“Role of Mini Nutritional Assessment (MNA) Tool to Detect Malnutrition in Patients with COPD: Prospective Observational Study”

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LIST OF ABBREVIATIONS

MNA – Mini Nutritional Assessment

COPD – Chronic Obstructive Pulmonary Disease

BMI – Body Mass Index

FFMI – Fat-Free Mass Index

BIA – Bioelectrical Impedance Analysis

HRQOL – Health-Related Quality of Life

FEV1 – Forced Expiratory Volume in One Second

FVC – Forced Vital Capacity

GOLD – Global Initiative for Chronic Obstructive Lung Disease

BODE Index – BMI, Airflow Obstruction, Dyspnea, and Exercise Capacity Index

NRS – Nutritional Risk Screening

SGA – Subjective Global Assessment

ESPEN – European Society for Clinical Nutrition and Metabolism

CRP – C-Reactive Protein (a marker of inflammation)

PA – Physical Activity

SARC-F – Sarcopenia Screening Tool

DXA – Dual-Energy X-ray Absorptiometry (for body composition analysis)

6MWT – Six-Minute Walk Test

QoL – Quality of Life

RCT – Randomized Controlled Trial

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ABSTRACT

INTRODUCTION:

Chronic Obstructive Pulmonary Disease (COPD) significantly impacts global health, characterized by persistent respiratory symptoms and progressive airflow limitation, often complicated by malnutrition. Malnutrition is frequently overlooked yet significantly affects disease progression, functional capacity, and patient prognosis. Early detection using validated nutritional assessment tools such as the Mini Nutritional Assessment (MNA) can potentially lead to better management strategies.

OBJECTIVE:

To assess the effectiveness of the MNA tool in identifying malnutrition among COPD patients and compare it with traditional methods like Body Mass Index (BMI).

METHODS:

This prospective observational study included 101 COPD patients attending the Respiratory Medicine Department at KLE Dr. Prabhakar Kore Hospital, Belagavi, from April 2023 to March 2024. Patients underwent comprehensive evaluations, including demographic data collection, clinical assessments using spirometry (GOLD criteria), anthropometric measurements, and nutritional assessments using the full MNA questionnaire. Data analysis utilized descriptive statistics, Chi-square tests, independent t-tests, and Pearson's correlation coefficient through SPSS version 22.

RESULTS:

Assessment of nutritional status using BMI alone indicated 38.6% of patients were underweight, with the majority appearing to have adequate nutritional health. However, the MNA tool provided contrasting results, identifying 41.6% of patients at risk of malnutrition and 26.7% of patients as malnourished, with only 31.7% of patients having normal nutritional status. Malnutrition status assessed by MNA showed a significant association with COPD severity, where higher GOLD stages correlated with increased rates of malnutrition or risk ($p<0.05$). Additionally, higher CAT scores indicating greater symptom burden and elevated mMRC grades reflecting greater functional impairment were strongly associated with worse nutritional status ($p<0.05$). Respiratory findings such as rhonchi, smoking status, and presence of comorbidities also demonstrated significant correlations with nutritional risk or malnutrition ($p<0.05$). The discrepancy between BMI and MNA results underscores BMI's limitation in detecting nutritional deficiencies, particularly in patients with normal or elevated BMI.

CONCLUSION:

The Mini Nutritional Assessment (MNA) tool effectively identifies malnutrition and nutritional risk in COPD patients, with significant associations observed between nutritional status and disease severity indicators like GOLD stage, CAT scores, and mMRC grading. The MNA provides a more comprehensive and sensitive evaluation of nutritional status than BMI alone, highlighting its critical role in routine COPD management to facilitate timely nutritional interventions, thus potentially improving clinical outcomes and quality of life in these cases.

KEY WORDS:

COPD, Malnutrition, Mini Nutritional Assessment, BMI, GOLD criteria, CAT score, mMRC grading, spirometry

INTRODUCTION

Chronic Obstructive Pulmonary Disease (COPD) is a major global health concern, characterized by persistent respiratory symptoms such as dyspnea, chronic cough, and progressive airflow limitation. These symptoms not only impair the patient's quality of life but also lead to frequent hospitalizations and a continuous decline in lung function(1). Malnutrition is a prevalent yet often under-recognized complication in COPD patients, significantly influencing disease progression, functional capacity, and overall prognosis. It is closely associated with reduced muscle strength, impaired immune response, and increased morbidity and mortality.(2–4)

Malnutrition is a prevalent but often under recognized complication in patients with COPD, significantly influencing disease progression, functional capacity, and overall prognosis. It is closely associated with reduced muscle strength, impaired immune response, and increased morbidity and mortality. Poor nutritional status further exacerbates respiratory muscle weakness, leading to decreased exercise tolerance and a higher risk of hospitalizations. Early identification of malnutrition through effective screening tools can enable timely nutritional interventions, potentially improving clinical outcomes, reducing exacerbations, and enhancing the patient's overall quality of life(5–7)

Studies have shown that tools like the Mini-Nutritional Assessment (MNA) are effective in evaluating the nutritional status of COPD patients, enabling early identification and intervention for those at risk (5). Nutritional support has been demonstrated to improve quality of life and clinical outcomes in this population, emphasizing the importance of integrating nutritional assessments into routine COPD management [2,4]

The prevalence of malnutrition among COPD patients in India, as assessed by the Mini Nutritional Assessment (MNA) tool, is alarmingly high, reflecting the dual burden of chronic respiratory disease and nutritional deficiencies in the population. Studies have shown that malnutrition is a significant comorbidity in COPD patients, with prevalence rates ranging from 14% to 55%, depending on the severity of the disease and the population studied[8,9]. In the study, which examined over 169,000 individuals across urban and rural regions in India, it was noted that approximately 22% of COPD patients were underweight or malnourished, with malnutrition being more pronounced in individuals with advanced COPD, particularly those suffering from emphysema and chronic bronchitis[10]. Older patients (above 60 years) and those with lower physical activity levels were found to be at a higher risk of malnutrition. Additionally, the study highlighted that 18% of patients with severe COPD had inadequate calorie intake, while protein and vitamin D deficiencies were prevalent in over 35% of patients. These findings underscore the critical need for routine nutritional assessment using tools like the MNA in COPD management, particularly in resource-limited settings like India, where malnutrition and chronic respiratory diseases often coexist. Early detection and intervention can help mitigate the adverse effects of malnutrition, improve clinical outcomes, and enhance the quality of life for COPD patients in India.

Stephenson et al.[11]explored the role of malnutrition in chronic obstructive pulmonary disease (COPD), emphasizing the significance of detecting undernutrition in these patients for improving clinical outcomes. The retrospective study, conducted across several outpatient clinics, included 86 COPD patients who underwent nutritional assessments using the commonly used body mass index (BMI), fat-free mass index (FFMI), and the Mini Nutritional Assessment (MNA®) tool. The study found that 28% of patients had low BMI, 27% had low FFMI, and 22% were classified as malnourished by the MNA®, with 43% at risk of malnutrition. More importantly, the MNA® tool identified a higher number of malnourished patients compared to BMI or FFMI, highlighting its potential for early detection of undernutrition. The study also found moderate correlations between nutritional status and disease severity (spirometry data) and symptom burden, making the MNA® a useful tool for identifying those who could benefit from dietary intervention. This approach offers the possibility of improving the quality of life and health outcomes for COPD patients through early nutritional support.

NEED OF THE STUDY

COPD is a complex and heterogeneous condition that affects individuals regardless of their smoking status. While never-smokers with COPD often present with less chronicity of respiratory symptoms and milder airflow limitations compared to their smoking counterparts, they still face a poor prognosis, with an increased risk of exacerbations and complications. Similarly, malnutrition is a critical yet often overlooked aspect of COPD management, contributing to worsened respiratory muscle function, increased disease severity, overall poor prognosis.

Malnutrition in COPD patients is a multifactorial issue, often resulting from a combination of reduced dietary intake, increased energy expenditure due to labored breathing, and systemic inflammation. Despite its significant impact on patient outcomes, malnutrition is frequently underdiagnosed and undertreated in clinical practice. The Mini Nutritional Assessment (MNA) tool has emerged as a reliable and validated method for assessing nutritional status, particularly in elderly and chronically ill populations. It is a simple, non-invasive tool that can identify patients at risk of malnutrition before severe weight loss or biochemical changes occur.

The role of MNA in assessing malnutrition in COPD has not been done in Indian COPD patients. Hence the present study was performed to evaluate nutritional assessment in COPD patients. By identifying malnutrition early, appropriate nutritional interventions can be implemented to improve patient outcomes. The MNA tool assesses various parameters, including dietary intake, weight loss, mobility, psychological stress, and anthropometric measurements, providing a comprehensive evaluation of a patient's nutritional status.

AIMS AND OBJECTIVES

The aim of this study is to assess the role of the Mini Nutritional Assessment (MNA) tool in detecting malnutrition among patients with Chronic Obstructive Pulmonary Disease (COPD) and to evaluate its effectiveness in comparison with traditional measures such as Body Mass Index (BMI).

Objectives of the Study:

1. **Primary Objective:**
   - To use the Mini Nutritional Assessment (MNA) tool to detect the presence of malnutrition among COPD patients.
2. **Secondary Objective:**
   - To compare the Mini Nutritional Assessment (MNA) tool with Body Mass Index (BMI) in detecting malnutrition in COPD patients.

REVIEW OF LITERATURE

Definition of COPD:

Chronic Obstructive Pulmonary Disease (COPD) is a heterogeneous lung condition characterized by chronic respiratory symptoms such as dyspnea, cough, and sputum production. These symptoms arise due to abnormalities in the airways (e.g., bronchitis, bronchiolitis) and/or alveoli (e.g., emphysema), leading to persistent and often progressive airflow obstruction. COPD is one of the leading causes of morbidity and mortality worldwide, significantly impacting patients' quality of life. The disease is frequently associated with systemic consequences and comorbidities, including hypertension, cardiovascular diseases, musculoskeletal abnormalities, and psychiatric disorders, which further complicate its management [(1)]

BURDEN OF COPD AND MALNUTRITION

COPD imposes a substantial burden on healthcare systems globally, particularly in low- and middle-income countries. It is a major cause of hospitalizations, disability, and premature death. The economic burden of COPD is significant, with high costs associated with hospitalizations, medications, and long-term care. Malnutrition, a common comorbidity in COPD patients, exacerbates the disease burden by contributing to respiratory muscle dysfunction, increased disease severity, and frequent exacerbations.[(12)] Malnutrition in COPD is often underdiagnosed, leading to delayed interventions and poorer outcomes. The Mini Nutritional Assessment (MNA) tool has been proposed as a reliable method for early detection of malnutrition, which can help in reducing the burden of COPD by enabling timely nutritional interventions.[(2)]

The prevalence of malnutrition in COPD patients, including non-smokers, is alarmingly high. A study by Benedik et al[(8)]. found that 14% of COPD patients were malnourished, and an additional 55% were at risk of malnutrition.The MNA tool has been shown to be effective in identifying malnutrition in COPD patients, including non-smokers, and is correlated with disease severity and poorer clinical outcomes.[9]

In the INSEARCH study[10], which examined over 169,000 individuals across urban and rural regions in India, it was noted that about 22% of COPD patients were underweight or malnourished. The study highlighted that malnutrition was more pronounced in individuals with advanced COPD, particularly those suffering from emphysema and chronic bronchitis. Additionally, older patients (above 60 years) and those with lower physical activity levels were found to be at a higher risk of malnutrition.

This study reinforced the critical need for addressing nutritional deficiencies in COPD management, particularly given the dual burden of malnutrition and chronic respiratory disease. The data showed that 18% of patients with severe COPD had inadequate intake of calories, while protein and vitamin D deficiencies were prevalent in over 35% of patients.

Grigsby MR et al.(13) examined the association between BMI, lung function, and COPD across 14 low- and middle-income countries, analyzing data from12,396 participants aged 35–95 years.Results indicated thatBMI < 19.8 kg/m²significantly increased the odds of COPD (2.28 times higher)and was associated with lower FEV1 and FEV1/FVC z-scores. The link between low BMI and poor lung function persisted even after excluding COPD patients, suggesting that underweight status contributes to impaired lung function. These findings highlight the importance of nutritional assessment and interventions in COPD management, particularly in resource-limited settings where undernutrition is prevalent.

Risk Factors for COPD:

The aetiology of Chronic Obstructive Pulmonary Disease (COPD) is primarily linked to long-term exposure to harmful particles or gases, most commonly cigarette smoke, as well as environmental pollutants, occupational dust, and genetic factors such as alpha-1 antitrypsin deficiency. These exposures lead to chronic inflammation in the airways and alveoli, causing structural changes like emphysema and bronchiolitis, which result in persistent airflow limitation and respiratory symptoms. Malnutrition in COPD patients often arises due to a combination of factors, including hypermetabolism (increased energy expenditure from the work of breathing), systemic inflammation, reduced dietary intake (due to dyspnea or fatigue), and the catabolic effects of recurrent infections or exacerbations. Additionally, comorbidities such as depression and gastrointestinal issues further exacerbate nutritional deficiencies. Malnutrition, in turn, worsens COPD outcomes by impairing respiratory muscle function, reducing exercise capacity, and increasing susceptibility to infections, creating a vicious cycle of disease progression [1–4]

Host-based and Environmental Factors in COPD Aetiology

COPD Risk Factors

Host-based Factors	Environmental Factors
1. Genetic Factors	1. Smoking
2. Asthma/Airway Hyperreactivity	2. Occupational Exposure
	3. Biomass Fuel Exposure
.	4. Environmental Air Pollution
	5. Low Socioeconomic Status

Genetic Factors

Genetic predispositions, such as alpha-1 antitrypsin deficiency, can increase susceptibility to COPD, although environmental factors are generally more influential in COPD development(14,15) A study by de Ignacio Blanco et al (16) identified a correlation between **genetic mutations** (such as alpha-1 antitrypsin deficiency) and the development of COPD. This genetic predisposition makes individuals more susceptible to lung damage even in the absence of environmental factors like smoking.

A history of asthma or increased airway reactivity can contribute to a higher risk of developing COPD. Apart from smoking, it stands as the second most significant risk factor, accounting for approximately 15–17% of new COPD cases in young adults(17)

Malnutrition can exacerbate the genetic factors by impairing the immune system and making the individual more vulnerable to infections, which can accelerate COPD progression.

Smoking

Smoking is the leading environmental risk factor for COPD and is responsible for the majority of COPD cases. Smoking damages the respiratory system by triggering chronic inflammation and narrowing the airways. The link between smoking and malnutrition is complex, as smoking often reduces appetite, alters taste, and leads to a higher metabolic rate, contributing to weight loss and muscle wasting—both common problems in COPD patients.(18)

Air Pollution

Long-term exposure to ambient air pollution has been shown to contribute to the development of COPD in nonsmokers. A study conducted by Marchetti P et al. (2023) found that long term exposure to NO_2 is a significant environmental risk factor for COPD. People who live in urban areas with high levels of pollution are more likely to develop COPD, even if they have never smoked.[19]

Occupational Exposures

Occupational exposures to dust, fumes, and chemicals also play a role in the development of COPD. Industries such as mining, construction, and agriculture expose workers to airborne pollutants that damage lung tissue over time.[20,21].These environmental exposures not only trigger COPD but may also contribute to malnutrition, as the physical strain of working in such conditions can reduce appetite and energy intake.

Chronic Obstructive Pulmonary Disease (COPD) is traditionally associated with smoking, but a significant proportion of COPD cases arise in nonsmokers. Studies show that nonsmoker COPD is influenced by various environmental, genetic, and physiological factors, and this subset of COPD poses unique challenges for both diagnosis and management. Research has highlighted that nonsmoker COPD is not solely caused by tobacco exposure, and it can be just as debilitating as COPD in smokers.In addition to occupational exposure, biomass fuel exposure in developing countries has been linked to COPD, with studies showing that individuals exposed to indoor air pollution are at a higher risk of developing COPD even in the absence of smoking[20,22] . One such study by Hnizdo et al. revealed that occupational exposure is a major contributor to nonsmoker COPD, especially in workers in construction and mining industries[23]

Childhood Respiratory Infections:

A study found that childhood respiratory infections were associated with an increased risk of developing COPD later in life. In particular, severe or recurrent respiratory infections during early childhood can damage the developing lungs and lead to chronic respiratory issues in adulthood[24]

A study by Roberts M et al.[25] found that 43% of individuals in the COPD group had never smoked. This underscores the role of factors beyond smoking, such as severe childhood asthma, in the development of COPD. This is especially relevant for nonsmokers, as these individuals may not have other risk factors like smoking but still face a higher susceptibility to COPD due to these early-life infections.

