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## ORIGINAL ARTICLE

# NUTRITIONAL STATUS AND SEVERITY CORRELATION OF COPD PATIENTS ADMITTED IN TERTIARY CARE HOSPITAL

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**Abstract:**

***Background:*** *Malnourishment is highly prevalent among COPD patients. The study was carried out to assess the nutritional status of hospital admitted COPD patients to evaluate the relationships between the nutritional indices and the pulmonary function parameters with severity correlation.* ***Methods:*** *A cross-sectional observational study was done constituting 50 spirometry-proven COPD patients admitted at Dhaka Medical College Hospital. Lung function was measured by routine spirometry. Anthropometric measures, biochemical parameters, and Mini Nutritional Assessment (MNA) score were used for nutritional assessment.* ***Results:*** *Mean age of study population was 64.31 years.22% (n = 11), 42% (n = 21) 32% (n = 16) & 4% (n = 2) of the patients were of stage I, II, III and IV of COPD respectively.According to MNA scalethe study population were malnourished 46% (n = 23), at risk of malnutrition 40% (n = 20) and normal nutritional status 14% (n = 7).13 patients were found malnourished according to BMI scale and were in stage I COPD 15.38% (n = 2), stage II 38.46% (n = 5), stage III 38.46% (n = 5) and stage IV 7.69% (n = 1). Mid arm circumference (MAC), mid-calf circumference (MCC), MNA scale score and BMI score showed a significant decline of mean value with increasing severity of stages of COPD. The correlation between BMI and FEV1 (R2 = 0.087 and p value= 0.038), body weight and FEV1 (R2 = 0.173 and p value= 0.003), MUAC and FEV1 (R2: 0.202, p value = 0.001) and MNA scale and FEV1 (R2 = 0.144 and p value= 0.007). All correlations were statistically significant.* ***Conclusion****: The high prevalence of malnutrition among hospitalized COPD patients is related to their lung function. Weight, mean MNA, and BMI score decrease with increasing severity of COPD.*

***Key Words:*** *COPD, Malnutrition, Nutritional status, Body mass index (BMI), Mini nutritional assessment (MNA), GOLD stage.*

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## Introduction:

COPD is one of the major causes of chronic morbidity and mortality worldwide and is considered the fourth leading cause of death.[1-4] The projection indicates that COPD will be the third leading cause of death worldwide and the fifth leading cause of year loss through early mortality or handicap in disability-adjusted life year (DALY).[5]

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Consistent history & physical examination, investigation findings including radiological features, spirometric readings, and blood gas analysis help diagnose COPD. FEV1<80% of predicted and FEV1/FVC <0.7 that remains unchanged after bronchodilator administration is considered diagnostic findings of COPD. GOLD severity classification criteria take FEV1 and FEV1/FVC to categorize COPD in four stages (I – IV). FEV1/FVC < 0.7 is the mandatory requirement in all four stages whereas post-bronchodilator FEV1 ≥80% predicted consists stage I, ≥50% but ≤80% predicted consists stage II, ≥30% but < 50% predicted makes stage III and < 30% predicted makes stage IV.[6]

Multiple factors can be responsible for the development of malnutrition in COPD patients that can be listed as:

- Increased respiratory work leads to a higher metabolism,
- Chronic inflammation,
- Recurrent infections
- Medications,
- Reduced dietary intake/dietary problems[7-8].

Schools defined this situation as "pulmonary cachexia"[9] where Protein-Energy-Malnutrition is most commonly seen. Nutritional counselingmay help improve nutritional status that can lead to improvement of the quality of life of COPD patients.[10] Body Mass Index <20 is a predictive factor for hospitalization in COPD[11]. To predict the severity of COPD patients, BMI and MAC should be considered for nutritional status assessment.[12]

Acute exacerbation among COPD patients requires frequent hospitalization.[13] The body responses to these triggers or exacerbation will ultimately result in excess energy requirements which can lead to further deterioration in nutritional status, and loss of lean body mass is a likely repercussion.[14] Acute exacerbations of COPD also lead to progression of the disease and have been directly related to reduced survival and decreased quality of life.[15]

We aimed to investigate the nutritional status of COPD patients with Body Mass Index (BMI) and Mini Nutritional Assessment (MNA) and compare the correlation of MNA, BMI, and anthropometric values with the severity of COPD.

