routine nutritional evaluation and targeted interventions aimed at improving BMI and functional capacity to enhance overall quality of life in COPD populations.

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