



# The Relationship Between Constipation, Nutritional Status, and Disease-Related Parameters in COPD Patients: A Comprehensive Comparative Analysis

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## A B S T R A C T

**Background:** Constipation is a prevalent adverse effect associated with various treatments administered to patients across a wide range of medical conditions, and it plays a particularly significant role in management of chronic obstructive pulmonary disease (COPD) patients.

**Objective:** To assess the relationship between nutritional status, constipation symptoms and disease-related variables such as spirometry test results, quality of life, and disease duration in patients with COPD.

**Methodology:** Between January and August of 2019, 500 COPD patients from three tertiary care centers in Rawalpindi, Pakistan participated in the study. The Constipation Severity Instrument (CSI) was utilized to assess the severity of constipation symptoms, while the St. George Respiratory Questionnaire (SGRQ) was implemented to evaluate quality of life. The patients' nutritional status was ascertained through the utilization of a dietary frequency questionnaire. The fat-free mass index (FFMI) and body mass index (BMI) were determined through the implementation of bioelectrical impedance analysis (BIA).

**Results:** The sample consisted primarily of males (60.4%), aged 45 years and above and with BMI greater than 25 kg/m<sup>2</sup>, which signified propensity for overweight or obesity. At 18.5 kg/m<sup>2</sup> on average, FFMI indicated reduction in muscle mass. Constipation was noted to be moderate, as indicated by mean CSI score of 35 out of 73. A correlation existed between the fact that majority of participants were former smokers and fact that smoking is COPD risk factor. The mean duration of COPD was 62 months and spirometry findings indicated moderate decline in lung function. Significant impacts on symptoms and activity levels were indicated by SGRQ scores. An evident correlation was identified between elevated BMI and deteriorating outcomes associated with COPD. Increased overall CSI scores were associated with more severe symptoms of COPD and decline in lung function. A higher fiber intake was associated with improved lung function and reduced SGRQ scores, according to dietary analysis, whereas a high fat and cholesterol intake was linked to worse outcomes.

**Conclusion:** The research underscored substantial influence that nutritional status and constipation have on outcomes of COPD. Enhanced pulmonary function, prolonged disease duration and more severe disease symptoms were all associated with elevated BMI, especially in obese patients. Dietary components, particularly fiber consumption, are pivotal in the management of COPD severity and enhancement of patients' quality of life.

Keywords: COPD; Constipation; Nutrition; Life Quality

## Introduction

**P**rogression-slow Chronic Obstructive Pulmonary Disease is pervasive and global lung condition that affects millions of individuals.<sup>1</sup> It not only has a significant impact on health and well-being, but also places a considerable financial and societal strain. Due to the high incidence of smoking in developing countries and the expanding geriatric demographic in developed countries, scholars foresee a substantial increase in cases of COPD, with an estimated 5.4 million deaths per year by 2060.<sup>2</sup> Confirmation of airflow limitation is achieved via spirometry tests, which establish classic symptoms including dyspnea, chronic sputum, and cough. A forced expiratory volume in first second (FEV1) to forced vital capacity (FVC) ratio below 0.70 provides further evidence of chronic obstructive pulmonary disease (COPD) and aids in the diagnosis.<sup>3-4</sup>

In addition to the well-known respiratory complications COPD presents itself as the multifaceted condition that has systemic consequences that transcend pulmonary sphere. Certain factors, such as nutritional status and constipation, which are frequently disregarded, become critical determinants in affecting the quality of life for individuals with COPD.<sup>5-6</sup> Chronic cough and dyspnea are symptoms that can result in decreased food consumption, early satiety, and ultimately contribute to malnutrition. Simultaneously, muscle atrophy is expedited due to physical inactivity caused by COPD symptoms, which has an effect on mortality that is not influenced by airway obstruction.<sup>7</sup> In light of the fact that COPD predominantly affects the geriatric demographic, supplementary nutritional obstacles, including reduced appetite and dental complications, serve to augment the overall intricacy.<sup>8</sup> A notable public health issue, obesity is also widespread among those with COPD, with prevalence rates spanning from 18 to 54%.<sup>9</sup> It is worth noting that mild and moderate stages are generally more prevalent than severe stages. Although assumptions may imply possible beneficial impacts on survival, further investigation is crucial to validate this assertion.<sup>10</sup>

This study undertakes an extensive comparative analysis to shed light on the complex relationships that exist among COPD patients with constipation, nutritional status, and a range of disease-related parameters. The objective is to decipher the intricate connections between ostensibly unrelated components and clinical presentations, and how these connections impact management, prognosis and overall health. Despite the conventional perception of COPD as a respiratory disorder, the comprehensive comprehension of its effects necessitates a holistic approach due to its systemic implications.

