Section: Miscellaneous

Original Research Article

ASSESSMENT OF NUTRITIONAL STATUS IN PATIENTS OF CHRONIC OBSTRUCTIVE PULMONARY DISEASE IN NORTHERN INDIA

Henbi Lendo[1], A K Nigam[2], Tejpal Singh[3], Santosh Kumar[4], Geetu Singh[5], Anupam Kumar Shukla[6], Nimish Gupta[6], Priyanka Joshi[6]

[1]Senior Resident, Department of Medicine, Sarojini Naidu Medical College, Agra, Uttar Pradesh, India
[2]Professor, Department of Medicine, Sarojini Naidu Medical College, Agra, Uttar Pradesh, India
[3]Professor & Head, Department of Medicine, Vice Principal, Sarojini Naidu Medical College, Agra, Uttar Pradesh, India
[4]Professor & Head Department of Respiratory Medicine, Sarojini Naidu Medical College, Agra, Uttar Pradesh, India
[5]Associate Professor, Department of Community Medicine, Sarojini Naidu Medical College, Agra, Uttar Pradesh, India
[6]Senior Resident, PG Department of Medicine, Sarojini Naidu Medical College, Agra, Uttar Pradesh, India.

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Corresponding Author:
Dr. Henbi Lendo,
Senior Resident, Department of Medicine, Sarojini Naidu Medical College, Agra, Uttar Pradesh, India.
Email: henbilendo1209@gmail.com

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ABSTRACT

Background: Chronic Obstructive Pulmonary Disease (COPD) is a progressive heterogeneous pulmonary disease, which is marked by airflow obstruction and chronic respiratory symptoms, and may be accompanied by a systemic presentation, such as malnutrition. Increased metabolic demand, consumption decrease, and inflammation in COPD patients cause malnutrition, which is under-evaluated despite the high effect on disease progression and outcomes. This study aimed to assess the nutritional status of COPD patients, identify factors associated with malnutrition, and explore its correlation with disease severity.

Materials and Methods: It was hospital based observational cross-sectional study conducted in the Department of Medicine of S.N medical college, Agra over a period of 1.5 years. The sample size consisted of 150 COPD patients of the age group of 50-75 years who were clinically, radiologically and spirometrically diagnosed and put on an oral diet. Comorbidities that influence the nutrition was not included in the patients. The data gathered was: demographics, smoking status, anthropometric measurements, biochemical markers and nutritional status measured using the Mini Nutritional Assessment (MNA) score. Data were analyzed in SPSS 29.0 and associations were tested by Chi-Square and correlation tests and p-values under 0.05 were taken as statistically significant.

Results: Among the 150 patients studied, 79.3% were male and 63.3% had a history of smoking. Severe COPD was the most commonly observed stage, accounting for 44% of the cases. Nutritional assessment indicated that 34.0% of patients were malnourished, while 45.3% were at risk of malnutrition. A strong correlation was found between malnutrition and COPD severity ($p<0.001$). Anthropometric measures (BMI, MAC, MCC) and biochemical markers (albumin, cholesterol, triglycerides) showed significant declines with increasing disease severity. Additionally, the MNA score showed a strong negative association with COPD severity ($r = -0.609$, $p<0.001$).

Conclusion: COPD patients, especially those patients with an advanced disease, were prone to malnutrition. Nutritional decline was strongly associated with the progression of COPD severity, which is strongly indicative of the importance of routine nutritional evaluation and intervention to maximize the outcomes or enhance the life satisfaction.

Keywords: COPD, Malnutrition, MNA Score, Nutritional Status, Anthropometry, Lipid Profile, Disease Severity.

INTRODUCTION

Chronic obstructive pulmonary disease (COPD), as defined in the GOLD 2023 guidelines, is a multifaceted respiratory condition characterized by persistent symptoms including breathlessness, chronic cough, sputum production, and episodes of exacerbation. These symptoms result from pathological changes in the airways, such as chronic bronchitis and small airway disease, and/or damage to the alveoli as seen in emphysema, ultimately causing persistent airflow obstruction that may worsen over time. COPD poses a major global health burden, significantly contributing to both disease-related disability and mortality. The World Health Organization (WHO) estimates that COPD will rank among the leading causes of death worldwide, largely due to ongoing exposure to risk factors such as tobacco use, environmental air pollution, and occupational inhalants.[1,2]