**Methods:**

A cross-sectional observation study constituting 50 COPD patients, were included during a period of 6months from September 2019 to February 2020. The study was carried out at the Department of Medicine of Dhaka Medical College Hospital. The study's inclusion criteria were the adult patients of both genders, diagnosed with COPD, fulfilling recommended criteria in Spirometry and Chest X-ray with relevant history and clinical examination findings. Patients with known co-morbid conditions that could affect nutritional status (thyroid problems, diabetes mellitus, cancer, congestive heart failure, pregnant female) were excluded from the study. The severity of COPD was being categorized using GOLD severity classification.[6]

For the Nutritional Status assessment, Mini Nutritional Assessment (MNA) score was being used. It consists of 18-score-weighted items. MNA test is an internationally validated, two-step procedure (screening for risk of malnutrition, followed by global assessment of the nutritional conditions) .[16] BMI was calculated by the formulae given as weight (kg) divided by height$^2$ (meter).[17] MAC is the circumference of the left upper arm and was measured at the mid-point between the tips of the shoulder and elbow. It was measured with a non-stretchable fiberglass tape graduated from 0 - 150cm. Measurements were taken three times consecutively, and mean values were observed. MNA provides a total score that ranges from 0 to 30. Below 17.5 is categorized as malnutrition, 17.5-23.5 as at risk for malnutrition, and above 23.5 as normal nutrition.

The study protocol was approved by the Institutional ethical review committee. After getting the informed written consent from the patients, they were interviewed face to face by the researcher for data collection.The following variables were being recorded of the whole study population; age, sex, occupation, income, smoking status. Lung function test was done with the help of Spirometry. Following anthropometric measures were measured; weight, height, Body mass index (BMI), mid-upper arm circumference (MUAC), triceps skinfold thickness, calf circumference. Nutritional status was being assessed by Mini Nutritional Assessment score. The statistical analysis was done using the SPSS version 23.0 (SPSS Inc, Chicago, IL) software for MS Windows. Descriptive frequencies expressed in terms of mean ± standard error of mean (SEM). Pearson's correlation coefficient applied to the correlation of nutritional status and lung function. P-value <0.05 was considered significant.

**Results:**

The study was done on 50 patients diagnosed as a case COPD by standard diagnostic criteria described in the previous chapters. We examined the patient and measure the anthropometric indices and did some routine tests. The pertinent findings are shown in a tabulated manner below.

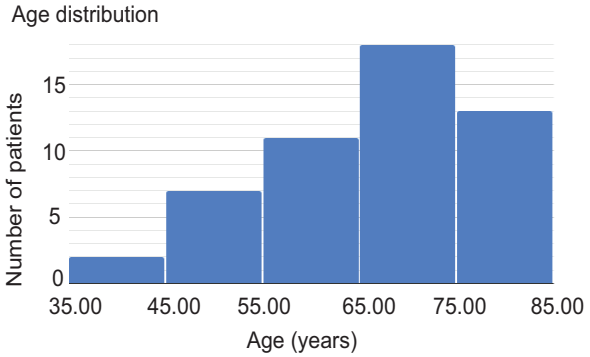


**Fig.-1:** *Distribution of Age*

The study populations were distributed among the age range of 35-85years. Among them, 4% (n=2) patients were 35-45years, 14% (n=7)45-55years, 24% (n=12) 55-65years, 34% (n=17) 65-75years and 24% (n=12) 75-85years as shown on Fig I. Majority of the patient pool were within 65-75 years of age (34%) (n=17). Mean age was 64.31 years.Male patients were 46 (90.2%) and female were 4 (9.8%) in the study.