Systemic Effects of COPD

Chronic Obstructive Pulmonary Disease (COPD) is primarily a respiratory condition, but it is increasingly recognized as a systemic disease with significant extra-pulmonary manifestations. These systemic effects arise due to chronic inflammation, oxidative stress, and metabolic dysregulation, contributing to poor prognosis, reduced quality of life, and increased mortality in COPD patients [26]

Unintentional Weight Loss and Malnutrition

Malnutrition is a frequent complication in COPD, with significant weight loss and muscle wasting observed even in patients with a normal Body Mass Index (BMI). Studies indicate that malnutrition is prevalent in 14% to 17% of COPD patients, with an additional 55% at risk [8,9] The Mini Nutritional Assessment (MNA) score, a key indicator of nutritional status, has been shown to decline with increasing COPD severity, underscoring the need for routine nutritional assessment and intervention.

Skeletal Muscle Dysfunction

COPD is associated with skeletal muscle dysfunction, particularly loss of fat-free mass (FFM) and reduced muscle strength. Low Fat-Free Mass Index (FFMI) has been linked to frequent exacerbations, reduced exercise capacity, and increased mortality[27–29]. Furthermore, muscle mass positively correlates with spirometric values, emphasizing the impact of nutritional and physical rehabilitation interventions in improving muscle function[9]

Cardiovascular Disease

Patients with COPD have a higher risk of cardiovascular disease (CVD) due to systemic inflammation, oxidative stress, and endothelial dysfunction [26] Studies highlight the increased prevalence of hypertension, coronary artery disease, and heart failure in COPD patients. The link between malnutrition, muscle wasting, and cardiovascular dysfunction further complicates disease management, necessitating a multidisciplinary approach for optimal care.

Osteoporosis and Bone Health

COPD is frequently associated with osteoporosis, partly due to chronic systemic inflammation, prolonged corticosteroid use, and reduced physical activity. Osteoporosis in COPD patients increases the risk of fractures, which further contributes to disability and mortality[29]. Monitoring bone mineral density (BMD) and implementing nutritional supplementation, exercise, and medication can help mitigate this risk.

Psychological and Cognitive Effects

Depression and anxiety are common among COPD patients, with prevalence rates ranging from 25% to 40% [29]. The impact of chronic dyspnea, social isolation, and disease progression can lead to poor treatment adherence and reduced physical activity, further exacerbating COPD symptoms. Psychological interventions, pulmonary rehabilitation, and social support play a crucial role in addressing these concerns.

Conclusion: The systemic effects of COPD significantly impact patient outcomes, beyond its respiratory manifestations. Nutritional status, muscle function, cardiovascular health, bone density, and mental well-being should be regularly assessed in COPD management. Integrating multidisciplinary care, including nutritional interventions, physical therapy, and psychological support, can improve overall prognosis and enhance quality of life for COPD patients.

The 2023 Global Strategy for Diagnosis, Management, and Prevention of COPD (GOLD) provides comprehensive guidelines on COPD care. It emphasizes the importance of nutritional status, offering a global framework for diagnosis, management, prevention, and nutritional assessment with recommended interventions.

DIAGNOSIS OF COPD

Pulmonary Function Testing and Diagnosis

Spirometry is the gold standard for diagnosing and monitoring COPD, assessing airflow limitation through FEV1 (forced expiratory volume in 1 second), FVC (forced vital capacity), and the FEV1/FVC ratio. COPD is defined by a post-bronchodilator FEV1/FVC ratio <0.70, confirming persistent airflow limitation. However, this fixed threshold may over-diagnose older adults and under-diagnose younger individuals; therefore, the use of the Lower Limit of Normal (LLN), adjusted for age, gender, height, and ethnicity, is often recommended for greater diagnostic precision [(1)]

FEV1% predicted post-bronchodilator is used for grading severity based on GOLD criteria(1):

GOLD 1 (Mild): FEV1 ≥ 80%

GOLD 2 (Moderate): 50% ≤ FEV1 < 80%

GOLD 3 (Severe): 30% ≤ FEV1 < 50%

GOLD 4 (Very Severe): FEV1 < 30%

Spirometry is a simple, non-invasive, and cost-effective tool that should be performed routinely in individuals with chronic respiratory symptoms or a history of exposure to risk factors such as smoking, biomass fuels, or occupational pollutants. It also aids in differentiating COPD from asthma and other restrictive lung diseases [(1)].

Additional Diagnostic Tools

Lung Volumes: Total Lung Capacity (TLC) and Residual Volume (RV) are often elevated in COPD due to air trapping and hyperinflation, especially in emphysematous patients [(1)].

DLCO: The diffusing capacity for carbon monoxide helps assess gas exchange function; reduced values suggest emphysema or other conditions affecting the alveolar-capillary membrane such as CPFE (Combined Pulmonary Fibrosis and Emphysema)[(1)]

6-Minute Walk Test (6MWT): A simple exercise test to assess functional capacity, need for supplemental oxygen, and prognosis. It's a key component of the BODE index.[(1)]

Imaging:

Chest X-ray: Can show hyperinflation, flattened diaphragms, and increased radiolucency [(1)].

CT Scan: The gold standard for detecting emphysema, bronchial wall thickening, and small airway disease. High-resolution CT (HRCT) is used preoperatively in lung volume reduction surgery and for differentiating COPD from other conditions like bronchiectasis or interstitial lung disease [(30)].

Symptom Assessment Tools

CAT: An 8-item questionnaire evaluating symptom burden [(31)].

mMRC: Grades breathlessness from 0 (none) to 4 (too breathless to leave home) [(32)].

SGRQ: Measures symptoms, activity, and impact on quality of life [33].

BODE Index: Combines BMI, airflow obstruction, dyspnea (mMRC), and 6MWT to predict mortality [34,35]

Comorbidities and Risk Stratification COPD often coexists with hypertension, cardiovascular disease, osteoporosis, depression, and cancer. GOLD 2023 emphasizes exacerbation history over symptom score, combining Groups C and D into Group E [36].

COPD Management Strategy: Review, Assess, Adjust

Review: Symptoms, exacerbation frequency.

Assess: Inhaler technique, adherence, non-pharmacological interventions.

Adjust: Escalate, switch, or de-escalate therapy based on response.

Pharmacotherapy for Stable COPD

Bronchodilators:[1]

SABAs (e.g., albuterol): Short-term relief

LABAs (e.g., salmeterol): Long-term bronchodilation

Anticholinergics:

SAMAs (e.g., ipratropium): Short-acting M3 blockade

LAMAs (e.g., tiotropium): Long-acting, reduce exacerbations

Inhaled Corticosteroids (ICS): Anti-inflammatory, used with LABAs

Combination Therapy:

LABA+ICS or Triple Therapy (LABA+LAMA+ICS) for severe cases [37].

Oral Steroids: Short-term use in exacerbations [1].

PDE4 Inhibitors (e.g., roflumilast): For chronic bronchitis, reduces exacerbations [1].

Methylxanthines & Mucolytics: Limited use; help reduce breathlessness and mucus viscosity [1].

Antibiotics (e.g., azithromycin): For frequent exacerbators [38].

Non-Pharmacological Measures

- Smoking Cessation: Reduces symptoms and exacerbations [39–41]
- Air Pollution Control: Reducing biomass exposure is crucial [42]
- Vaccination: Influenza, COVID-19, pneumococcal, RSV, Tdap, and zoster vaccines recommended [36]
- Pulmonary Rehabilitation and Surgery
- Rehabilitation: Improves symptoms, exercise tolerance, and quality of life [43]
- Lung Volume Reduction Surgery (LVRS): Beneficial in selected emphysema patients.[1]

Follow-Up and Monitoring Regular reviews with spirometry, symptom assessment, and patient-centered treatment modifications are critical for long-term disease control and improving quality of life[1]

Prevalence and Risk Factors of Malnutrition in COPD:

Malnutrition is a significant yet often overlooked comorbidity in patients with Chronic Obstructive Pulmonary Disease (COPD). Studies have shown that the prevalence of malnutrition in COPD patients ranges from 14% to 55%, depending on the population and the assessment tools used[8–10]. Malnutrition in COPD is associated with increased disease severity, frequent exacerbations, and poor clinical outcomes. Risk factors for malnutrition in COPD patients include advanced age, low body mass index (BMI), reduced dietary intake, and systemic inflammation.[9] The Mini Nutritional Assessment (MNA) tool has been validated as an effective method for identifying malnutrition in COPD patients, particularly in the early stages, enabling timely interventions to improve outcomes.[5]

Occupational Exposure and Biomass Fuel:

Occupational exposure to dust, chemicals, and fumes is a well-documented risk factor for COPD, particularly in low- and middle-income countries[20,21]..As per reports, the population attributable risk for developing COPD at the work place is between 12 and 55%.[46] Several occupational exposures have been identified as significant risk factors for COPD. These include dust from coal, hard rock, concrete, construction work, tunneling, brick manufacturing, and iron and steel foundries. Additionally, occupations such as crop and animal farming, gold mining, and industries involving chemicals (textiles, plastics, rubber, and leather manufacturing) pose a risk. Exposure to diesel exhaust and road dust (e.g., sweeping) can also contribute to airway obstruction and worsening respiratory symptoms over time[44].Additionally, the use of biomass fuel for cooking and heating is a significant contributor to COPD, especially among women in rural areas. Biomass fuel exposure leads to chronic inhalation of harmful pollutants, which can cause airway inflammation and progressive lung damage.[20,45,46] Studies have shown that patients with COPD due to biomass fuel exposure are at a higher risk of malnutrition compared to those with smoking-related COPD. This is likely due to the combined effects of chronic inflammation, reduced lung function, and socioeconomic factors that limit access to adequate nutrition[4] The MNA tool has been used to assess nutritional status in these populations, highlighting the need for targeted nutritional interventions to improve outcomes.

Socioeconomic Factors:

Socioeconomic factors play a critical role in the prevalence of malnutrition among COPD patients. Low socioeconomic status is associated with limited access to healthcare, poor dietary intake, and increased exposure to environmental pollutants such as biomass fuel.[47–49]

In low- and middle-income countries, where COPD prevalence is high, malnutrition is often exacerbated by poverty, food insecurity, and lack of awareness about the importance of nutrition in disease management.[7,47–49].Studies have shown that COPD patients from lower socioeconomic backgrounds are more likely to be malnourished and have worse clinical outcomes compared to those from higher socioeconomic groups.[50]

The literature highlights the high prevalence of malnutrition in COPD patients, particularly among those with occupational exposure to biomass fuel and those from lower socioeconomic backgrounds.

IMPACT OF MALNUTRITION ON COPD OUTCOMES

The aetiology of COPD is primarily linked to environmental exposures such as smoking and air pollution, along with genetic factors and occupational hazards. However, malnutrition is a key aspect of COPD management that is often overlooked. Malnutrition in COPD patients has a profound impact on disease outcomes, contributing to muscle wasting, weakened immune response, and increased risk of infections and exacerbations. The combination of poor nutritional status and compromised lung function significantly reduces the body's ability to recover from exacerbations and manage symptoms effectively. Patients who are malnourished are more likely to experience prolonged hospital stays, higher rates of readmission, and greater functional limitations. As COPD progresses, nutritional deficiencies worsen the clinical outcomes by accelerating muscle wasting, reducing immune function, and increasing the risk of comorbidities. [4,22,51]

A study by Di Raimondo D et al.[52] highlighted the role of malnutrition in worsening COPD prognosis. Their research found that malnourished COPD patients had a higher incidence of exacerbations and increased mortality rates compared to well-nourished patients. This study emphasized the need for integrated care approaches that not only address the respiratory aspects of COPD but also focus on improving the nutritional status of these patients.

The Mini Nutritional Assessment (MNA) tool plays a vital role in early detection of malnutrition in COPD patients, allowing healthcare providers to intervene early and improve patient care through targeted nutritional interventions.[5,9]

Malnutrition and its Role in COPD

Malnutrition in COPD patients, whether smoker or nonsmoker leads to muscle wasting, weakened immune function, and a decline in overall respiratory health. A study by Zhi, J.et al[53] emphasized that nutritional status is a significant determinant of COPD prognosis of elderly COPD patients in ICU setting, with malnourished individuals experiencing worse clinical outcomes and a more rapid decline in lung function.

Increased Metabolic Demand: COPD increases the body's metabolic demand because of the energy expended on breathing and maintaining lung function. This increased demand can lead to muscle wasting and weight loss. A study by Schols et al.[54] found that weight loss and muscle wasting were associated with a worse prognosis in COPD patients. The study highlighted that nutritional support is critical to prevent these complications, especially in nonsmokers who may not have the same obvious signs of malnutrition as smokers.

Muscle Wasting and Respiratory Function: Muscle wasting in COPD patients, including the diaphragm and respiratory muscles, is a key factor that worsens the disease. According to a study by Sillanpää et al.[55] protein-energy malnutrition in COPD patients exacerbates muscle wasting, leading to decreased respiratory muscle strength

Impaired Immune Function: Malnutrition also leads to impaired immune function**,** which is a major concern for COPD patients[51,56,57] In a study by Zapatero A et al.[58], malnourished COPD patients were found to have a higher risk of exacerbations and further lung damage. This is especially relevant for nonsmokers, who may not have smoking-related immune suppression but can still face a compromised immune system due to inadequate nutrition.

Assessing malnutrition in COPD patients is critical for effective management and improved outcomes. Several tools and methods are commonly used:

Body Mass Index (BMI): BMI is a simple and widely used indicator of nutritional status. It serves as a general indicator of underweight, normal weight, overweight, and obesity. Several studies have shown low body mass index (BMI) is associated with worse outcomes in COPD.[59–62]. In COPD, a BMI < 21 kg/m² is often associated with malnutrition and increased mortality risk[63]. Malnutrition can however be present across all BMI ranges, and patients with COPD may experience significant alterations in body composition even when their BMI is within the normal range.[28,64]

Fat-Free Mass Index (FFMI): In the two-compartment model, body composition is typically categorized into fat mass and fat-free mass (FFM). In clinically stable COPD patients, FFM is often used as a proxy for muscle mass.[65].FFMI, calculated using bioelectrical impedance analysis (BIA), measures muscle mass and is particularly useful in COPD patients who may have normal BMI but reduced muscle mass (sarcopenia). An FFMI below gender-specific thresholds (e.g., < 15 kg/m² in women and < 17 kg/m² in men) indicates malnutrition and is associated with poor outcomes.[27,66]

Summary of Studies Evaluating Prognostic Value of FFMI as Indicator of Nutrition Status in COPD.

Study	Population	Number of Patients	COPD Stage	Summary of Outcomes
Luo et al[27]	Stable COPD, outpatient clinic, age ≥ 18 years, China	235	All stages	Low FFMI correlated with frequent exacerbations, older age, decreased pulmonary function, 6MWD, peak inspiratory pressure, and worsened dyspnea.
Vestbo et al[28]	Population-based cohort, age ≥ 18 years, Denmark	1898	All stages	Low FFMI was associated with increased overall mortality and COPD mortality.
Ischaki et al[67]	Stable COPD, outpatient clinic, United States	100	All stages	FFMI correlated with 6MWD, dyspnea, FEV_1% predicted, and FEV_1/FVC.
Schols et al[29]	Stable COPD, pulmonary rehabilitation, the Netherlands	412	Moderate-severe	FFMI was an independent predictor of survival.

The Role of the Mini Nutritional Assessment (MNA) Tool in COPD

Mini Nutritional Assessment (MNA): The MNA is a validated tool specifically designed for older adults and those with chronic conditions. It evaluates dietary intake, weight loss, mobility, and psychological stress, providing a comprehensive assessment of nutritional risk. A score of ≤ 23.5 indicates malnutrition or risk of malnutrition [5,6]

Bruno Vellas et al.[68] developed and validated the Mini Nutritional Assessment (MNA)as arapid and reliable tool for assessing nutritional status in elderly patients across outpatient clinics, hospitals, and nursing homes. The MNA, consisting of simple measurements and brief questions, can be completed within10 minutes and effectively identifies patients with adequate nutrition (MNA ≥ 24), malnutrition (MNA < 17), or at risk of malnutrition (MNA 17–23.5). The MNA demonstrated high sensitivity (96%), specificity (98%), and predictive value (97%), making it avaluable predictor of mortality and hospital costs. Early detection of malnutrition risk allows timely nutritional intervention before severe weight loss or biochemical changes occur. Rubenstein et al.[69] focused on developing a short-form Mini-Nutritional Assessment (MNA-SF) to screen for undernutrition in geriatric patients. The original MNA was effective but too lengthy for quick assessments. Analyzed data from 881 elderly individuals across France, Spain, and New Mexico to identify key items strongly linked to nutritional status. They selected six questions, creating a simplified tool with a scoring range of 0–14. A score of 11 or higher indicates normal nutrition, while lower scores suggest potential undernutrition. The MNA-SF showed high accuracy, with 97.9% sensitivity and 100% specificity. This tool allows healthcare professionals to quickly and effectively identify malnourished older adults, enabling timely interventions.