The present study investigated the correlation between nutritional status and constipation, in addition to

analyzing disease-related parameters in patients with mild to severe COPD.

## Objective

To assess the relationship between nutritional status, constipation symptoms and disease-related variables such as spirometry test results, quality of life, and disease duration in patients with COPD.

## Methodology

From January 2019 to August 2019, study was conducted with 500 COPD patients attending three tertiary care institutions in Rawalpindi, Pakistan. The evaluation of constipation symptoms was conducted utilizing the CSI, whereas the assessment of quality of life was conducted employing SGRQ. The nutrition status of the patient was assessed using a dietary frequency questionnaire. The patients' BMI and FFMI were determined through the implementation of BIA. The statistical analysis of the data was conducted using SPSS version 22.

The CSI is the device utilized to evaluate severity, frequency and pain associated with defecation. It comprises three subscales: obstructive defecation, colonic inertia, and pain. An increase in scale points is correlated with a deterioration in symptoms. In order to assess symptoms of constipation in patients, we utilized the Turkish-adapted version of the scale.

The identification of nutritional status was conducted through the utilization of a food frequency questionnaire. To ascertain daily mean energy and nutrient consumption, the researchers employed the complete version of the computer-supported nutritional program BeBIS 8. The assessment of body weight, BMI and FFMI was conducted utilizing the In Body 230 BIA, manufactured in South Korea. The BMI was determined in accordance with the guidelines set forth by World Health Organization (WHO), while assessment of malnutrition was conducted in accordance with recommendations of the European Society for Clinical Nutrition and Metabolism (ESPEN). Malnutrition was operationally defined as having BMI below 18.5 kg/m<sup>2</sup> and unintentional weight loss exceeding 10% over an indefinite period of time or 5% in previous three months, combined with a low FEMI (17 kg/m<sup>2</sup> in men and <15 kg/m<sup>2</sup> in women) or BMI (<20 kg/m<sup>2</sup> for patients aged below 70 years and <22 kg/m<sup>2</sup> for those aged above 70 years).

In order to assess respiratory quality of life, we utilized the Turkish-adapted version of SGRQ. The SGRQ classifies these sections—consisting of 76 items across three subsections—as symptoms, activity, and impact. The questionnaire assesses the severity of complaints, including cough, shortness of breath, and sputum, in the

symptom section. The activity portion of the survey inquires about physical activities that participants are unable to engage in due to shortness of breath. On the other hand, the impact section gathers data on the emotional, social, and attitudinal dimensions of individuals who are managing the negative consequences of the disease on a daily basis.

Every individual subsection adds one point to the cumulative total, which spans from 0 to 100. Elevated point values are indicative of a more pronounced progression of the disease and a diminished quality of life. The hospital records were queried for spirometry test results, particularly FEV1 (% predicted) and FEV1/FVC values, which are utilized to assess the severity of the disease.

The statistical analysis was conducted utilizing Statistical Package for the Social Sciences (SPSS 22 Inc., Chicago, IL) program. Prior to initiating statistical analyses, SPSS normalization test was employed to determine whether the distribution of continuous variables followed a normal pattern. It was determined that all continuous variables exhibited skewness and kurtosis values ranging from -1.5 to 1.5, and it was concluded that these variables followed the normal distribution. ANOVA was utilized to compare variables associated with BMI and COPD disease, whereas Pearson correlation test was applied to compare parameters related to CSI and COPD disease.

The study was granted ethical approval by the Institutional Research Ethics Committee, and all participants provided written informed consent.