Patients were distributed between different occupations, amongthem 18% (n = 9)were farmers, 22% (n = 11) were businessman. Majority of the patients were categorized as "Other". In "Others" category patient's occupations were unemployed (n=8), rickshaw puller (n=3), driver (n=2), salesman (n=1) and plumber (n=1).More than half of the study population (72%) (n = 36) were in the low-income category.

**TableI**

| | | Frequency | Percent |
|---|---|---|---|
| SmokingHabit | Smoker | 37 | 74.0% |
| | Nonsmoker | 13 | 26.0% |
| | Total | 50 | 100.0% |

Table I showed that 74% (n = 37) of the patients were currently smoker and 26% (n = 13) were not smoker or quieted. However, a number of the patients were passive smokers or resided in air polluted area or had exposure to smoke from cooking stove among nonsmoker group.

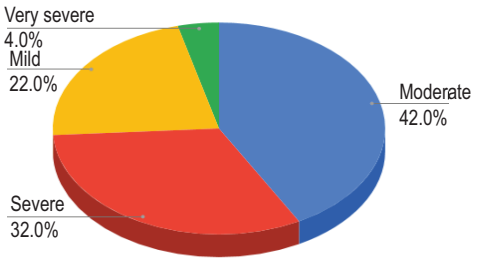


**Fig.-2:** *Distribution of different stages of COPD*

Here the study population is distributed according to COPD stage. The patient in stage I/ mild was 22% (n = 11), stage II/ moderate was 42% (n = 21), stage III/ severe was 32% (n = 16), and stage IV/ very severe was 4% (n = 2).

**Table II**

| | | | GOLD -I | GOLD - II | GOLD - III | GOLD - IV |
|---|---|---|---|---|---|---|
| Age | 30-44 years | Count | 0 | 1 | 1 | 0 |
| | | % | 0.0% | 2.0% | 2.0% | 0.0% |
| | 45-59 years | Count | 4 | 5 | 5 | 1 |
| | | % | 8.0% | 10.0% | 10.0% | 2.0% |
| | 60-74 years | Count | 5 | 7 | 7 | 1 |
| | | % | 10.0% | 14.0% | 14.0% | 2.0% |
| | > 75years | Count | 2 | 8 | 3 | 0 |
| | | % | 4.0% | 16.0% | 6.0% | 0.0% |
| Total | Count | | 11 | 21 | 16 | 2 |
| | % | | 22.0% | 42.0% | 32.0% | 4.0% |

With increasing age, the percentage of the patients having moderate and severe COPD increased. In 30-44years-age range only two patients had been found to have COPD. In 45-59 years and 60-74 years age range majority of the patients were in stage II 24.0% (n= 12) and stage III 24.0% (n=12). Among patients above 75years around 16.0% (n=8) were in stage II and 6.0% (n=3) in stage III COPD.

Here, the study population had been classified according to MNA scale into 3 categories. In this study, majority of the patients (46%) (n = 23) were in malnourished group according to MNA scale and around 40% (n= 20) patients were at risk of malnutrition and normal nutritional status present was in 14% (n=7) study population which is being showed in the figure (Fig.3) below.

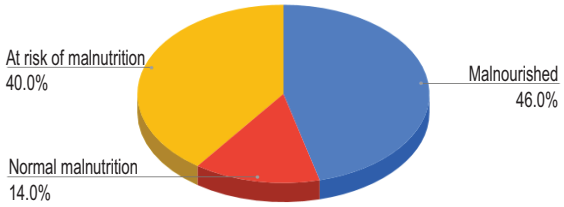


**Fig.-3:** *Distribution of Nutritional status according to MNA scale*

**Table III**

| | | Malnutrition (BMI <18.5) | Percent |
|---|---|---|---|
| Severity of COPD | Mild | 2 | 15.38% |
| | Moderate | 5 | 38.46% |
| | Severe | 5 | 38.46% |
| | Very Severe | 1 | 7.69% |