Nutritional disorders represent a common problem in about one -fifth of patients with COPD. A body mass index (BMI) less than 20 predicts hospitalization for these patients. COPD is often associated with weight loss, and, according to the criteria applied and population studied, between 19% and up to 60%, were malnourished.[3] Understandably, the mechanisms of weight and fat mass loss among patients with COPD are well established. And one of the important mechanisms for that is an increased metabolic rate associated with decreased caloric intake. Other important factors include tissue hypoxia, systemic inflammation, oxidative stress, effects of medicines and sedentary lifestyle. COPD causes malnutrition and this can be fatal due to weakness of respiratory muscles, resulting in weakening of the immune systems which can lead to respiratory failure.[4,5] The extrapulmonary involvement of COPD is well-established, and malnutrition directly affects respiratory muscles and lung tissue, causing progression or exacerbation of the underlying disease.[6] Earlier research has also shown that underweight and normal-weight COPD patients are at higher risk of mortality compared to overweight or obese people with the disease.[7]

Although its clinical value is undeniable, nutritional assessment is not widely considered in the normal COPD management, particularly in low-resource environments. Various anthropometric and biochemical measurements, including Body Mass Index, Mid-Upper Arm Circumference, skinfold thickness and serum protein measurements can be applied in assessing the nutritional status of such patients. Early preventive treatment of malnutrition can significantly change the clinical outcomes and the success of pulmonary rehabilitation.

The aim of this study is to evaluate the nutritional status of patients with COPD by combining anthropometric and biochemical indicators as well as Mini nutritional assessment scoring and relationship between nutritional parametersand severity of disease. Through its focus on the incidence and consequences of malnutrition in individuals with COPD, this study emphasizes the need for nutritional evaluation and early intervention to be included as a fundamental component of standard care protocols for those with this disease.

Chronic obstructive pulmonary disease (COPD), as described in the Global Initiative for Chronic Obstructive Lung Disease (GOLD) 2023 report, is a long-term respiratory disorder with diverse clinical presentations. It is characterized by persistent symptoms such as breathlessness, chronic cough, sputum production, and periodic exacerbations. These manifestations arise due to structural and functional alterations within the lungs, including airway inflammation seen in chronic bronchitis and small airway disease, as well as alveolar destruction typical of emphysema. Together, these changes result in sustained airflow limitation that often progresses over time. COPD continues to be a major public health concern, contributing substantially to both morbidity and mortality. According to the World Health Organization, it is expected to remain one of the leading causes of death globally, largely driven by risk factors such as tobacco smoking, environmental pollution, and occupational exposures.[1,2]

Malnutrition is frequently observed in individuals with COPD and represents a significant yet often under-recognized clinical problem. Approximately one-fifth of patients are affected, and a body mass index below 20 has been associated with increased risk of hospitalization. Weight loss is a common feature in COPD, with reported prevalence of malnutrition ranging widely depending on study population and diagnostic criteria.[3] Multiple mechanisms contribute to this nutritional decline, including an imbalance between increased energy expenditure and reduced caloric intake. In addition, factors such as chronic hypoxia, systemic inflammation, oxidative stress, medication effects, and reduced physical activity further aggravate the condition. The resulting malnutrition can have serious consequences, including respiratory muscle weakness, impaired immune function, and a higher likelihood of respiratory failure.[4,5] Furthermore, COPD is now recognized as a systemic disease, and poor nutritional status has a direct impact on both respiratory muscles and lung structure, thereby influencing disease progression. Previous studies have also indicated that patients who are underweight or even of normal weight may have a higher risk of mortality compared to those who are overweight or obese.[7]

Despite its clear clinical importance, nutritional evaluation is not consistently incorporated into routine COPD management, particularly in resource-limited settings. A variety of assessment tools are available, including anthropometric measurements such as body mass index, mid-upper arm circumference, and skinfold thickness, as well as biochemical markers like serum protein levels. These

methods provide valuable insights into the nutritional status of patients. Early identification and timely management of malnutrition can improve clinical outcomes and enhance the effectiveness of pulmonary rehabilitation programs.