A comprehensive review of the literature indicates a high prevalence of undernutrition among hospitalized and institutionalized older adults, with malnutrition rates averaging 23% in hospitals and 21% in care institutions. The MNA has proven effective in early detection of malnutrition risk, allowing for timely nutritional interventions that can improve health outcomes in this population[70]

Study	**Population**	**Number of Patients**	**COPD Stage**	**Summary of Outcomes**
Hsu et al[5]	Stable COPD, pulmonary rehabilitation, Taiwan	83	All stages	A Taiwan-specific MNA score declined as disease severity increased. It showed a strong correlation with FFMI, calf circumference, resting and exercise SpO_2, and 6-minute walk distance. The MNA score was also linked to GOLD classification.
Yoshikawa et al[71]	Stable COPD, Japan	60	All stages	A significant association was found between the MNA-SF score and the occurrence of COPD exacerbations.
Tabar et al[72]	Stable COPD, elderly (age > 65 years), Philippines	131	Undetermined	Patients with normal nutritional status experienced fewer exacerbations, whereas those with lower MNA scores were more likely to have at least one exacerbation per year.
Furutate et al[73]	Stable COPD, age ≥ 65 years, Japan	68	Undetermined	MNA scores were closely related to FEV_1% predicted, BMI, and COPD Assessment Test (CAT)

Study	**Population**	**Number of Patients**	**COPD Stage**	**Summary of Outcomes**
				scores, indicating their potential role in assessing disease severity.
Scichilone et al[74]	Stable COPD, outpatients and inpatients at discharge, age ≥ 60 years, Italy	32	FEV_1% predicted 47 ± 12.6	Patients with lower FEV_1% had a higher likelihood of malnutrition. Those at risk of malnutrition reported increased dyspnea, whereas well-nourished individuals responded more favorably to treatment.
Benedik et al[8]	Stable COPD, hospitalized patients, Slovenia	108 COPD patients, 22 healthy controls	Severe and very severe COPD	COPD patients had significantly lower MNA scores than controls. Malnutrition was observed in 14% of patients, with 55% at risk. MNA scores declined as disease severity worsened ($p = 0.02$), while BMI was linked to nutritional status. However, body composition was not a significant predictor.
Mete et al[9]	Stable COPD, Turkey	105	All stages	Malnutrition was found in 17% of COPD patients, with a higher prevalence in those with severe dyspnea ($p = 0.002$). Muscle mass showed a positive correlation with spirometric values, while higher protein intake was associated with better muscle mass ($p < 0.001$). The study emphasized the need for

Study	Population	Number of Patients	COPD Stage	Summary of Outcomes
				routine nutritional assessments and personalized dietary interventions.

A **Mini Nutritional Assessment (MNA)** score in the range of 17-23.5 indicates that a patient is **at risk of malnutrition.** This score suggests that the individual may not be meeting their nutritional needs adequately, which can lead to further health complications if not addressed. The MNA tool evaluates various factors, including dietary intake, weight loss, mobility, psychological stress, and body mass index (BMI), to assess nutritional status. For patients scoring in this range, early intervention is crucial to prevent progression to malnutrition. Nutritional interventions, such as high-calorie, high-protein diets, micronutrient supplementation, and regular monitoring, can help improve their nutritional status and overall health outcomes. This is particularly important for vulnerable populations, such as the elderly or those with chronic diseases like COPD, where malnutrition can exacerbate disease severity and reduce quality of life [5–7]

Role of Nutritional Assessment in COPD:

Nutritional status plays a critical role in the progression and management of COPD. These tools, when used in combination, provide a comprehensive evaluation of nutritional status, enabling targeted interventions to improve clinical outcomes in COPD patients[2,4]

Malnutrition in COPD patients is associated with lower body fat mass, lean body mass, and increased hospitalizations.(5) The MNA tool has been validated as a rapid and effective method for assessing nutritional status in COPD patients. It is composed of simple measurements and brief questions that can be completed in about 10 minutes, making it a practical tool for clinical use. Studies have shown that the MNA score is positively correlated with lung function parameters such as FEV1 and FVC, and negatively correlated with disease severity as per GOLD stages.(45) This highlights the importance of incorporating nutritional assessment, particularly using the MNA tool, into the routine management of COPD patients. A study demonstrated that the MNA tool effectively predicts hospitalization rates and mortality in COPD patients, emphasizing its role in early detection of malnutrition.(75)

Nutritional support, including dietary changes and supplements, has been shown to improve muscle mass, immune function, and lung capacity in COPD patients.(76) A study by Zhang JH(77) showed that nutritional interventions in malnourished COPD patients improved exercise capacity and pulmonary function.

Treatment strategies for malnourished COPD patients

1. Nutritional Assessment and Early Detection: The first step in treating malnutrition in COPD patients is the early detection of nutritional deficits. The MNA tool is a widely used screening method to identify nutritional risks and assess the severity of malnutrition. This simple, quick, and validated tool can classify patients into categories based on their nutritional status, such as well-nourished, at risk of malnutrition, or malnourished. Early identification through the MNA is crucial because malnutrition can impair immune function, reduce muscle mass, and worsen respiratory function, thus complicating COPD management. For instance, low body mass index (BMI), reduced fat-free mass, and decreased muscle mass often indicate severe malnutrition, leading to poor prognosis and higher hospitalizations in COPD patients.

2. Nutritional Interventions: Nutritional interventions are the cornerstone of managing malnutrition in COPD patients. The primary focus is to provide a balanced, high-calorie diet to support energy requirements, reduce the risk of further weight loss, and improve the patient's overall health status.[78–80].

- **Protein and Energy-Dense Diet:** COPD patients with malnutrition typically have increased energy expenditure due to the higher work of breathing and inflammation associated with the disease. Therefore, increasing dietary intake of proteins and energy-dense foods is essential. Protein is crucial for maintaining muscle mass and lung function, as muscle wasting is common in malnourished COPD patients. A diet high in calories, particularly from complex carbohydrates and healthy fats, can help provide the energy needed to meet the metabolic demands of the disease.
- **Supplemental Feeding:** In cases where oral intake alone is insufficient, enteral feeding, such as the use of high-calorie oral supplements, may be necessary to ensure the patient meets their nutritional requirements. The use of oral nutritional supplements has been shown to improve weight, strength, and overall quality of life in malnourished COPD patients.

MATERIALS AND METHODS

Source of Data:

The study includes patients diagnosed with Chronic Obstructive Pulmonary Disease (COPD) who visited the Respiratory Medicine department and casualty of KLE Dr. Prabhakar Kore Hospital, Belagavi.

Study Design:

This was a prospective observational study aimed at assessing the role of the Mini Nutritional Assessment (MNA) tool in detecting malnutrition among COPD patients.

Study Period:

The study was conducted over a period of one year, from 1st April 2023 to 31st March 2024.

Sample Size:

The sample size was calculated using the formula:

$n=(Za+Zpc)^2+3n=(cZa+Zp)^2+3$

where:

$c=0.5\ln \quad (1+r1-r)c=0.5\ln(1-r1+r)$

$r=0.3r=0.3$ (assumed correlation based on previous studies)

$Za=1.96Za=1.96$ (for $\alpha = 5\%$)

$Zp=0.84Zp=0.84$ (for $\beta = 20\%$)

Substituting the values:

n=(1.96+0.840.3095)^2+3=84.83≈85n=(0.30951.96+0.84)2+3=84.83≈85

Considering a 10% non-response rate, the final sample size is 100 patients.

Sampling Technique:

Simple Random Sampling was used to select patients who met the inclusion criteria.

Inclusion Criteria:

- Patients who provided informed consent to participate in the study.
- Patients diagnosed with COPD according to the 2023 GOLD guidelines**.**
- Patients with preserved mental function who can communicate verbally.
- Patients who developed COPD symptoms after the age of 40.

Exclusion Criteria:

- Patients unwilling to participate in the study.
- Patients with chronic diseases other than COPD and controlled arterial hypertension.
- Patients with psychiatric illnesses who are unable to provide consent.
- Patients diagnosed with bronchiectasis, asthma, or any other significant respiratory disease.

Data Collection Procedure:

Sampling Method

Systematic random sampling was used to select participants for the study.

Study Tools

- **Case Reporting Form**: Used to document demographic details, clinical profiles, and other relevant data.
- **Consent Form**: All participants (or their legal guardians) provided informed consent before enrollment.

Methodology:

- Participants meeting the inclusion and exclusion criteria were included in the study.

- Demographic and clinical data were recorded at the time of enrollment.
- Anthropometric measurements of the patients were taken and patients were assessed using the MNA malnutrition analysis tool.
- Subjective measures of the severity of disease was measured using mMRC grading of breathlessness and CAT score
- Spirometry was done to determine the clinical staging of COPD using GOLD criteria.
- Mini Nutritional Assessment (MNA): Patients were assessed using the MNA tool to determine their nutritional status.

  The full MNA consists of 18 items, divided into four main components:

- Anthropometric measurements: Weight, height, BMI, mid-arm and calf circumference.
- General assessment: Lifestyle, medication use, mobility, presence of psychological stress or acute disease.

- Dietary assessment: Number of meals per day, food and fluid intake, and autonomy of feeding.
- Subjective assessment: Self-perception of health and nutrition.

Scoring and Interpretation

Screening score(A to F) (subtotal max. 14 points)

12-14 points: Normal nutritional status

8-11 points: At risk of malnutrition

0-7 points: Malnourished

Assessment Score(G to R):Max 16 points

Total Score:Screening + Assessment Score: Maximum 30 points

≥24 points: Normal nutritional status

17 to 23.5 points: At risk of malnutrition

<17 points: Malnourished

Mini Nutritional Assessment MNA®

Nestlé Nutrition Institute

Last name:			First name:	
Sex:	Age:	Weight, kg:	Height, cm:	Date:

Complete the screen by filling in the boxes with the appropriate numbers.
Add the numbers for the screen. If score is 11 or less, continue with the assessment to gain a Malnutrition Indicator Score.

Screening

A Has food intake declined over the past 3 months due to loss of appetite, digestive problems, chewing or swallowing difficulties?
0 = severe decrease in food intake
1 = moderate decrease in food intake
2 = no decrease in food intake ☐

B Weight loss during the last 3 months
0 = weight loss greater than 3kg (6.6lbs)
1 = does not know
2 = weight loss between 1 and 3kg (2.2 and 6.6 lbs)
3 = no weight loss ☐

C Mobility
0 = bed or chair bound
1 = able to get out of bed / chair but does not go out
2 = goes out ☐

D Has suffered psychological stress or acute disease in the past 3 months?
0 = yes 2 = no ☐

E Neuropsychological problems
0 = severe dementia or depression
1 = mild dementia
2 = no psychological problems ☐

F Body Mass Index (BMI) (weight in kg) / (height in m^2)
0 = BMI less than 19
1 = BMI 19 to less than 21
2 = BMI 21 to less than 23
3 = BMI 23 or greater ☐

Screening score (subtotal max. 14 points) ☐☐

12-14 points:	Normal nutritional status
8-11 points:	At risk of malnutrition
0-7 points:	Malnourished

For a more in-depth assessment, continue with questions G-R

Assessment

G Lives independently (not in nursing home or hospital)
1 = yes 0 = no ☐

H Takes more than 3 prescription drugs per day
0 = yes 1 = no ☐

I Pressure sores or skin ulcers
0 = yes 1 = no ☐

J How many full meals does the patient eat daily?
0 = 1 meal
1 = 2 meals
2 = 3 meals ☐

K Selected consumption markers for protein intake
- At least one serving of dairy products (milk, cheese, yoghurt) per day — yes ☐ no ☐
- Two or more servings of legumes or eggs per week — yes ☐ no ☐
- Meat, fish or poultry every day — yes ☐ no ☐

0.0 = if 0 or 1 yes
0.5 = if 2 yes
1.0 = if 3 yes ☐.☐

L Consumes two or more servings of fruit or vegetables per day?
0 = no 1 = yes ☐

M How much fluid (water, juice, coffee, tea, milk...) is consumed per day?
0.0 = less than 3 cups
0.5 = 3 to 5 cups
1.0 = more than 5 cups ☐.☐

N Mode of feeding
0 = unable to eat without assistance
1 = self-fed with some difficulty
2 = self-fed without any problem ☐

O Self view of nutritional status
0 = views self as being malnourished
1 = is uncertain of nutritional state
2 = views self as having no nutritional problem ☐

P In comparison with other people of the same age, how does the patient consider his / her health status?
0.0 = not as good
0.5 = does not know
1.0 = as good
2.0 = better ☐.☐

Q Mid-arm circumference (MAC) in cm
0.0 = MAC less than 21
0.5 = MAC 21 to 22
1.0 = MAC 22 or greater ☐.☐

R Calf circumference (CC) in cm
0 = CC less than 31
1 = CC 31 or greater ☐

Assessment (max. 16 points) ☐☐.☐
Screening score ☐☐.☐
Total Assessment (max. 30 points) ☐☐.☐

Malnutrition Indicator Score

24 to 30 points	☐	Normal nutritional status
17 to 23.5 points	☐	At risk of malnutrition
Less than 17 points	☐	Malnourished

References
1. Vellas B, Villars H, Abellan G, *et al.* Overview of the MNA® - Its History and Challenges. *J Nutr Health Aging.* 2006; **10:456-465.**
2. Rubenstein LZ, Harker JO, Salva A, Guigoz Y, Vellas B. Screening for Undernutrition in Geriatric Practice: Developing the Short-Form Mini Nutritional Assessment (MNA-SF). *J. Geront.* 2001; **56A**: M366-377
3. Guigoz Y. The Mini-Nutritional Assessment (MNA®) Review of the Literature - What does it tell us? *J Nutr Health Aging.* 2006; **10**:466-487.

- For more information: www.mna-elderly.com

Anticipated Adverse Events:

No serious adverse events (SAE) or adverse events were observed during the course of the study.

Investigations or Interventions:

No additional investigations or interventions were required for this study.

Cost of Investigations:

Not applicable, as no additional investigations were required.

Statistical Analysis:

Data Processing and Analysis:

Data was entered into Microsoft Excel and analyzed using SPSS version 22.

Categorical data was represented as frequencies and proportions, and the Chi-square test will be used to determine significance.

Continuous data was represented as mean and standard deviation, and the Independent t-test will be used to identify mean differences.

Pearson's Correlation was used to assess the relationship between two quantitative variables.

A p-value < 0.05 was considered statistically significant.

Data was analyzed using appropriate statistical methods, including chi-square tests and correlation coefficients, to identify significant associations between findings and clinical symptoms.