Again, the study population had been classified into 'malnutrition' according to BMI scale (BMI < 18.5) and it was found that 26% (n = 13) study population were malnourished according to BMI score. And then we distributed this malnourished group into different stages of COPD.Among them, 15.38% (n = 2) were in stage I, 38.46% (n = 5) were in stage II, 38.46% (n = 5) were in stage III and 7.69% (n = 1) were in stage IV COPD.

Mid arm circumference (MAC) and mid-calf circumference (MCC) showed a significant decline of mean value with increasing severity of stages of COPD. With increasing severity of COPD there were also a significant decrease in mean MNA scale score and BMI score.

**Table-IV**

| | | GOLD-I **Mean±SD** | GOLD – II **Mean±SD** | GOLD – III **Mean±SD** | GOLD-IV **Mean±SD** |
|---|---|---|---|---|---|
| Variable | MAC | 26.18 ± 5.25 | 24.1 ± 3.45 | 23.06 ± 3.47 | 21.5 ± 3.54 |
| | MCC | 30.45 ± 4.74 | 28.86 ± 3.51 | 29.19 ± 3.94 | 28 ± 5.66 |
| | MNA scale | 19.59 ± 5.29 | 17.4 ± 4.92 | 16.44 ± 5.7 | 15.5 ± 2.83 |
| | BMI | 23.3 ± 5.79 | 20.9 ± 4.3 | 20.71 ± 4.38 | 20.35 ± 6.44 |