The present study aims to assess the nutritional status of patients with COPD by integrating anthropometric parameters, biochemical indicators, and Mini Nutritional Assessment (MNA) scoring. It also seeks to examine the relationship between nutritional status and disease severity. By highlighting the prevalence and impact of malnutrition in COPD, this study underscores the importance of incorporating routine nutritional assessment and early intervention into standard patient care.

Objectives of the study

1. To estimate prevalence of malnutrition in patients of Chronic obstructive pulmonary disease (COPD) of different GOLD stages by using anthropometric, biochemical parameters, Mini Nutritional assessment questionnaire.
2. To assess correlation of anthropometric, biochemical parameters with Mini Nutritional assessment (MNA).

MATERIALS AND METHODS

This study was designed as a hospital-based observational cross-sectional study carried out over a period of 1.5 years in the P.G. Department of Medicine at S.N. Medical College, Agra. It was approved by the Institutional review board and Institutional ethics committee and confirmed to the guidelines of the Declaration of Helsinki.

A total of 150 COPD patients aged 50–75 years were included.

Inclusion Criteria

- All COPD patients aged 50-75 years.
- Patient on oral diet with no prior malabsorptive disease.
- Cases who are diagnosed clinically, radiologically and through spirometry.

The severity of COPD was assessed using the GOLD criteria.

Exclusion Criteria

- • Patients with comorbid conditions that could affect nutritional status—such as thyroid disorders, diabetes mellitus, malignancy, congestive heart failure, bronchial asthma, bronchiectasis, interstitial lung disease, chronic liver disease, cerebrovascular accidents, or those requiring surgical intervention etc.

A detailed medical history was obtained from all participants, including smoking status, disease duration, and comorbidities. A general and respiratory system examination was conducted.

Chest X-rays was performed to evaluate structural abnormalities of the lungs. Spirometry was carried out according to standard protocols to measure forced expiratory volume in one second (FEV_1) and forced vital capacity (FVC). Based on postbronchodilator FEV_1 % predicted values, patients were categorized into GOLD stages. Nutritional status was evaluated using the Mini Nutritional Assessment (MNA) questionnaire, along with anthropometric parameters such as age, sex, body mass index (BMI), waist circumference, calf circumference, and triceps skinfold thickness, as well as relevant biochemical investigations.

Mini Nutritional Assessment (MNA)

The Mini Nutritional Assessment (MNA) questionnaire was used to categorize patients into three groups: well-nourished (score 24–30), at risk of malnutrition (score 17–23.5), and malnourished (score <17). The tool incorporates components related to dietary intake, recent weight loss, mobility, psychological stress, neuropsychological status, and the patient's self-perception of health and nutritional condition.

Statistical Analysis: The data obtained were organized using Microsoft Excel and subsequently processed with IBM SPSS Statistics software. Descriptive statistics were applied to summarize both demographic and clinical characteristics of the study population. Categorical variables were presented as proportions and percentages, while continuous variables were expressed as mean values along with their standard deviations. The relationship between nutritional status and various GOLD stages of COPD was assessed using the Chi-square test. A p-value below 0.05 was considered statistically significant.

RESULTS

A total of 150 patients with COPD were enrolled in the study, of which 119 (79.3%) were male and 31 (20.7%) were female. The mean age of participants was 59.75 ± 10.36 years, with the majority (58.7%) in the 50–60-year age group.

Out of the total participants, 63.3% (n=95) had a positive history of smoking. The average daily cigarette consumption was 13.6 ± 5.1, and the mean smoking duration was 29.0 ± 10.7 years. The smoking index for mild, moderate, and severe smokers was 457.1 ± 205.3, 325.0 ± 106, and 417.3 ± 185.2 respectively.

Based on GOLD criteria [Table 1], the majority of patients had severe COPD (44.0%), followed by moderate (29.3%) and mild disease (17.3%), while only 9.3% were classified as very severe.

Nutritional assessment using the Mini Nutritional Assessment (MNA) revealed that 34.0% of the patients were malnourished, 45.3% were at risk of malnutrition, and only 20.7% had a normal nutritional status.

A significant association was observed between nutritional status and COPD severity [Table 2], with malnutrition and lower BMI increasingly prevalent in severe and very severe cases ($p<0.001$), while normal nutritional status was more common in mild disease.