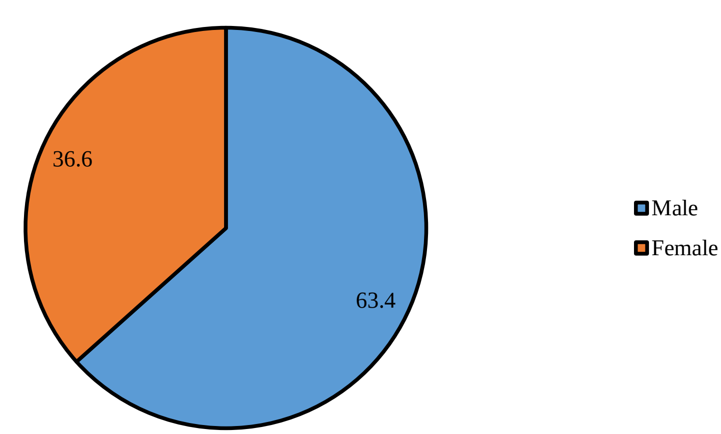
RESULTS

Data Analysis Table: Demographic Data

Table 1: Distribution of patients by Gender

		n	%
Sex	Male	64	63.4
	Female	37	36.6

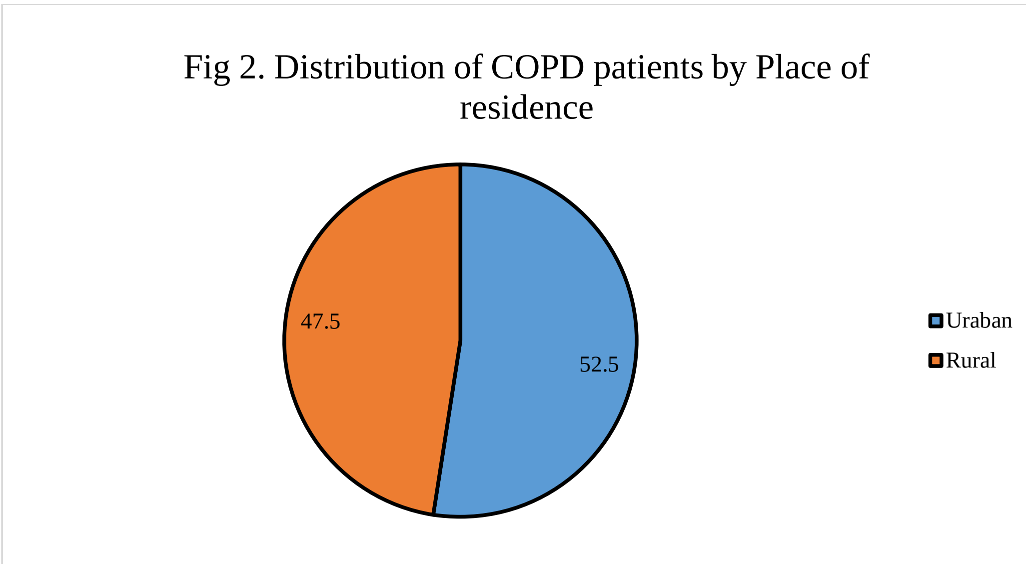
Fig 1. Gender wise distribution of participants



The data presented in Table 1 and Fig.1 shows the gender distribution of patients. Out of the total 101 patients, 64 (63.4%) are male, while 37 (36.6%) are female. This indicates a higher proportion of male patients compared to females. The graph visually represents this distribution, with the male category significantly outweighing the female category. This trend suggests that, in this sample, there may be a gender disparity in the population being studied.

Table 2: Distribution of patients by place of residence

		n	%
Residence	Urban	53	52.5
	Rural	48	47.5

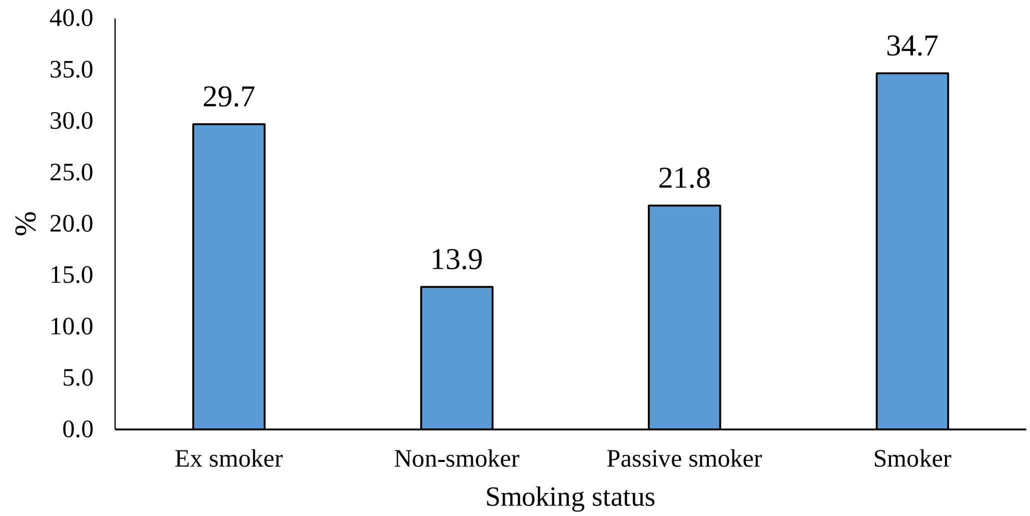


The data in Table 2 and the pie chart represent the distribution of COPD patients based on their place of residence. Out of the total 101 patients, 53 (52.5%) are from urban areas, while 48 (47.5%) are from rural areas. The chart visually shows a nearly equal split between the two groups, with urban residents slightly outnumbering rural residents. This suggests that COPD is prevalent in both urban and rural populations, highlighting the need for targeted healthcare strategies in both environments.

Table 3: Distribution of patients by smoking status

		n	%
Smoking Status	Ex smoker	30	29.7
	Non-smoker	14	13.9
	Passive smoker	22	21.8
	Smoker	35	34.7

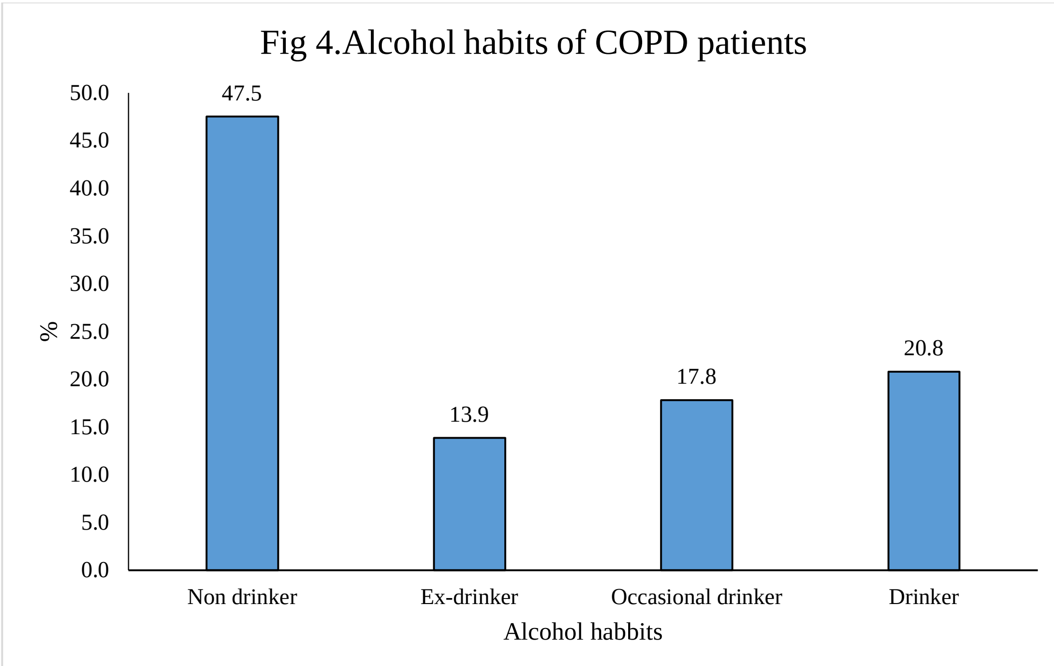
Fig 3.Smoking status of COPD patients



The data in Table 3 and the Fig 3 illustrate the smoking status of COPD patients. Among the 101 patients, the majority are smokers, with 35 (34.7%) currently smoking, followed by 30 (29.7%) who are ex-smokers. Passive smokers account for 22 (21.8%) patients, while 14 (13.9%) are non-smokers. The graph clearly shows that smoking, whether active or passive, is highly prevalent among COPD patients, with the highest percentage being active smokers.

Table 4: Distribution of patients by alcohol habits

		n	%
Alcohol Habits	Non-drinker	48	47.5
	Ex-drinker	14	13.9
	Occasional drinker	18	17.8
	Drinker	21	20.8

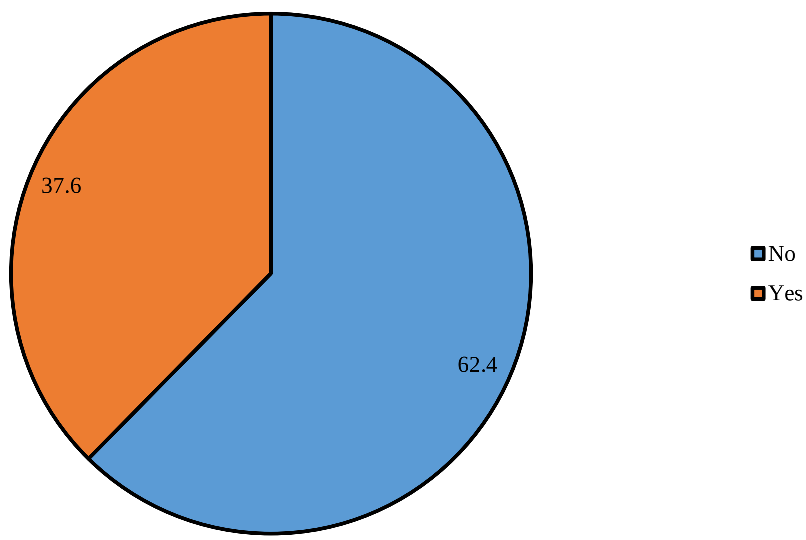


The data in Table 4 and Fig 4 represent the alcohol habits of COPD patients. Out of the total 101 patients, 48 (47.5%) are non-drinkers, followed by 21 (20.8%) who are regular drinkers. There are 18 (17.8%) occasional drinkers and 14 (13.9%) ex-drinkers. The graph shows that non-drinkers make up the largest group, with a significant number of regular drinkers as well.

Table 5: Distribution of patients by Biogas exposure

		n	%
Biogas Exposure	No	63	62.4
	Yes	38	37.6

Fig 5.Distribution of patients by Biogas exposure

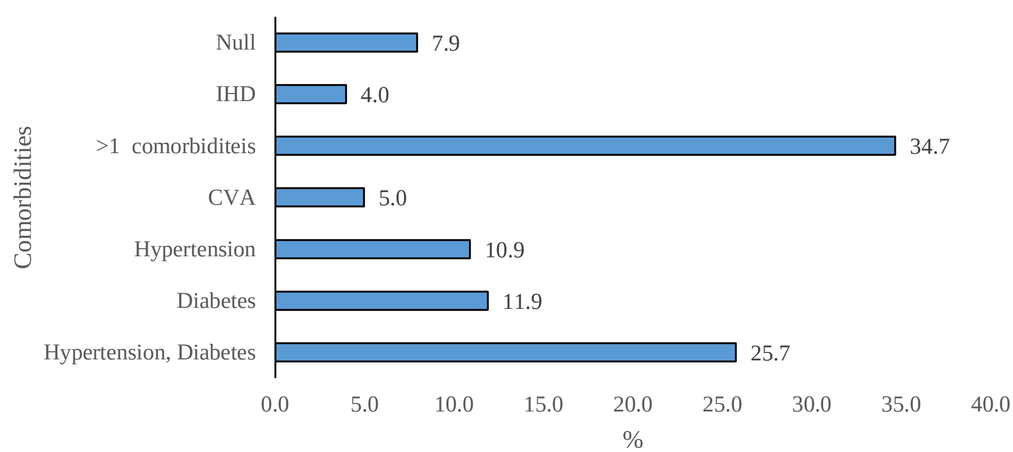


The data in Table 5 and the pie chart illustrate the distribution of COPD patients based on their exposure to biogas. Out of the 101 patients, 63 (62.4%) have not been exposed to biogas, while 38 (37.6%) have been exposed. The pie chart visually shows that the majority of patients in this sample have not been exposed to biogas, while a smaller proportion has had exposure.

Table 6: Distribution of patients by comorbidities

		n	%
Comorbidities	Hypertension, Diabetes	26	25.7
	Diabetes	12	11.9
	Hypertension	11	10.9
	CVA	5	5.0
	>1 comorbidities	35	34.7
	IHD	4	4.0
	Null	8	7.9

Fig 6.Distribution of COPD patients by type of comorbidities

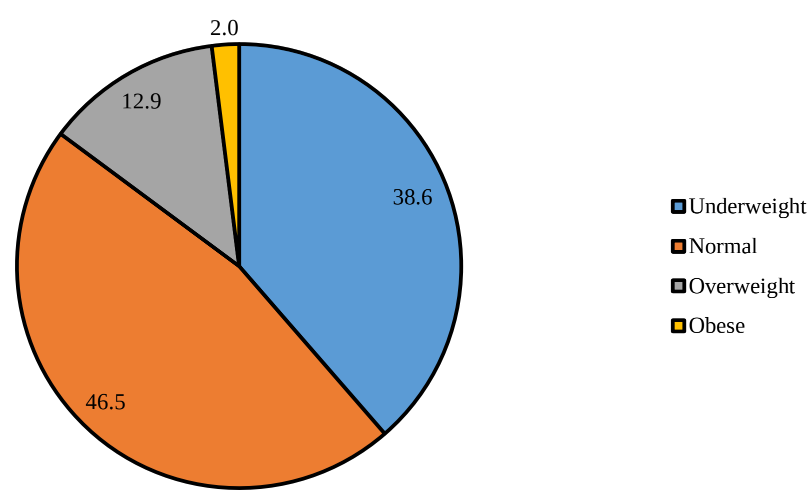


According to Table 6 and the bar graph showing the distribution of COPD-Patients with their comorbidities, the combination of hypertension and diabetes is the commonest comorbidity to affect 26 (25.7%) patients. Thus, 35 (34.7%) have more than one comorbidity which is the highest percentage in the dataset. Standing alone, diabetes affects 12 (11.9%) patients, while hypertension affects 11 (10.9%) patients. Some other comorbidities, such as a CVA and IHD, are less common, affecting 5 (5.0%) and 4 (4.0%) patients, respectively.

Table 7: BMI of Patients

		n	%
BMI	Underweight	39	38.6
	Normal	47	46.5
	Overweight	13	12.9
	Obese	2	2.0

Fig 7.Distribution of patients by Body Mass Index±BMI

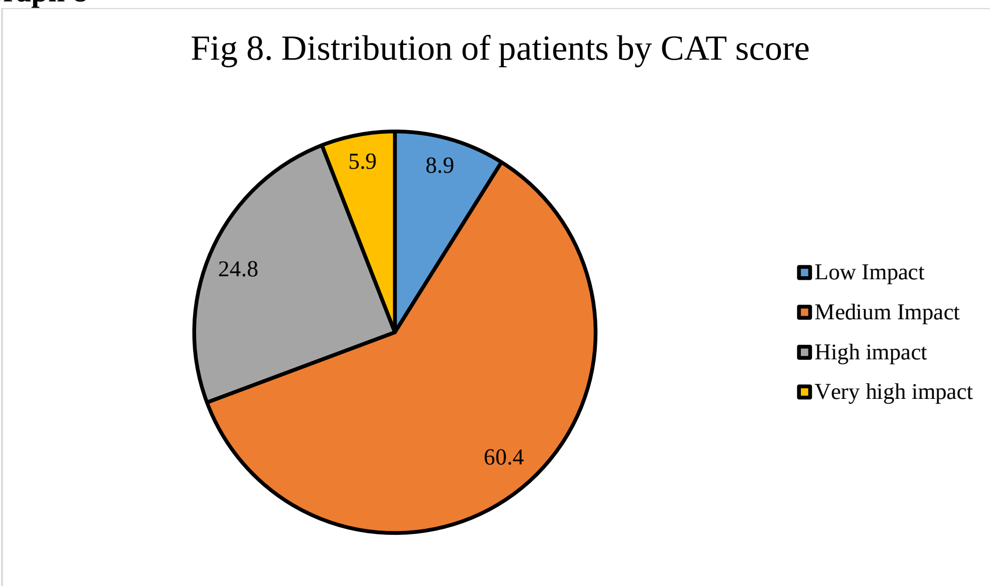


The data from Table 7 and the pie chart show the distribution of COPD patients based on BMI. Among the 101 patients, normal BMI made up the majority with 47 (46.5%), followed by underweight with 39 (38.6%), while a smaller proportion of 13 (12.9%) belonged to the overweight category, and only 2 were classified as obese (2%). The pie chart portrays this distribution visually, which implies that the majority of patients were either normal or underweight.

Table 8: CAT score of Patients

		n	%
CAT Score Impact	Low Impact	9	8.9
	Medium Impact	61	60.4
	High impact	25	24.8
	Very high impact	6	5.9

Graph 8

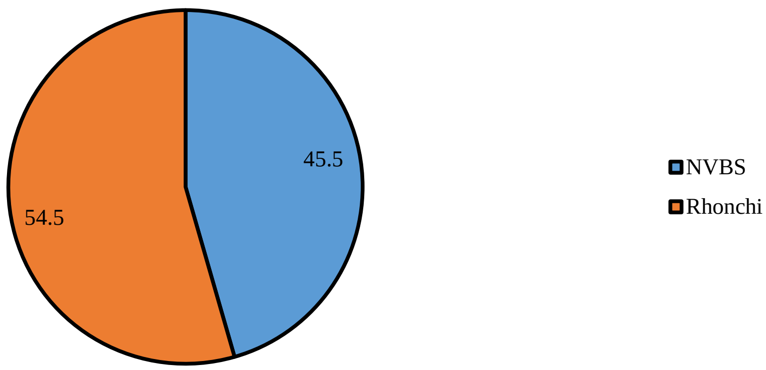


As per the data in Table 8 and the pie chart, on the distribution of the COPD patients, according to their CAT impact scores, among the 101 patients, most, 61 (60.4%), belonged to medium impact category. Others comprising a smaller group of 25 (24.8%) are in high impact conditions, followed by 9 (8.9%) patients with low impact categories, and only 6 (5.9%) in the very high impact classification. The chart portrays that most patients suffer from the medium level of impact as a consequence of COPD, and fewer patients have very high and low impact.