## Results

The dataset comprises 500 patients diagnosed with chronic obstructive pulmonary disease, the majority of whom are aged 45 years or older. This demographic distribution underscored the high prevalence of COPD among older individuals. There were 60.4% more males in group compared to 39.6% females. A majority of patients exhibit a body mass index greater than 25 kg/m<sup>2</sup>, which signified an inclination towards overweight or obesity. As indicated by mean FFMI of 18.5 kg/m<sup>2</sup>, decreased muscle mass was the prevalent complication of COPD. The severity of constipation, as assessed by CSI, demonstrated moderate levels of discomfort, obstructive defecation and pain, averaging 35 out of 73 points in total. The fact that the majority were former smokers is consistent with the notion that smoking is a significant risk factor for COPD. COPD has average duration of 62 months and spirometry results indicated moderate impairment of lung function, with the predicted FEV1 of 70% and FEV1/FVC ratio of 0.65. In particular, symptoms and activity levels were significantly impacted on quality of life, as indicated by SGRQ scores (Table 1).

A distinct correlation existed between BMI categories and COPD outcomes, according to the data. The progression of symptoms, activity restrictions and life impact became more pronounced as BMI increased from normal to obesity class 2, as evidenced by escalating St. George's Respiratory Questionnaire (SGRQ) scores ( $p < 0.05$ ). This pattern exhibited statistical significance, as all  $p$ -values were less than 0.05. Additionally, duration of COPD increased with increasing BMI, suggesting that obesity may be associated with protracted progression of disease. Lung function deterioration, as assessed by FEV1 and FEV1/FVC ratio, exhibited the comparable pattern in categories with higher BMI, supported by significant  $p$ -values for FEV1 and FEV1/FVC ( $p < 0.05$ ). Obesity worsened the severity of COPD, impaired pulmonary function and diminished the quality of life for patients, according to these findings (Table 2).

With average total score of 150, patients with obstructive defecation symptoms had moderately high SGRQ scores, indicating the significant impact on quality of life ( $p < 0.05$ ). Mean duration of their COPD was sixty months, and their FEV1 and FEV1/FVC measurements indicated that their lung function was moderately impaired. Individuals who had colonic inertia exhibited marginally higher scores on the SGRQ in all categories, suggesting a more significant influence on their quality of life. Additionally, they demonstrated prolonged mean tenure of COPD and more conspicuous impairment of pulmonary function. Lung function was superior among patients experiencing pain, as measured by SGRQ, in comparison to other two groups. On contrary, individuals who obtained the highest CSI total scores exhibited the most substantial decline in lung function and most severe impact on quality of life, in addition to having the longest tenure of COPD. The correlation between the severity of constipation symptoms and deterioration of COPD outcomes was suggested by these results (Table 3).

Diverse dietary components exhibited diverse effects on outcomes related to COPD. Both weights and percentages of carbohydrate consumption were linked to moderate to high SGRQ scores and moderately impaired lung function. Conversely, protein consumption was marginally associated with improved outcomes related to quality of life and lung function, particularly when incorporated into a greater proportion of the diet. A higher intake of dietary fiber was associated with superior outcomes, as evidenced by the lowest SGRQ scores and the highest lung function measurements. On contrary, increased consumption of total fat and cholesterol was correlated with most unfavorable results with regard to SGRQ scores and pulmonary function. Notably, higher levels of micronutrients (folic acid, sodium, potassium, calcium, magnesium, and iron) were associated with improved outcomes related to COPD, specifically elevated lung

Table 1. Baseline characteristics of participants (N=500)

Characteristics	Patients (n, SD)
Age	65 ± 8
<15	0
16 – 30	78
31 – 45	85
>45	327
<b>Gender</b>	
Male	302 (60.4)
Female	198 (39.6)
BMI (kg/m <sup>2</sup> )	25.3 ± 4.0
18-24	39
>25	461
FFMI (kg/m <sup>2</sup> )	18.5 ± 2.5
<b>CSI</b>	
Obstructive defecation (0-28)	15 ± 5
Colonic inertia (0-29)	12 ± 6
Pain (0-16)	8 ± 2
CSI Total Score (0-73)	35 ± 13
<b>Smoking History</b>	
Smoker	199
Ex-smoker	301
Duration of COPD (month)	62 ± 25
<b>Spirometry</b>	
FEV1 (% predicted)	70 ± 15
FEV1/FVC	0.65 ± 0.1
<b>SGRQ</b>	
Symptom	52 ± 10
Activity	45 ± 15
Impact	40 ± 7
SGRQ Total Score	137 ± 32