A significant difference in BMI, MAC, and MCC was observed among the malnourished, at-risk, and

normal groups (p<0.001). Waist circumference and TSFT were not significantly associated with nutritional status [Table 3].

Similarly, total cholesterol (p=0.027), triglyceride (p=0.011), and LDL (p=0.026) were significantly lower in malnourished patients compared to those with normal nutritional status, while albumin, hemoglobin, and total leukocyte count did not show significant associations [Table 4].

Table 1: Distribution of the studied cases based on Severity of COPD

Severity of COPD (GOLD CRITERIA)	Spirometry		No. of cases (n=150)	Percentage
	FEV1	FEV1/FVC		
Mild	>80%	<0.7	26	17.3%
Moderate	50-79%	<0.7	44	29.3%
Severe	30-49%	<0.7	66	44.0%
Very Severe	<30%	<0.7	14	9.3%

Table 2: Association of nutritional status (MNA)with severity of COPD

Variables		Severity of COPD				Chi Square value	pvalue
		Mild	Moderate	Severe	Very severe		
MNA	Malnutrition	1 (3.8)	8 (18.2)	28 (42.4)	14 (100.0)	73.949	<0.001
	Risk of malnutrition	7 (26.9)	26 (59.1)	35 (53.0)	0 (0.0)		
	Normal	18 (69.2)	10 (22.7)	3 (4.5)	0 (0.0)		
BMI	≤16	0 (0.0)	17 (38.6)	43 (65.2)	14 (100.0)	66.718	<0.001
	16.0-18.0	13 (50.0)	22 (50.0)	21 (31.8)	0 (0.0)		
	>18	13 (50.0)	5 (11.4)	2 (3.0%)	0 (0.0)		

Table 3: Correlation between anthropometry and severity of disease

Variables	Severity of COPD				pvalue
	Mild	Moderate	Severe	Very severe	
BMI	19.18±2.11	17.67±1.62	16.75±1.45	15.01±0.68	<0.001
WC	103.7±6.32	102.71±6.23	101.69±5.79	99.1±5.32	0.037
MCC	31.58±3.02	29.77±3.00	28.26±2.72	27.07±1.82	<0.001
MAC	22.23±2.73	19.18±3.04	18.41±2.77	17.57±1.45	<0.001
TSFT	18.92±2.97	17.32±2.96	17.59±2.91	16.1±2.69	0.027

Table 4: Biochemical indicators and severity of disease

Biochemic al indicators	Severity of COPD				pvalue
	Mild	Moderate	Severe	Very Severe	
Hemoglobin	12.36±2.65	11.87±2.27	10.91±1.04	11.06±1.78	0.003
TLC	12504.23±626 4.98	12324.27±640 9.44	13820.91±508 6.47	16307.9±33 46	0.097
S. Protein	6.67±0.67	6.77±0.90	6.65±0.74	5.99±0.46	<0.001
S. Albumin	4.27±0.52	4.36±0.58	4.34±0.62	4.11±0.43	<0.001
S. TIBC (µg/dl)	190.6±46.9	195.2±48.9	220.8±102.6	271.9±80.3	0.063
Triglyceri des	140.3±6.4	138.0±16.3	117.6±11.1	98.3±5.5	<0.001
LDL	115.9±8.3	117.5±6.4	112.9±5.4	95.9±4.0	<0.001
HDL	47.6±7.2	40.9±4.6	37.6±1.7	33.1±1.3	<0.001
Total Cholesterol	191.6±9.1	186.0±10.1	184.0±10.1	148.7±4.9	<0.001

Table 5: Correlation of MNA and anthropometric with severity of COPD

Severity of COPD		
	r-value	p-value
MNA	-0.609**	<0.001
BMI	-0.578**	<0.001
WC	-0.214**	0.008
MCC	-0.444**	<0.001
MAC	-0.435**	<0.001
TSFT	-0.195*	0.017
**. Correlation is significant at the 0.01 level (2-tailed).		
*. Correlation is significant at the 0.05 level (2-tailed).		
r-value = Pearson' Correlation Coefficients		

DISCUSSION

Chronic Obstructive Pulmonary Disease is traditionally viewed as a disorder confined to the lungs; however, recent understanding highlights its systemic nature, with significant extrapulmonary manifestations such as malnutrition. The present study was undertaken to evaluate the nutritional status of patients with COPD and to explore its relationship with disease severity using a combination of clinical, anthropometric, and biochemical parameters. The findings demonstrate a high prevalence of malnutrition among COPD patients, along with an inverse relationship between nutritional status and disease severity.