Table 09: Distribution of patients by Respiratory system

		n	%
Respiratory System	NVBS	46	45.5
	Rhonchi	55	54.5

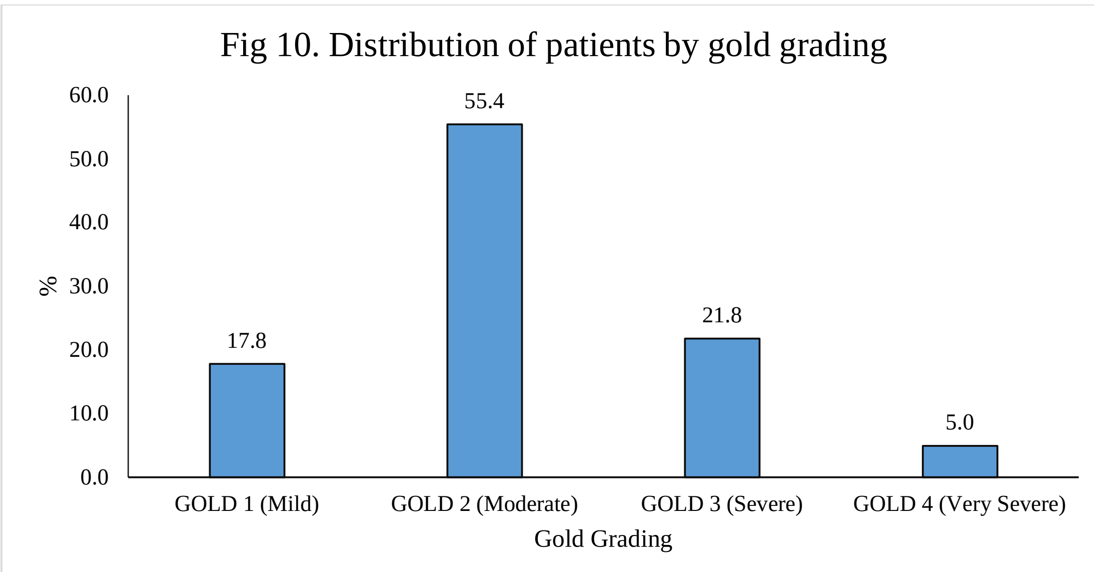
Fig 9.Distribution of patients by Respiratory examination findings



The data in Table 09 and the pie chart illustrate the respiratory examination findings for COPD patients. Out of the 101 patients, 55 (54.5%) were diagnosed with rhonchi, while 46 (45.5%) had normal vesicular breath sounds (NVBS). The chart visually indicates that a slightly higher proportion of patients exhibited rhonchi. The presence of rhonchi suggests that these patients may experience airway obstruction or inflammation.

Table 10: GOLD Grading of Patients

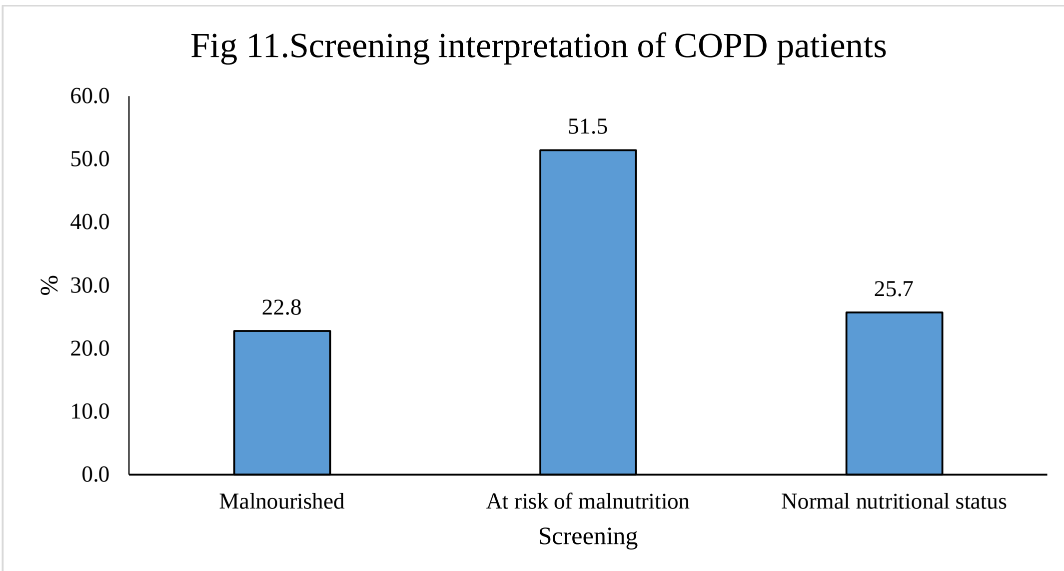
		n	%
GOLD Grading	GOLD 1 (Mild)	18	17.8
	GOLD 2 (Moderate)	56	55.4
	GOLD 3 (Severe)	22	21.8
	GOLD 4 (Very Severe)	5	5.0



The data in the table 10 and the Fig 10 indicate the distribution of COPD patients according to their GOLD grading. Out of 101 patients, 56, or 55.4 percent, belonged to GOLD 2, making it the largest group. It was followed by GOLD 3 with 22 (21.8%) patients, GOLD 1 with 18 (17.8%), and GOLD 4 with 5 (5.0%). Most of the patients had a moderate form of COPD, whereas a small percentage suffer from severe or mild form of COPD.

Table 11: Malnutrtion Screening of Patients

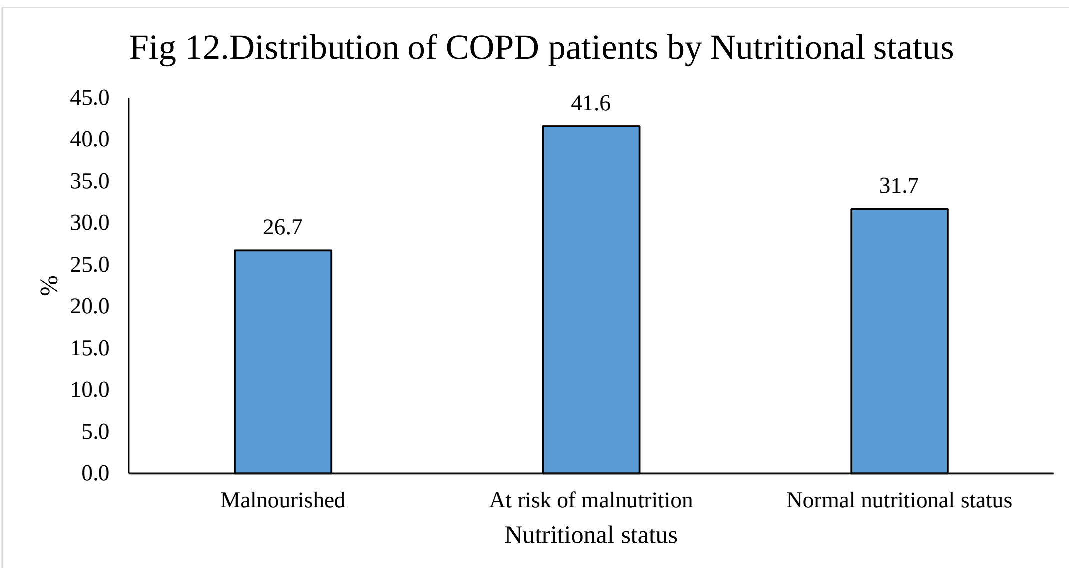
		n	%
Screening Interpretation	Malnourished	23	22.8
	At risk of malnutrition	52	51.5
	Normal nutritional status	26	25.7



According to Table 11 and the Fig 11, 52 out of the total 101 COPD patients, 52 (51.5%) were observed to be "at risk of malnutrition," constituting the bulk of the group. However, there was also a significant number of those with a normal nutritional status, (25.7%). Similarly, the number of malnourished patients constituted 22.8% of the patients (23 cases).

Table 12: Nutritional status of Patient

		n	%
Nutritional Status Interpretation	Malnourished	27	26.7
	At risk of malnutrition	42	41.6
	Normal nutritional status	32	31.7

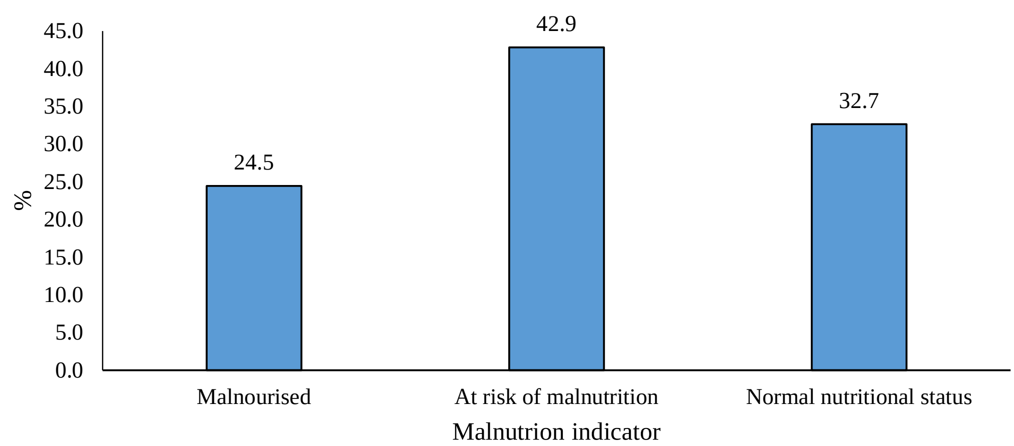


The data in Table 12 and the Fig 12 show the nutritional status of COPD patients. Among the 101 patients, 42 (41.6%) are identified as "at risk of malnutrition," which is the largest group. This was followed by 27 (26.7%) patients who were categorized as malnourished, and 32 (31.7%) patients had normal nutritional status.

Table 13: Malnutrition indicator Score

		n	%
Malnutrition indicator score	Malnourished	24	24.5
	At risk of malnutrition	42	42.9
	Normal nutritional status	32	32.7

Fig 13.Distribution of COPD patients by Malnutrition indicator

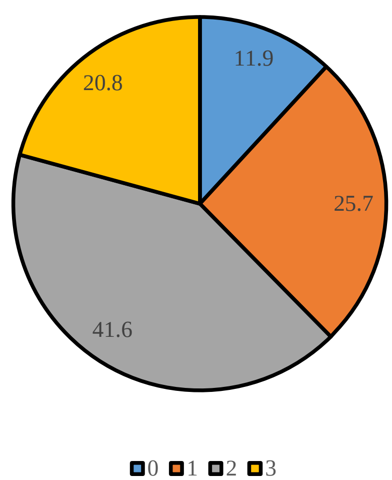


The data in Table 13 and the bar graph show the distribution of COPD patients based on the malnutrition indicator score. Among the 101 patients, 42 (42.9%) were identified as "at risk of malnutrition," making it the largest group. A smaller proportion, 32 (32.7%), had normal nutritional status, while 24 (24.5%) patients were classified as malnourished. The graph clearly highlights that a significant percentage of patients are at risk of malnutrition, emphasizing the importance of addressing nutritional needs in COPD management.

Table 14: Distribution of patients by mMRC Grading

		n	%
mMRC Grading	.00	12	11.9
	1.00	26	25.7
	2.00	42	41.6
	3.00	21	20.8

Fig 14. Distribution of patients by mMRC grading

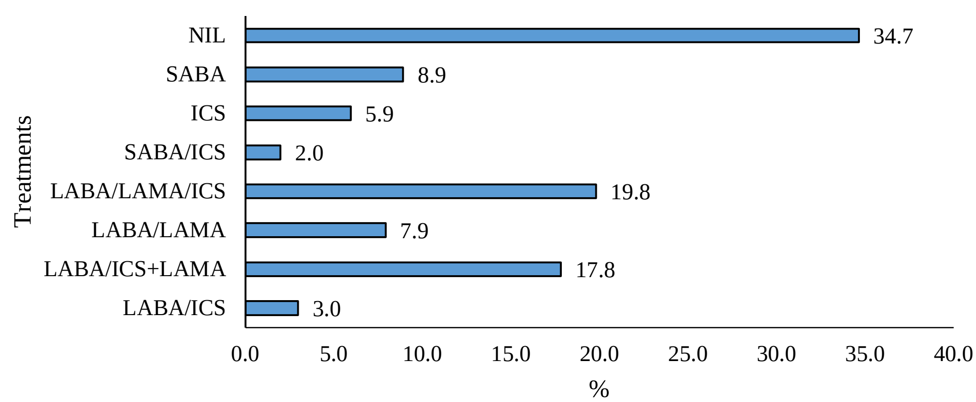


The data in Table 14 and the accompanying Fig 14 illustrate the distribution of COPD patients based on their mMRC (modified Medical Research Council) grading. Out of the 101 patients, the majority, 42 (41.6%), fall under the mMRC grade 2. This was followed by 26 (25.7%) patients in grade 1, 21 (20.8%) in grade 3, and 12 (11.9%) in grade 0.

Table 15: Treatment of Patients

		n	**%**
Treatment	LABA/ICS	3	3.0
	LABA/ICS+LAMA	18	17.8
	LABA/LAMA	8	7.9
	LABA/LAMA/ICS	20	19.8
	SABA/ICS	2	2.0
	ICS	6	5.9
	SABA	9	8.9
	Newly Diagnosed	35	34.7

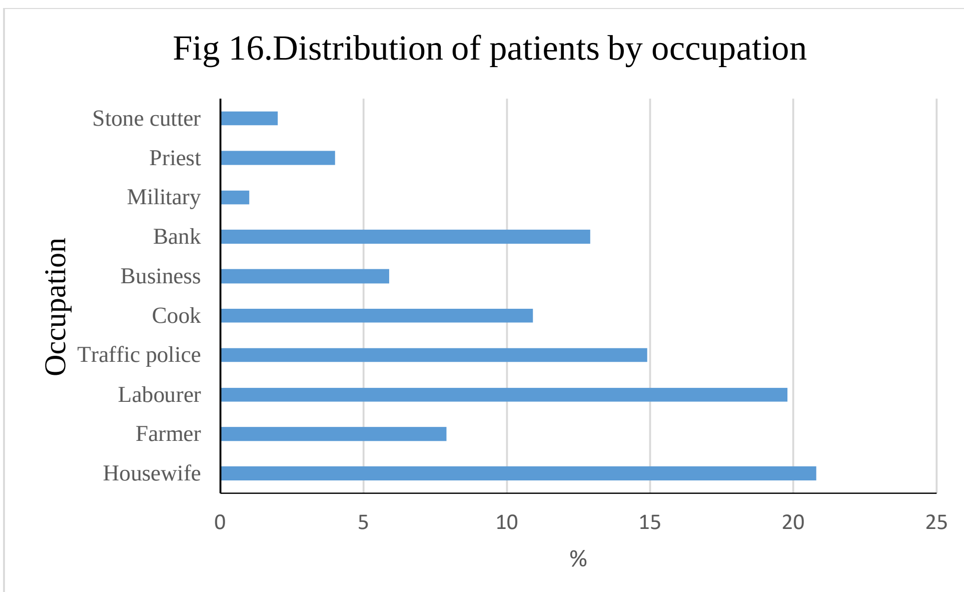
Fig 15. Distribution of patients by treatments



The data in Table 15 and the accompanying Fig 15 show the distribution of COPD patients based on their treatment regimen. Among the 101 patients, the largest group, 35 (34.7%), were newly diagnosed. The next most common treatment regimens include LABA/LAMA/ICS (20 patients, 19.8%) and LABA/ICS+LAMA (18 patients, 17.8%). Smaller groups received LABA/LAMA (8 patients, 7.9%), SABA (9 patients, 8.9%), ICS (6 patients, 5.9%), and SABA/ICS (2 patients, 2.0%). The graph highlights that a significant number of patients are either untreated or receiving combinations of bronchodilators and corticosteroids.