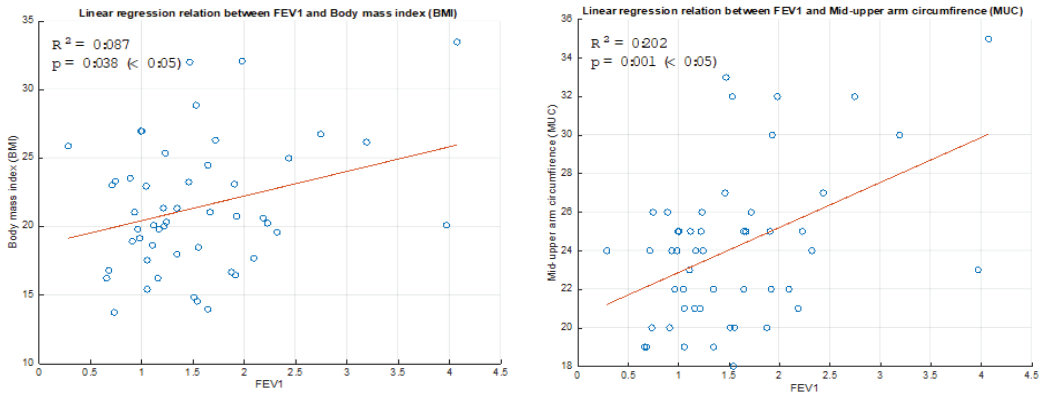


**Fig.4:** *Linear regression relation between FEV1&BMI (Left) and FEV1 & MAC (Right)*

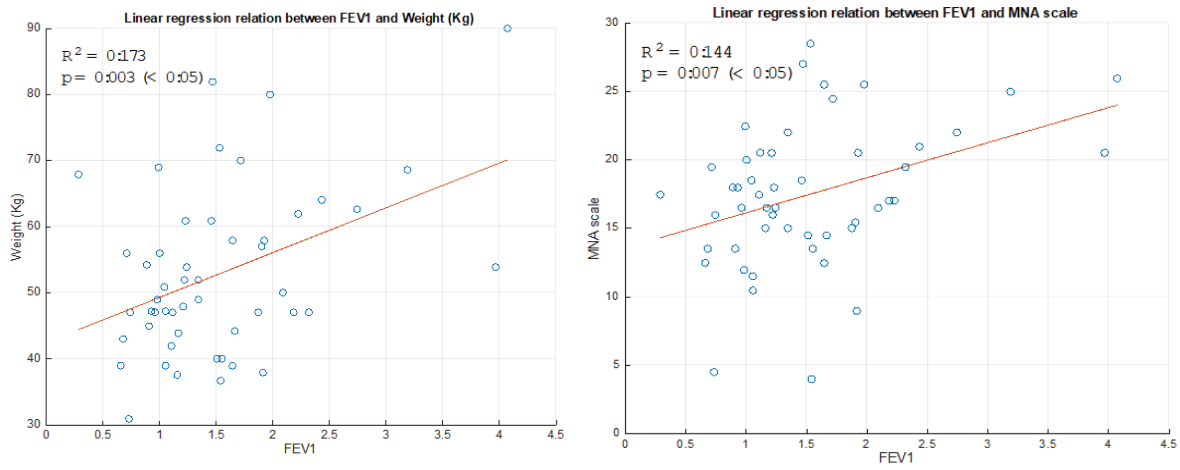


**Fig.-5:** *Linear regression relation between FEV1 &Weight(Left) and FEV1&MNA scale (right)*

To determine if there was a relationship between the degree of nutritional depletion and airway obstruction in the subjects studied, we correlated the flow rates with the indicators of somatic nutritional scores (Fig. IV-V).Fig IV onleft sideshows the correlation by linear regression between FEV1 and BMI and it was statistically significant ($R^2$ = 0.087 and p value 0.038 which was <0.05).There was strong statistically significant correlation between FEV1 and Mid upper arm circumference (MAC) had been found which is shown in Fig IV on right side by linear regression ($R^2$: 0.202, p value 0.001 which is <0.05).

Fig.-5 on right side shows the correlation by linear regression between FEV1 and weight and it is statistically significant ($R^2$ = 0.173 and p value 0.003 which is < 0.05).The correlation between FEV1 and MNA scale is statisticallysignificant ($R^2$ = 0.144 and p value 0.007 which is < 0.05) which is shown in the above Fig. 5 (right).

**Discussion:**

58% of patients of the study population were above the age of 65years and the age range was 35-85 years, and the mean age was 64.31 years. Yuceege M B M.D. et al. carried out a study where 60 stable COPD patients were enrolled and showed similar age distribution with a mean age of 63±9.4.[18] In our study, male patients were 46 (90.2%), and females were 4 (9.8%) in number. Patients were distributed between different occupations; 22% were businessmen, 20% were service holders, 18% of patients were farmers. About 72% of study populations were in the low-income category. Lowe KE et al. also evaluated that low socioeconomic status has been associated with COPD.[19]

Statistically, a significant association between smoking status and COPD stage was observed (p=0.025) in a study conducted by Chaudhary SC et al.[20] It was observed that 74% of the patients were smokers, and 26% were not smokers. However, many of the patients were passive smokers or heavy air pollution in the residing area or had exposure to smoke from cooking stove.

In this study, when the population was distributed according to COPD stage, the patient in stage I/ mild was 22%, stage II/ moderate was 42%, stage III/ severe was 32%, and stage IV/ very severe was 4%. The majority of the study patients were in stage II COPD. Similar stage distribution was also found in Chaudhary SC et al.[20] With increasing age, the percentage of the patients having COPD severity increased. Among patients over 60years of age, around 52% of patients were in the moderate to very severe category. 30% of patients over 60years of age were in Gold stage II, 20% were in GOLD stage III, and 2% were in GOLD stage IV category.