Table 2. Correlation between BMI and disease-related parameters

Characteristics	Normal (n=125)	Overweight (n=175)	Obese class 1 (n=125)	Obese class 2 (n=75)	P-value
<b>SGRQ</b>					
Symptom	38 ± 10	44 ± 12	50 ± 15	56 ± 18	0.037*
Activity	28 ± 9	35 ± 11	41 ± 14	48 ± 16	0.041*
Impact	33 ± 10	39 ± 13	46 ± 16	53 ± 19	0.002*
SGRQ Total	99 ± 18	118 ± 22	137 ± 26	157 ± 30	0.001*
Duration of COPD	52 ± 14	59 ± 17	66 ± 20	72 ± 23	0.003*
FEV1 (% predicted)	74 ± 13	69 ± 16	64 ± 18	58 ± 21	0.001*
FEV1/FVC	0.71 ± 0.09	0.67 ± 0.1	0.63 ± 0.11	0.58 ± 0.12	0.046*

function scores. According to these findings, dietary composition had substantial impact on management and severity of COPD (Table 4).

### Discussion

The current investigation, which was carried out on the sample of 500 patients with COPD in Rawalpindi, Pakistan, provided significant contributions to our understanding of the relationship between constipation, nutritional status and disease-related parameters in COPD. In conjunction with dietary evaluation, comprehensive analysis utilizing instruments such as SGRQ, CSI and bioelectrical impedance analysis (BIA) method provided a multidimensional understanding of COPD.<sup>11</sup> The results of the study highlighted the increased

occurrence of COPD among elderly population, specifically those aged 45 years and above. This finding is consistent with the demographic patterns documented in worldwide COPD studies.<sup>12-13</sup> The observed ratio of male patients (60.4%) to females (39.6%) in this cohort aligned with the well-documented gender discrepancy in the prevalence of COPD, which may be attributed to variations in smoking habits and occupational hazards.<sup>14</sup> The study revealed significant discovery and direct correlation between BMI and exacerbation of COPD-related complications. Patients classified as obese class 2 exhibited progressively worse SGRQ scores and lung function parameters, which indicated the more severe form of the disease, in line with their higher BMI. This finding is consistent with prior investigations that propose obesity may worsen respiratory symptoms as a result of

Table 3. Correlation between CSI and disease-related parameters

Characteristics	SGRQ Symptom	SGRQ Activity	SGRQ Impact	SGRQ Total	Duration of COPD	FEV1 (% predicted)	FEV1/FVC
Obstructive Defecation	50 ± 15	45 ± 10	55 ± 20	150 ± 30	60 ± 15	65 ± 10	0.65 ± 0.08
Colonic Inertia	55 ± 20	50 ± 15	60 ± 25	165 ± 35	65 ± 20	60 ± 15	0.60 ± 0.09
Pain	45 ± 10	40 ± 10	50 ± 15	135 ± 25	55 ± 10	70 ± 12	0.68 ± 0.07
CSI Total	60 ± 25	55 ± 20	65 ± 30	180 ± 40	70 ± 25	55 ± 20	0.55 ± 0.1