Table 16: Occupation of Patients

		n	%
Occupation	Housewife	21	20.8
	Farmer	8	7.9
	Labourer	20	19.8
	Traffic police	15	14.9
	Cook	11	10.9
	Business	6	5.9
	Bank	13	12.9
	Military	1	1
	Priest	4	4
	Stone cutter	2	2



The data in Table 16 presents the occupational distribution of individuals, showing that housewives form the largest group (20.8%), followed by labourers (19.8%) and traffic police personnel (14.9%). Farmers (7.9%) and cooks (10.9%) also hold a notable share. Business professionals (5.9%) and bankers (12.9%) contribute to the workforce, while military personnel (1%) and priests (4%) form smaller segments. Stone cutters account for only 2% of the total.

Table 17: Baseline characteristics

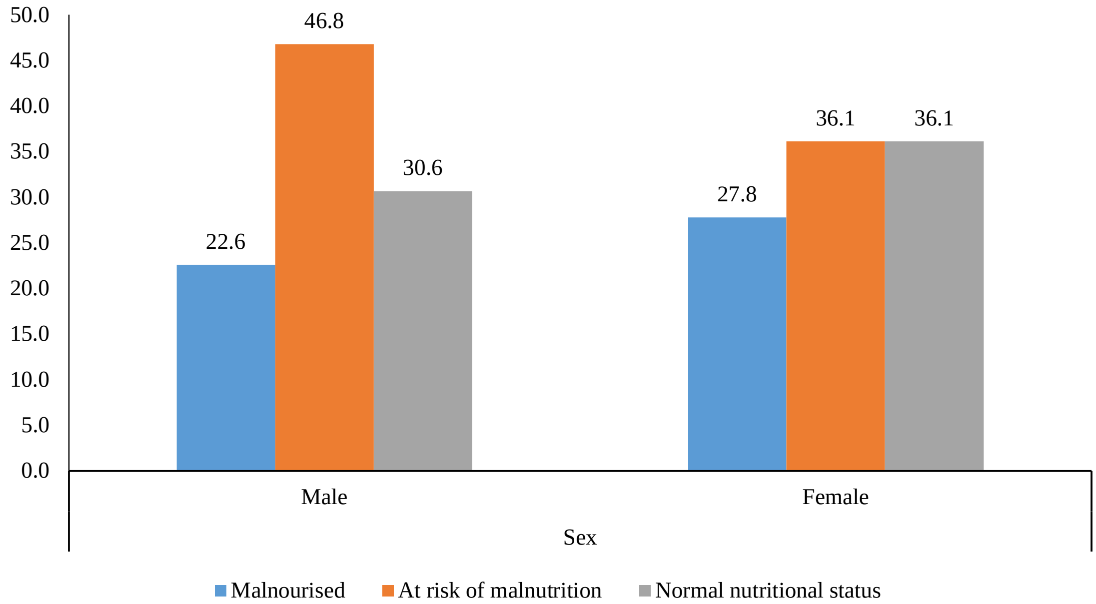
	Median ± IQR	Minimum	Maximum
Age	60.00 ± 19.00	40.00	85.00
Weight (kg)	58.50 ±16.30	44.00	90.00
Height (cm)	168.50 ± 9.60	153.20	198.10
BMI	20.40 ± 4.94	16.30	33.34
Mid Arm Circumference	25.30 ± 2.60	20.50	30.00
Calf Circumference	34.00 ± 4.00	29.00	42.00
CAT Score	15.00 ± 9.00	5.00	35.00
Pulse	79.00 ± 23.00	60.00	99.00
Systolic BP	124.00 ± 15.00	110.00	140.00
Diastolic BP	80.00 ± 9.00	70.00	90.00
Spo2	97.00 ± 3.00	95.00	100.00
FEV1	58.00 ± 21.00	28.00	85.00
FVC	93.00 ± 19.00	52.00	112.00
FEV1/FVC Ratio	63.72 ± 12.76	46.67	86.17
Assessment Score	12.00 ± 5.00	4.50	16.00
Total Score	23.00 ± 9.00	8.50	30.00

Table 17 presents the descriptive statistics for various health parameters of COPD patients. The median age of the patients is 60 years, with an interquartile range (IQR) of 19 years, indicating a wide age distribution ranging from 40 to 85 years. The median weight is 58.5 kg with a IQR of 16.3 kg, ranging from 44 kg to 90 kg. The median height is 168.5 cm (IQR = 9.6 cm), with a range from 153.2 cm to 198.1 cm. BMI has a median of 20.4 (IQR = 4.94), ranging from 16.3 to 33.34. Other key measures include mid-arm circumference (25.3 cm), calf circumference (34 cm), and pulse rate (79 bpm), indicating the overall physical characteristics of the patients. Respiratory and blood pressure parameters show moderate variation with median values like CAT score (15), systolic BP (124 mm Hg), diastolic BP (80 mm Hg), and SpO2 (97%). Pulmonary function tests show a median FEV1 of 58% and FVC of 93%, while the FEV1/FVC ratio stands at 63.72%. These measures provide a detailed overview of the physical and respiratory health of the cohort, highlighting variations in key health metrics among the COPD patients.

Table 18: Association Between MNA Classification and Sex

		Malnourished	At risk of malnutrition	Normal nutritional status	Chi-square (Sig.)
Sex	Male	14 (22.6)	29 (46.8)	19 (30.6)	1.064 (0.587)
	Female	10 (27.8)	13 (36.1)	13 (36.1)	

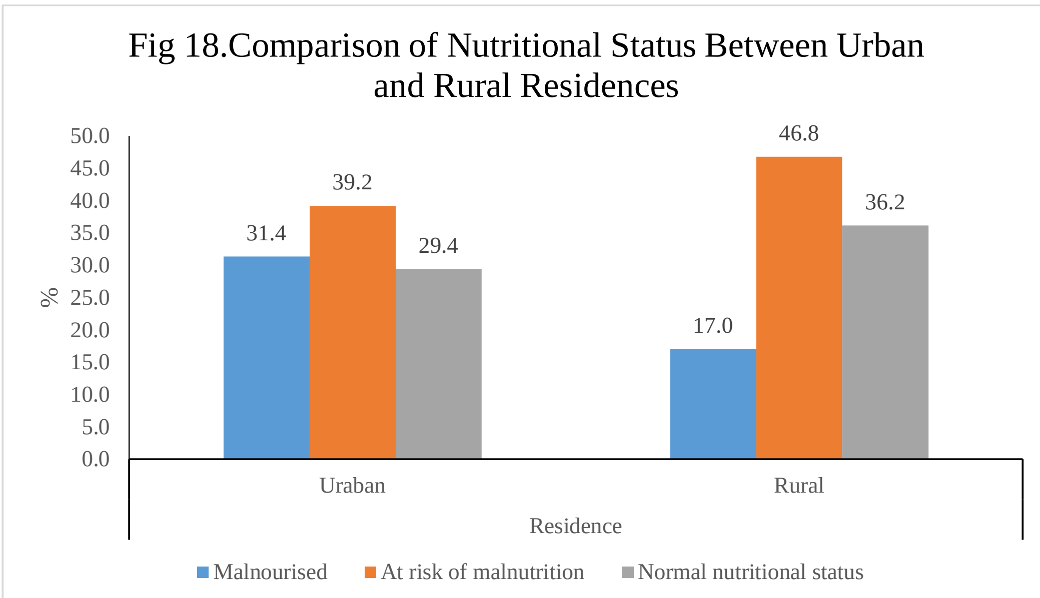
Fig 17. Gender-wise Comparison of Nutritional Status Across Three Categories



The data in Table 18 and the accompanying bar graph display the association between MNA (Malnutrition Screening Tool) classification and sex among COPD patients. In the male group, 14 patients (22.6%) are malnourished, 29 (46.8%) are at risk of malnutrition, and 19 (30.6%) had normal nutritional status. In contrast, the female group has 10 patients (27.8%) are malnourished, 13 (36.1%) at risk of malnutrition, and 13 (36.1%) had normal nutritional status.

Table 19: Association Between MNA Classification and Place of residence

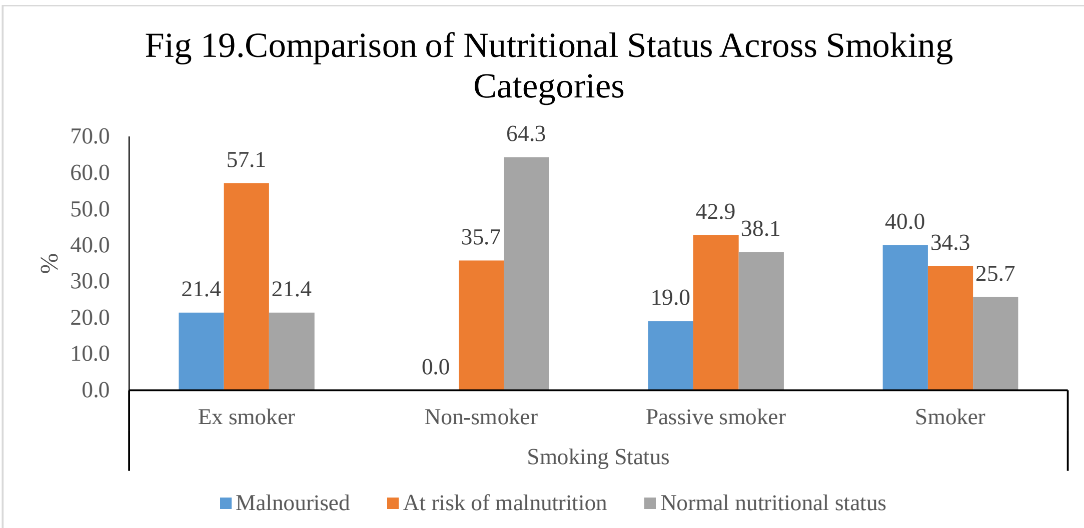
		Malnourished	At risk of malnutrition	Normal nutritional status	Chi-square (Sig.)
Residence	Urban	16 (31.4)	20 (39.2)	15 (29.4)	2.728 (0.256)
	Rural	8 (17.0)	22 (46.8)	17 (36.2)	



The data in Table 19 and the accompanying bar graph illustrate the association between MNA (Malnutrition Screening Tool) classification and place of residence among COPD patients. In the urban group, 16 patients (31.4%) are malnourished, 20 (39.2%) are at risk of malnutrition, and 15 (29.4%) had normal nutritional status. In the rural group, 8 patients (17.0%) are malnourished, 22 (46.8%) are at risk of malnutrition, and 17 (36.2%) had normal nutritional status.

Table 20: Association Between MNA Classification and Smoking status

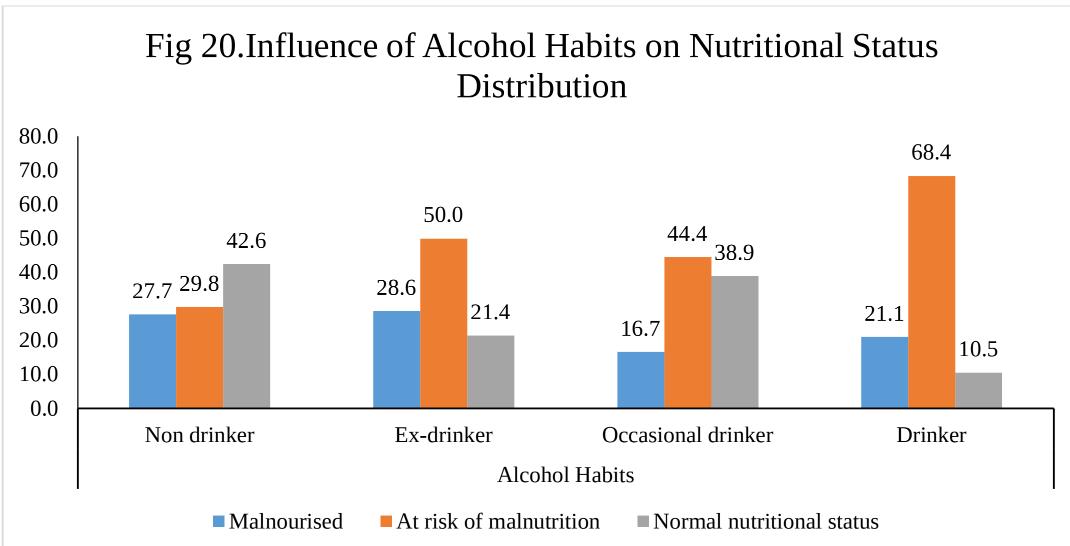
Smoking Status	Malnourished	At risk of malnutrition	Normal nutritional status	Chi-square (Sig.)
Ex smoker	6 (21.4)	16 (57.1)	6 (21.4)	15.405 (0.017)*
Non-smoker	0 (0.0)	5 (35.7)	9 (64.3)	
Passive smoker	4 (19.0)	9 (42.9)	8 (38.1)	
Smoker	14 (40.0)	12 (34.3)	9 (25.7)	



The data in Table 20 and the accompanying Fig 19 illustrate the association between MNA (Malnutrition Screening Tool) classification and smoking status among COPD patients. Among ex-smokers, 6 patients (21.4%) are malnourished, 16 (57.1%) are at risk of malnutrition, and 6 (21.4%) had normal nutritional status. For non-smokers, 0 patients are malnourished, 5 (35.7%) are at risk of malnutrition, and 9 (64.3%) had normal nutritional status. In passive smokers, 4 patients (19.0%) are malnourished, 9 (42.9%) are at risk of malnutrition, and 8 (38.1%) had normal nutritional status. Among smokers, 14 patients (40.0%) are malnourished, 12 (34.3%) are at risk of malnutrition, and 9 (25.7%) had normal nutritional status.

Table 21: Association Between MNA Classification and Alcohol Habits

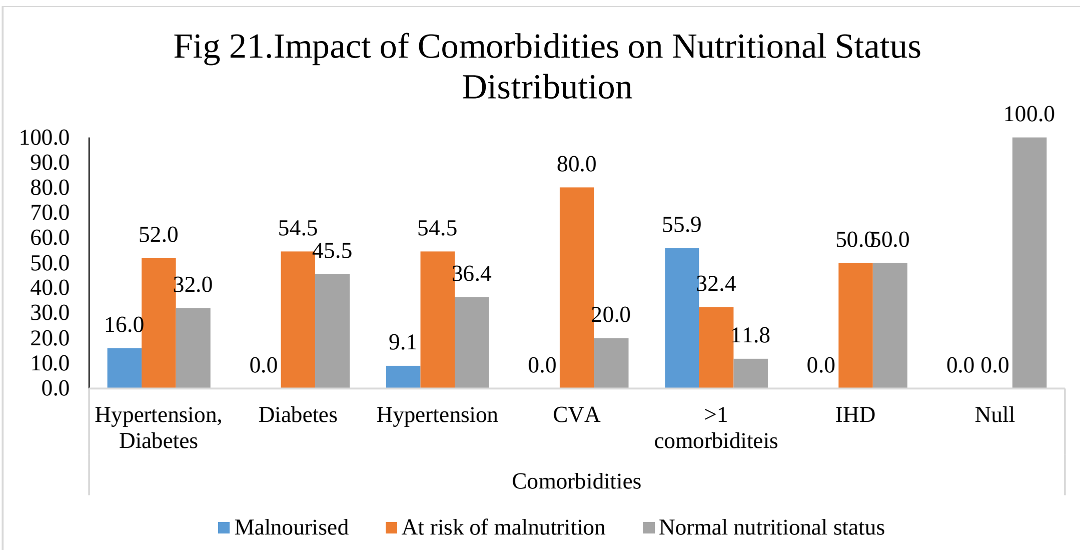
		Malnourished	At risk of malnutrition	Normal nutritional status	Chi-square (Sig.)
Alcohol Habits	Non-drinker	13 (27.7)	14 (29.8)	20 (42.6)	10.843 (0.086)
	Ex-drinker	4 (28.6)	7 (50.0)	3 (21.4)	
	Occasional drinker	3 (16.7)	8 (44.4)	7 (38.9)	
	Drinker	4 (21.1)	13 (68.4)	2 (10.5)	



The data in Table 21 and the accompanying Fig 20 show the association between MNA classification and alcohol habits among COPD patients. Among non-drinkers, 42.6% had normal nutritional status, 29.8% were at risk of malnutrition, and 27.7% were malnourished. Ex-drinkers had 50% at risk of malnutrition, with fewer showing normal nutritional status (21.4%). Drinkers had the highest percentage (68.4%) at risk of malnutrition, with only 10.5% had normal nutritional status.