MNA scale identified the study population as Malnourished 46%, at risk of malnutrition 40%, and standard nutritional status 14%. When 'risk of malnutrition patients were accepted as malnutrition, the rate increased to 86%. Gupta B et al. had studied a total of 106 hospitalized patients with COPD. Out of 106 patient's malnourishment was found in 83%.[21] In our study, malnutrition prevalence was 26% among the study population using the BMI scale (BMI < 18.5). Malnutrition based on BMI was correlated with the COPD severity: 15.38% in mild COPD, 38.46% in moderate COPD, 38.46% in severe COPD, 7.69% in very severe COPD. Yuceege M B M.D. et al. showed a prevalence of malnutrition prevalence of 26.7% using

BMI, which was also incompatible with the other studies on COPD[22]. Land and coworkers studied a cohort of 2,132 patients with COPD in which they found low BMI leads to increased mortality in patients compared with subjects of average weight.[23]

In our study, mid-arm circumference and mid-calf circumference showed a significant decline with increasing severity of COPD. With the increasing severity of COPD, there was also a significant decrease in mean MNA and BMI scores. Wijnhoven et al. showed that with increasing severity of COPD, there was a significant decrease in mean MNA and BMI levels ($p<0.001$). Nutritional status in the study population worsened with increasing severity of COPD stage as assessed by BMI ($p<.001$) and MNA ($p<.001$).[24] Chaudhary SC et al. showed a significant decrease in mean MNA and BMI levels were observed with increasing stage of COPD ($p<0.001$). Mid-arm circumference and mid-calf circumference showed a significant decline with increasing severity of COPD ($p<0.001$).[20] King D et al. observed that being underweight is a poor prognostic sign in chronic obstructive pulmonary disease (COPD) is at least in part associated with the severity of airflow obstruction. Nutritional supplementation in undernourished patients with COPD can lead to weight gain and improvements in respiratory muscle function and exercise performance.[25]

To determine the relationship between the degree of nutritional depletion and the severity of COPD, we correlated the flow rates with the indicators of somatic nutritional scores (Fig. IV - V). The linear regression between BMI and FEV1 ($R2 = 0.087$ and p value= 0.038), body weight and FEV1 ($R2 = 0.173$ and p value= 0.003), MUAC and FEV1(R2: 0.202, p-value = 0.001) and MNA scale and FEV1 ($R2 = 0.144$ and p value= 0.007). All correlations were statistically significant. Gupta et al conducted similar study, which showed the correlation between body weight and FEV1/FVC% ($r = 0.648$, $p = 0.003$), FEV1 (Pre) and BMI ($r = 0.0964$, $p = 0.037$), MUAC and FEV1/FVC% ($r = 0.0.3081$, $p = 0.003$) and serum albumin was correlated with FEV1/FVC% ($r = 0.03816$, $p = 0.03$) .[26] Our study reported low values for FEV1 showing lung function deterioration in patients with malnourishment. Statistically significant correlation between FEV1 and nutritional parameters by weight, MNA scale, BMI score, and MUAC suggest that nutritional depletion may worsen lung function. Gupta et al. conducted a study that showed somatic depletion is present among COPD patients and that there is a relationship between the degree of nutrition depletion and lung dysfunction[38] that is consistent with our study result.

**Conclusion:**

Malnutrition is highly prevalent among hospitalized COPD patients, directly related to their lung function. Assessment of the nutritional status in COPD is a vital step in managing COPD patients. Improving the nutritional status will not cure COPD but will surely postpone the associated comorbidity.

**Limitations:**

The study was done on 50 cases only and in only Department of Medicine of Dhaka Medical College Hospital in Dhaka, which may not reflect the whole population. The study area has heavier air pollution that may impact the pulmonary function parameters. Many stage-IV COPD patients could not be enrolled in the study due to their severe illness; limiting the anthropometric measurement and survey participation

**Conflict of Interest:**

The authors stated that there is no conflict of interest in this study.

**Funding:**

No specific funding was received for this study**.**

**Ethical consideration:**

The study was conducted after approval from the ethical review committee. The confidentiality and anonymity of the study participants were maintained

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