The pathophysiology of COPD is largely driven by chronic inflammation resulting from prolonged exposure to harmful particles and gases. This inflammatory response leads to structural damage and narrowing of the airways, ultimately impairing lung function and causing airflow limitation.[8] Disease severity is commonly classified according to the Global Initiative for Chronic Obstructive Lung Disease (GOLD) criteria, which are based on spirometric measurements. Despite being primarily a pulmonary condition, COPD also exerts significant systemic effects, including impacts on the cardiovascular system.[9]

COPD represents a substantial public health burden due to its progressive nature and association with complications such as weight loss and malnutrition. Poor nutritional status in these patients contributes to muscle wasting, reduced respiratory muscle strength, and increased risk of respiratory failure and mortality. Additionally, deterioration in nutritional status and body composition may worsen the clinical course by increasing susceptibility to exacerbations and negatively affecting overall quality of life. Although the role of nutrition is well recognized, there remains limited regionspecific data, particularly from the Indian population, highlighting the need for focused research in this area.

In the present study, 34% of patients were found to be malnourished, while 45.3% were identified as being at risk, indicating that nutritional impairment is highly prevalent, especially in advanced stages of COPD. These observations are consistent with previous studies, such as that by Tandon et al,[10] (2021) which reported comparable rates of malnutrition and demonstrated an inverse relationship between Mini Nutritional Assessment (MNA) scores and disease severity.

Anthropometric measurements in this study revealed a progressive decline in body mass index, mid-arm circumference, and mid-calf circumference with increasing severity of COPD. These findings are in agreement with earlier research, including studies by SV J et al,[11] (2016) and Chaudhary et al,[12] (2017) which also reported a reduction in these parameters across advancing GOLD stages. Furthermore, correlation analysis indicated a strong negative association between MNA scores and disease severity, supporting the utility of MNA as a reliable and practical tool for nutritional assessment.

Biochemical analysis demonstrated significantly lower levels of serum protein, albumin, triglycerides, low-density lipoprotein, and total cholesterol in patients with more severe disease. These changes likely reflect the underlying inflammatory and catabolic processes associated with COPD, particularly during exacerbations. Similar findings have been reported by Yazdanpanah et al,[13] (2009) and Singh et al,[14] (2019) who identified serum albumin and lipid profiles as important indicators of nutritional decline and systemic inflammation in COPD patients.

Interestingly, no significant differences were observed in triceps skinfold thickness and waist circumference between malnourished and well-nourished individuals. This suggests that these conventional measures may not be sufficiently sensitive in detecting malnutrition in COPD, where muscle loss tends to predominate over fat loss. Previous studies, such as that by Kuznar-Kaminska et al,[15] (2008) have also emphasized that indices reflecting lean body mass, such as fat-free mass index, may provide a more accurate assessment of nutritional status in such patients.

The findings of this study underscore the importance of early and routine nutritional evaluation in the management of COPD. Malnutrition should not be regarded merely as an associated condition but as a significant factor influencing disease progression, exacerbation risk, functional capacity, and survival. Evidence from prior studies suggests that appropriate nutritional interventions, including oral nutritional supplementation, can lead to improvements in nutritional status, respiratory muscle function, exercise tolerance, and overall clinical outcomes.

Strengths and Limitations

The strength of this study lies in its comprehensive assessment of nutritional status using a combination of anthropometric, biochemical, and validated tools such as the Mini Nutritional Assessment. However, the cross-sectional design limits the ability to establish causal relationships. In addition, advanced methods for assessing body composition, such as dual-energy X-ray absorptiometry (DEXA) or fat-free mass index, could not be utilized due to resource constraints, although these techniques may provide more sensitive evaluation of muscle mass loss.

CONCLUSION

This study gives strong evidence supporting that malnutrition is highly prevalent and further aggravates with the severeness of the COPD disease. Disordered nutritional condition which was closely related to anthropometric and biochemical parameters. These findings contribute to the significance of implementing nutritional screening and interventions as a vital part of COPD management, particularly in the resourceconstrained setting where high burden of disease is present.

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