Table 22: Association Between MNA Classification and Comorbidities

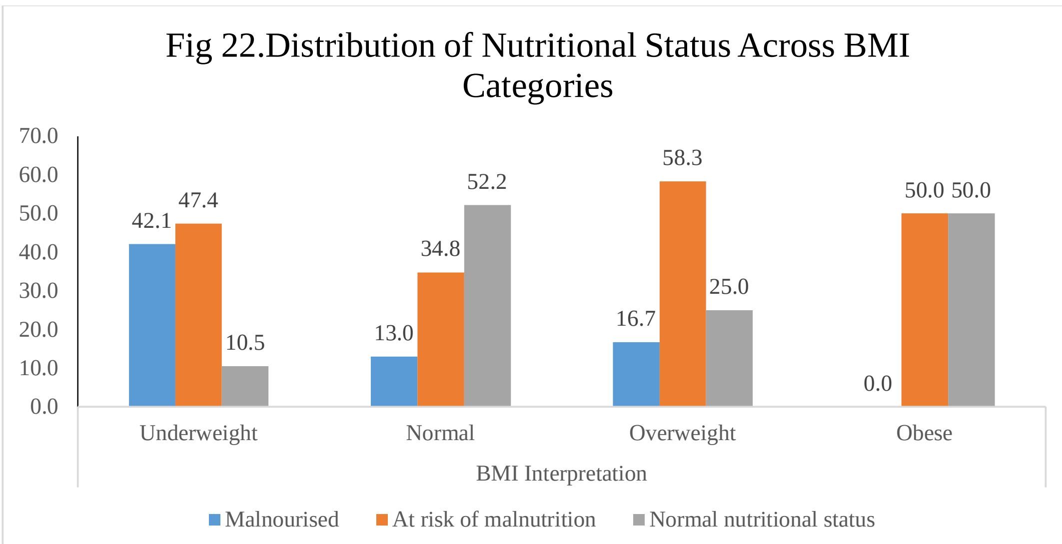
Comorbidities	Malnourished	At risk of malnutrition	Normal nutritional status	Chi-square (Sig.)
Hypertension, Diabetes	4 (16.0)	13 (52.0)	8 (32.0)	39.950 (<0.05)*
Diabetes	0 (0.0)	6 (54.5)	5 (45.5)	
Hypertension	1 (9.1)	6 (54.5)	4 (36.4)	
CVA	0 (0.0)	4 (80.0)	1 (20.0)	
>1 comorbiditeis	19 (55.9)	11 (32.4)	4 (11.8)	
IHD	0 (0.0)	2 (50.0)	2 (50.0)	
Nil	0 (0.0)	0 (0.0)	8 (100.0)	



The data in Table 22 and the accompanying Fig 21 show the impact of comorbidities on the nutritional status of COPD patients. Among patients with hypertension and diabetes, 52% are at risk of malnutrition, 16% are malnourished, and 32% had normal nutritional status. For those with diabetes, 54.5% are at risk of malnutrition, and 45.5% had normal nutritional status. Similarly, for hypertension patients, 54.5% are at risk of malnutrition. The highest percentage of malnourished patients (55.9%) had more than one comorbidity.

Table 23: Association Between MNA Classification and BMI

BMI Interpretation	Malnourised	At risk of malnutrition	Normal nutritional status	Chi-square (Sig.)
Underweight	16 (42.1)	18 (47.4)	4 (10.5)	21.204 (<0.05)*
Normal	6 (13.0)	16 (34.8)	24 (52.2)	
Overweight	2 (16.7)	7 (58.3)	3 (25.0)	
Obese	0 (0.0)	1 (50.0)	1 (50.0)	

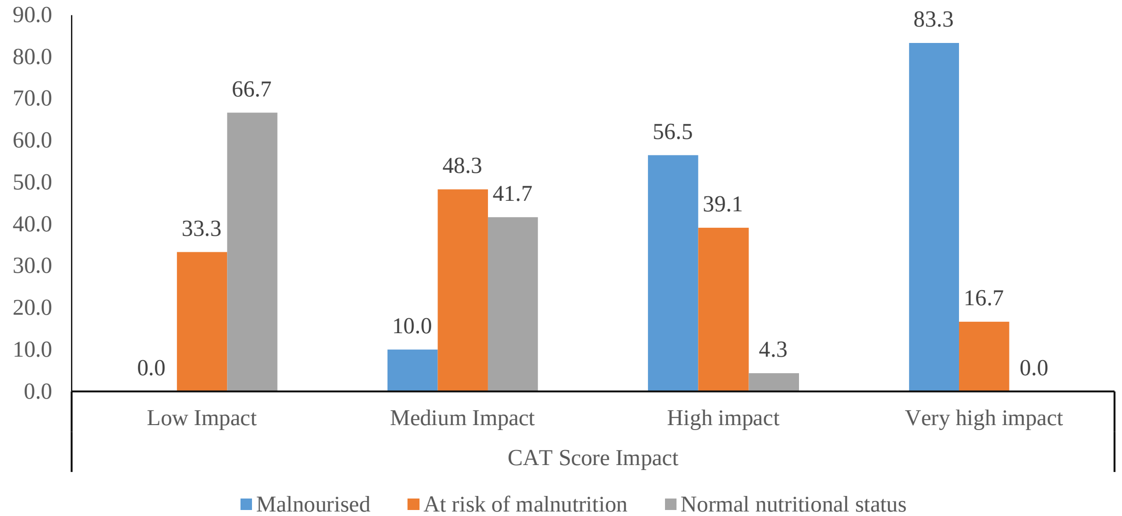


The data in Table 23 and the accompanying Fig 22 show the distribution of nutritional status across different BMI categories among COPD patients. Among patients who are underweight, 42.1% are malnourished, 47.4% are at risk of malnutrition, and 10.5% had normal nutritional status. Among patients with normal BMI, 52.2% have normal nutritional status, 34.8% are at risk of malnutrition, and 13% were malnourished. For overweight patients, 58.3% are at risk of malnutrition, 25% had normal nutritional status, and 16.7% were malnourished. Obese patients showed an even distribution of 50% at risk of malnutrition and 50% with normal nutritional status. The Chi-square test result (21.204, $p<0.05$) indicates a statistically significant association between BMI and nutritional status.

Table 24: Association Between MNA Classification and CAT Score

CAT Score Impact	Malnourished	At risk of malnutrition	Normal nutritional status	Chi-square (Sig.)
Low Impact	0 (0.0)	3 (33.3)	6 (66.7)	36.147 (<0.05)*
Medium Impact	6 (10.0)	29 (48.3)	25 (41.7)	
High impact	13 (56.5)	9 (39.1)	1 (4.3)	
Very high impact	5 (83.3)	1 (16.7)	0 (0.0)	

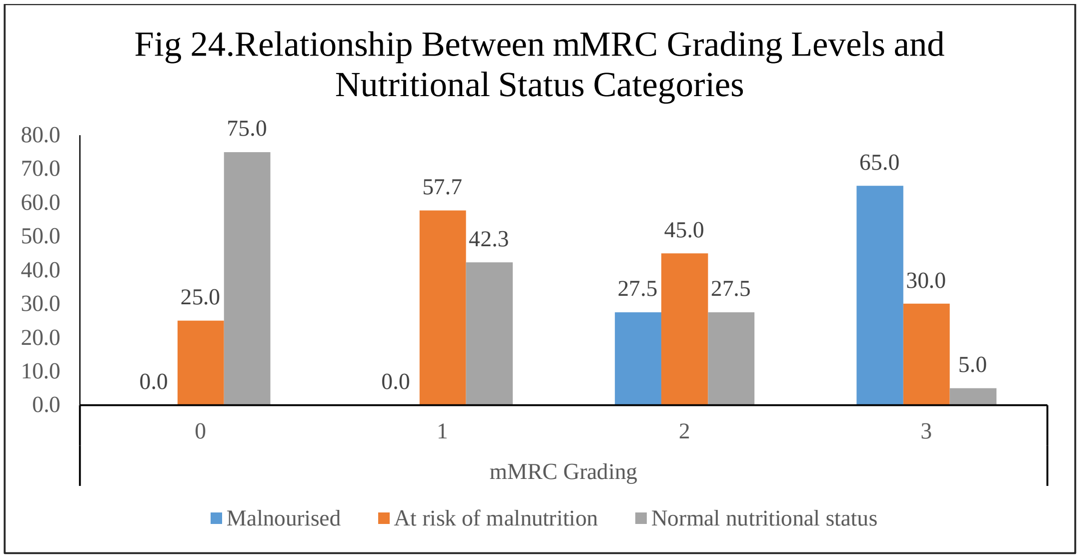
Fig 23.Association Between CAT Score Impact and Nutritional Status Categories



The data in Table 24 and Fig.23 show the significant relationship between CAT (COPD Assessment Test) score impact and nutritional status among COPD patients. In patients with low impact CAT scores, 66.7% had normal nutritional status, and only 33.3% were at risk of malnutrition. For those with medium impact, 48.3% are at risk of malnutrition, while 41.7% had normal nutritional status. Among patients with high impact, 56.5% are malnourished, and only 4.3% had normal nutritional status. The group with very high impact shows 83.3% malnourished, with no patients in normal nutritional status.

Table 25: Association Between MNA Classification and mMRC Grading

mMRC Grading	Malnourised	At risk of malnutrition	Normal nutritional status	Chi-square (Sig.)
0	0 (0.0)	3 (25.0)	9 (75.0)	37.500 (<0.05)*
1	0 (0.0)	15 (57.7)	11 (42.3)	
2	11 (27.5)	18 (45.0)	11 (27.5)	
3	13 (65.0)	6 (30.0)	1 (5.0)	

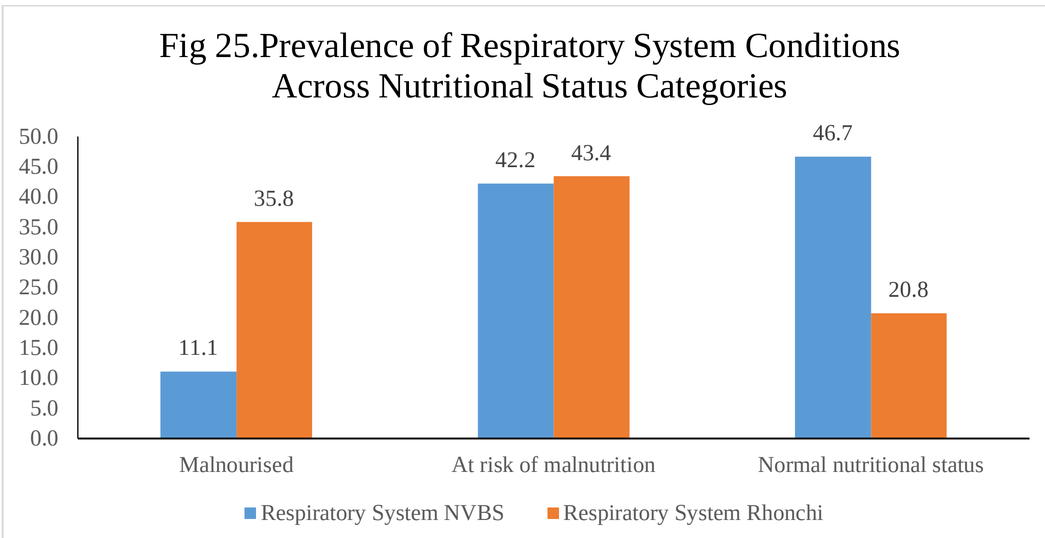


The data in Table 25 and the accompanying fig 24 demonstrate the relationship between mMRC (modified Medical Research Council) grading levels and nutritional status among COPD patients. In the mMRC grade 0 group, 75% of patients had normal nutritional status, with 25% at risk of malnutrition. For grade 1, 57.7% of patients are at risk of malnutrition, while 42.3% have normal nutritional status. In grade 2, 45% of patients are at risk of malnutrition, and 27.5% are malnourished. Among grade 3 patients, 65% are malnourished, with 30% at risk of malnutrition and only 5% were having normal nutritional status.

The Chi-square test result (37.500, $p<0.05$) indicates a statistically significant association, showing that as mMRC grading increases, the risk of malnutrition and the percentage of malnourished patients also rise, highlighting the critical role of mMRC grading in assessing the nutritional status of COPD patients.

Table 26: Association Between MNA Classification and Respiratory classification

		Malnourished	At risk of malnutrition	Normal nutritional status	Chi-square (Sig.)
Respiratory System	NVBS	5 (11.1)	19 (42.2)	21 (46.7)	11.093 (0.004)*
	Rhonchi	19 (35.8)	23 (43.4)	11 (20.8)	



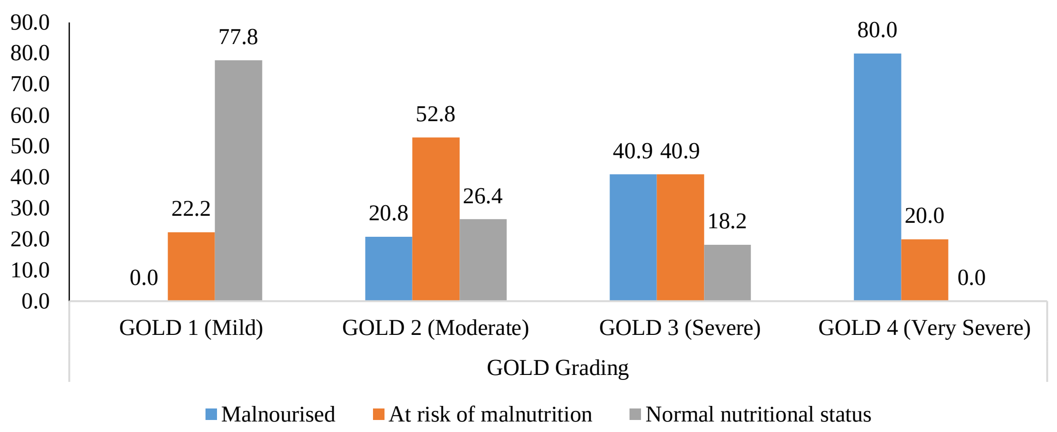
The data in Table 26 and the accompanying Fig 25 show the association between MNA (Malnutrition Screening Tool) classification and respiratory system conditions among COPD patients. For malnourished patients, 35.8% have rhonchi and 11.1% have normal vesicular breath sounds (NVBS). Among those at risk of malnutrition, 43.4% have rhonchi, and 42.2% have NVBS. For patients with normal nutritional status, 46.7% have NVBS, while 20.8% have rhonchi.The Chi-square test result (11.093, p=0.004) indicates a statistically significant association between nutritional status and respiratory conditions, suggesting that patients with malnutrition are more likely to have rhonchi, while those with normal nutritional status tend to have NVBS.