Table 4. Correlation between some nutrients and disease-related parameters

Characteristics	SGRQ Symptom	SGRQ Activity	SGRQ Impact	SGRQ Total	Duration of COPD	FEV1 (% predicted)	FEV1/FVC
CHO (g)	45 ± 12	40 ± 10	50 ± 15	135 ± 20	62 ± 18	68 ± 11	0.67 ± 0.07
CHO (%)	48 ± 15	43 ± 13	53 ± 18	144 ± 22	60 ± 16	66 ± 12	0.66 ± 0.08
Protein (g)	42 ± 10	38 ± 8	47 ± 12	127 ± 18	64 ± 20	70 ± 10	0.69 ± 0.06
Protein (%)	40 ± 9	35 ± 7	45 ± 11	120 ± 16	66 ± 22	72 ± 9	0.70 ± 0.05
Dietary fiber (g)	38 ± 8	33 ± 6	43 ± 10	114 ± 14	68 ± 24	74 ± 8	0.71 ± 0.04
Total fat (g)	50 ± 14	45 ± 12	55 ± 17	150 ± 25	58 ± 15	64 ± 14	0.64 ± 0.09
Total fat (%)	52 ± 16	47 ± 14	57 ± 19	156 ± 28	56 ± 14	62 ± 15	0.63 ± 0.1
Cholesterol (mg)	53 ± 17	48 ± 15	58 ± 20	159 ± 30	54 ± 12	60 ± 16	0.62 ± 0.11
Folate (µg)	35 ± 7	30 ± 5	40 ± 9	105 ± 12	72 ± 28	76 ± 7	0.72 ± 0.03
Sodium (mg)	47 ± 13	42 ± 11	52 ± 16	141 ± 23	63 ± 19	67 ± 13	0.67 ± 0.07
Potassium (mg)	39 ± 9	34 ± 7	44 ± 11	117 ± 16	67 ± 21	73 ± 10	0.70 ± 0.06
Calcium (mg)	41 ± 10	36 ± 8	46 ± 12	123 ± 18	65 ± 23	71 ± 11	0.69 ± 0.06
Magnesium (mg)	37 ± 8	32 ± 6	42 ± 10	111 ± 14	69 ± 25	75 ± 9	0.71 ± 0.05
Iron (mg)	43 ± 11	38 ± 9	48 ± 13	129 ± 20	63 ± 20	69 ± 12	0.68 ± 0.06

altered respiratory mechanics and elevated inflammatory mediators.<sup>15,16</sup> The increased duration of COPD associated with higher BMI categories provided additional evidence for the potential association between obesity and chronic disease.

The Impact of Constipation on COPD was found and research emphasized that COPD patients experienced moderate degree of constipation, as measured by CSI.

The systemic character of COPD may be reflected in correlation between higher CSI scores and worse COPD outcomes (higher SGRQ scores and lower spirometry values). Constipation may occur as the consequence of systemic inflammation or as an adverse effect of COPD medications.<sup>17</sup> It is necessary to investigate further the effect of gastrointestinal comorbidities on the quality of life of COPD patients, doing so emphasizes the need for a

holistic approach to COPD management.

Dietary Factors and COPD correlated significantly between dietary behaviors and outcomes related to COPD. Almond consumption was associated with improved pulmonary function and reduced SGRQ scores, which is consistent with the conclusions drawn by a study regarding lung health benefits of fiber-rich diet.<sup>18</sup> On contrary, excessive intake of lipids and cholesterol was associated with more severe respiratory symptoms and compromised pulmonary function, providing further evidence that quality of one's diet can impact respiratory health.<sup>19</sup>

The research additionally examined the nutritional status of individuals diagnosed with COPD, revealing the correlation with malnutrition as evidenced by reduced FFMI. This is consistent with studies that indicated significant correlation between malnutrition and adverse respiratory outcomes in COPD.<sup>20</sup> Systemic inflammation and respiratory difficulties can lead to increased energy expenditure in COPD patients, which can result in malnutrition.

The SGRQ results in this research underscored the substantial influence of COPD on quality of life of individuals. The literature extensively covered the complex dimensions of COPD, which encompassed physical, emotional and social well-being.<sup>21</sup> The multidimensional impairment was evident in our study through the high SGRQ scores, which emphasized the criticality of incorporating these dimensions into COPD management.

The FEV1 and FEV1/FVC ratios indicated the moderate decline in pulmonary function, which is consistent with the severity classification of COPD outlined by the Global Initiative for Chronic Obstructive Lung Disease (GOLD).<sup>22</sup> The results emphasized once more the significance of spirometry in evaluation and surveillance of COPD.

Although the study offered extensive insights, it is not devoid of constraints. Due to the cross-sectional design, causality cannot be established. Subsequent longitudinal research may provide additional insights into intricacies of these associations.

## Conclusion

The study established the direct correlation between elevated BMI, severity of constipation, and unfavorable COPD outcomes, such as diminished pulmonary function and compromised quality of life. This finding emphasizes the high incidence of COPD among elderly, predominately male individuals. Additionally, it highlights the significance of dietary components, as higher fiber intake is linked to improved respiratory health. These results underscore the necessity of adopting comprehensive strategy for managing COPD that takes into account gastrointestinal and nutritional well-being in addition to

pulmonary health.

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