Table 27: Association Between MNA Classification and GOLD Grading

GOLD Grading	Malnourished	At risk of malnutrition	Normal nutritional status	Chi-square (Sig.)
GOLD 1 (Mild)	0 (0.0)	4 (22.2)	14 (77.8)	27.844 (<0.05)*
GOLD 2 (Moderate)	11 (20.8)	28 (52.8)	14 (26.4)	
GOLD 3 (Severe)	9 (40.9)	9 (40.9)	4 (18.2)	
GOLD 4 (Very Severe)	4 (80.0)	1 (20.0)	0 (0.0)	

*<0.05 significance is obtained by chi-square test

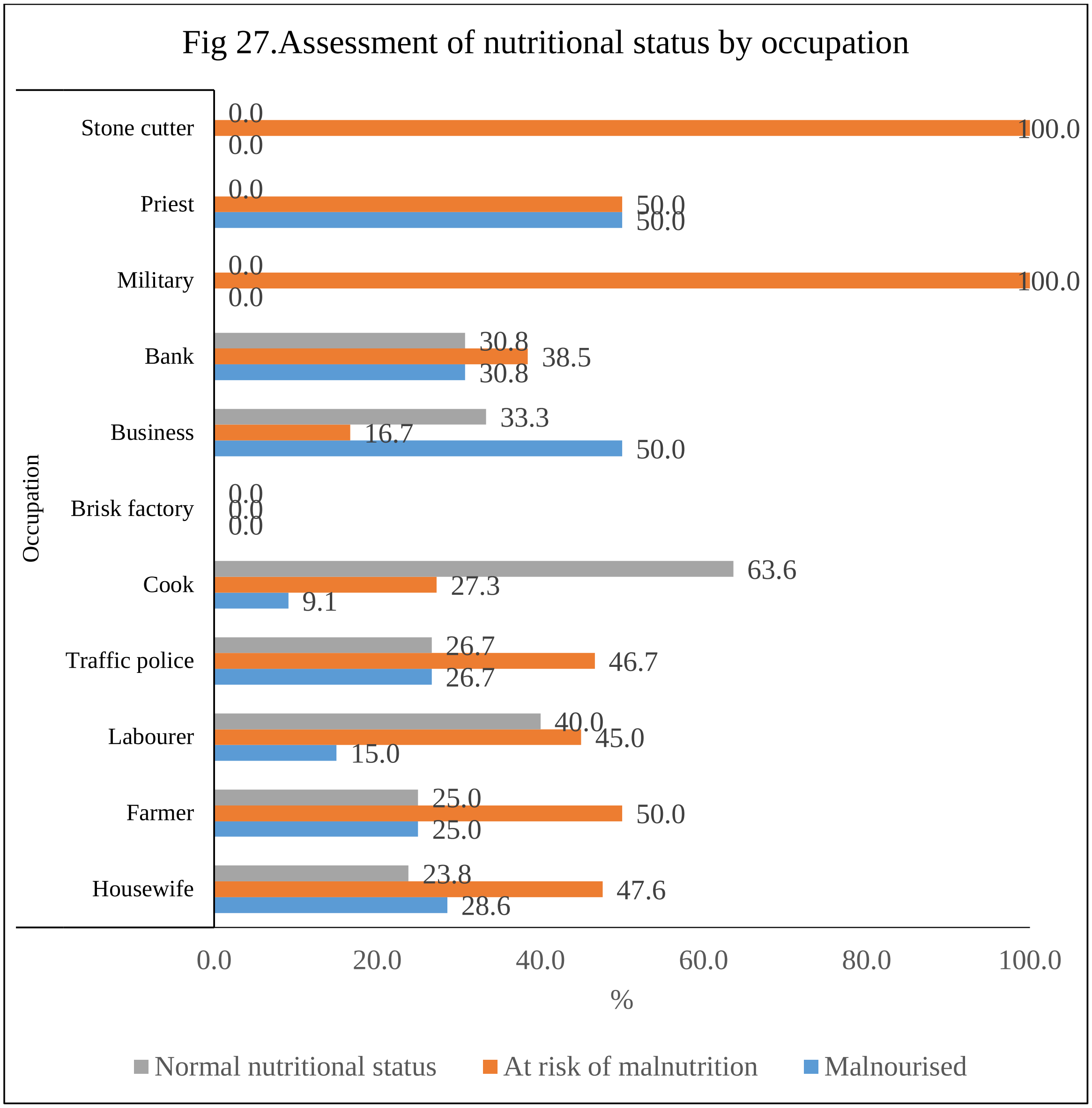
Fig 26.Impact of GOLD Grading on Nutritional Status



The data in Table 27 and the accompanying Fig 26 illustrate the impact of GOLD grading on the nutritional status of COPD patients. Among patients with GOLD 1 (Mild), 77.8% had normal nutritional status, 22.2% were at risk of malnutrition, and none were malnourished. For GOLD 2 (Moderate), 52.8% were at risk of malnutrition, 20.8% were malnourished, and 26.4% had normal nutritional status. In GOLD 3 (Severe), 40.9% were malnourished, 40.9% were at risk of malnutrition, and 18.2% had normal nutritional status. For GOLD 4 (Very Severe), 80% were malnourished, and 20% were at risk of malnutrition, with no patients had normal nutritional status. The Chi-square test result (27.844, $p<0.05$) indicates a statistically significant association between GOLD grading and nutritional status.

Table 28: Association Between MNA Classification and Occupation

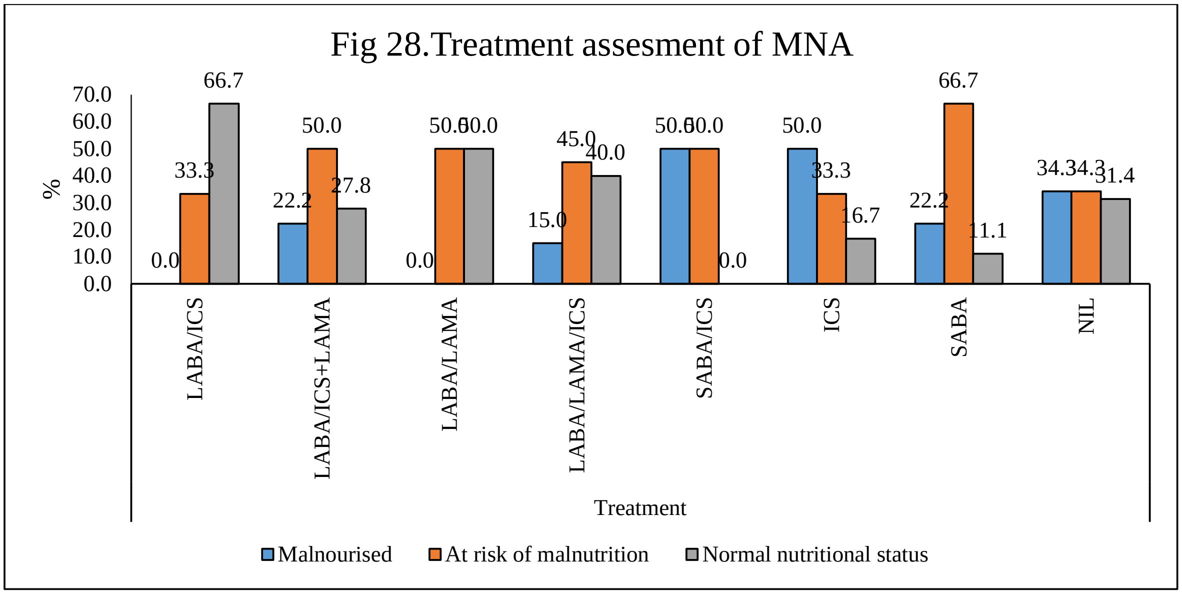
Occupation	Malnourished	At risk of malnutrition	Normal nutritional status	Chi-square (Sig.)
Housewife	6 (28.6)	10 (47.6)	5 (23.8)	14.996 (0.657)
Farmer	2 (25.0)	4 (50.0)	2 (25.0)	
Labourer	3 (15.0)	9 (45.0)	8 (40.0)	
Traffic police	4 (26.7)	7 (46.7)	4 (26.7)	
Cook	1 (9.1)	3 (27.3)	7 (63.6)	
Brisk factory	0 (0.0)	0 (0.0)	0 (0.0)	
Business	3 (50.0)	1 (16.7)	2 (33.3)	
Bank	4 (30.8)	5 (38.5)	4 (30.8)	
Military	0 (0.0)	1 (100.0)	0 (0.0)	
Priest	2 (50.0)	2 (50.0)	0 (0.0)	
Stone cutter	0 (0.0)	2 (100.0)	0 (0.0)	



The data in Table 28 and the accompanying Fig 27 illustrate the association between MNA (Malnutrition Screening Tool) classification and occupation among COPD patients. Among housewives, 28.6% are malnourished, 47.6% are at risk of malnutrition, and 23.8% had normal nutritional status. Among farmers, 25% are malnourished, 50% are at risk of malnutrition, and 25% had normal nutritional status. For laborers, 15% are malnourished, 45% are at risk, and 40% had normal nutritional status. The Fig 27 also shows similar distributions for other occupations like traffic police, cooks, and business employees. The Chi-square test result (14.996, p=0.657) suggests no statistically significant association between occupation and nutritional status.

Table 29: Association Between MNA Classification and Treatment

Treatments	Malnourished	At risk of malnutrition	Normal nutritional status	Chi-square (Sig.)
LABA/ICS	0 (0.0)	1 (33.3)	2 (66.7)	13.306 (0.454)
LABA/ICS+LAMA	4 (22.2)	9 (50.0)	5 (27.8)	
LABA/LAMA	0 (0.0)	4 (50.0)	4 (50.0)	
LABA/LAMA/ICS	3 (15.0)	9 (45.0)	8 (40.0)	
SABA/ICS	1 (50.0)	1 (50.0)	0 (0.0)	
ICS	3 (50.0)	2 (33.3)	1 (16.7)	
SABA	2 (22.2)	6 (66.7)	1 (11.1)	
Newly Diagnosed	12 (34.3)	12 (34.3)	11 (31.4)	

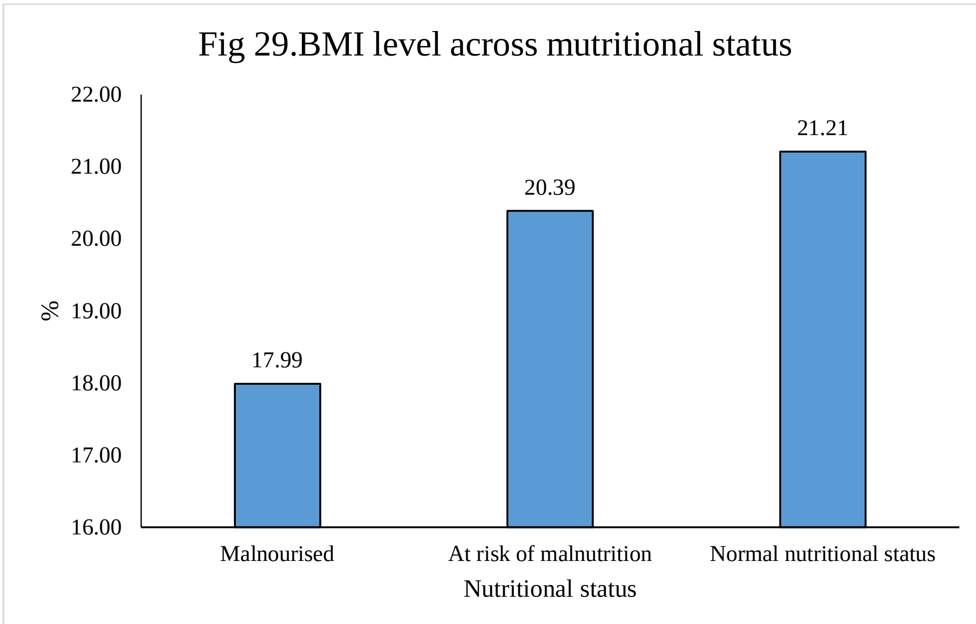


The data in Table 29 and the accompanying Fig 28 show the association between MNA (Malnutrition Screening Tool) classification and treatment among COPD patients. For patients receiving LABA/ICS treatment, 66.7% have normal nutritional status, while 33.3% are at risk of malnutrition. In the LABA/ICS+LAMA group, 50% are at risk of malnutrition, and 22.2% are malnourished. For LABA/LAMA, 50% have normal nutritional status, and the other 50% are at risk of malnutrition. In the LABA/LAMA/ICS group, 45% are at risk of malnutrition, and 15% are malnourished. Other treatments like SABA/ICS, ICS, and SABA show varying levels of malnutrition and nutritional risk.

Table 30: Comparison of BMI Across Nutritional Status Categories

	Malnourished Median (IQR)	At risk of malnutrition Median (IQR)	Normal nutritional status Median (IQR)	Sig.
BMI	17.99 ±2.91	20.39± 5.19	21.21±4.23	<0.05*

*<0.05 is obtained by Kruskal Wallis test

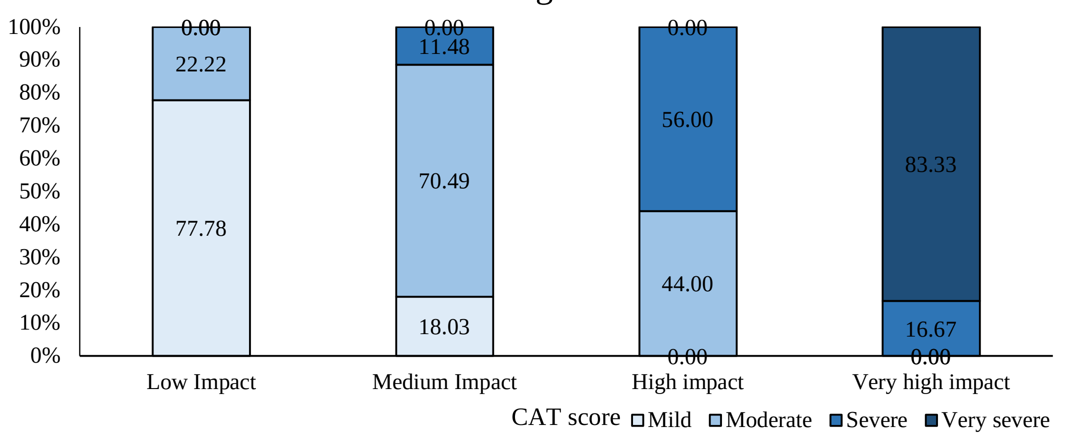


The data in Table 30 and the accompanying Fig 29 show the comparison of BMI levels across different nutritional status categories among COPD patients. The median BMI for malnourished patients is 17.99, for those at risk of malnutrition it is 20.39, and for patients with normal nutritional status, it was 21.21. The Kruskal-Wallis test result (<0.05) indicates a statistically significant difference in BMI across the nutritional status categories. This suggests that BMI levels vary significantly between the groups, with malnourished patients having the lowest BMI, while those with normal nutritional status have the highest BMI.

Table 31: Comparison of CAT score impact Across GOLD Grading Categories

CAT Score Impact	Mild n (%)	Moderate n (%)	Severe n (%)	Very severe n (%)	chi-square (Sig.)
Low Impact	7.00 (77.78)	2.00 (22.22)	0.00 (0.00)	0.00 (0.00	64.849 (<0.05) *
Medium Impact	11.00 (18.03)	43.00 (70.49)	7.00 (11.48)	0.00 (0.00	
High impact	0.00 (0.00)	11.00 (44.00)	14.00 (56.00)	0.00 (0.00	
Very high impact	0.00 (0.00)	0.00 (0.00)	1.00 (16.67)	5.00 (83.33	

Fig 30.Comparison of CAT score across Gold grading catergories



The data in Table 31 and the accompanying Fig 30 show the comparison of CAT (COPD Assessment Test) score impact across different GOLD grading categories. Among patients with mild GOLD grading, 77.78% have low CAT score impact, while 22.22% have medium impact. In the moderate GOLD group, 70.49% have medium CAT score impact, 18.03% have low impact, and 11.48% had high impact. For severe GOLD patients, 56% have high impact, and 44% had medium impact. In the very severe GOLD group, 83.33% of patients have very high CAT score impact, and 16.67% had high impact. The Chi-square test result (64.849, p<0.05) indicates a statistically significant association between CAT score impact and GOLD grading, suggesting that as the severity of COPD increases, the CAT score impact also increases significantly.

DISCUSSION

This study provides a comprehensive analysis of the demographic, clinical, and nutritional characteristics of COPD patients, offering valuable insights into the factors influencing disease progression and management and its impact on the Nutritional Status of the COPD patients

1. Demographic Characteristics

The study had 101 participants with a mean age of 60$\pm$19 years which indicates a higher prevalence in older age group. The higher age group in our study is comparable with other studies.[1-6]

Age also played a role in nutritional status in our study, with elderly patients—particularly those aged above 65 years—showing higher malnutrition rates. This is consistent with findings from Scichilone et al.[81] who emphasized the increased vulnerability of older COPD patients to malnutrition due to physiological anorexia of aging, dentition problems, social isolation, and reduced mobility. Gender also contributed to disparities in nutritional status. While both men and women in our cohort were affected, female patients—especially housewives exposed to biomass smoke—showed higher rates of malnutrition, which was similar to another Indian study by Kurmi et al.[82] Their research highlighted the compounded effects of gender roles, indoor air pollution, and poverty, particularly in rural Indian women, on both respiratory and nutritional outcomes.

Our study demonstrated a significant disparity in nutritional status between rural and urban COPD patients. Out of 101 participants, 48 (47.5%) were from rural areas and 53 (52.5%) from urban settings. Among rural patients, 35.4% were malnourished and 41.7% were at risk, while only 22.9% had normal nutritional status. In contrast among urban patients 18.9% were malnourished, 41.5% were at risk of malnourishment, and 39.6% were well-nourished. These results indicate that rural residence is associated with a higher prevalence of malnutrition, likely due to limited access to healthcare, poor dietary diversity, greater biomass fuel exposure, and socioeconomic constraints.

This trend aligns with Indian studies such as Koul et al.[83] , who found significantly higher malnutrition and sarcopenia among rural COPD patients. Similarly, Kurmi et al.[82] emphasized the compounded risk of COPD and nutritional deficits in rural Indian women exposed to indoor air pollution. These findings underscore that rural residence is not only a geographic variable but a marker of health inequity. Our results highlight the need for targeted interventions in rural populations, including nutritional education, clean cooking fuel programs, and improved access to integrated COPD care, to bridge the urban–rural health divide.

2. Smoking and Alcohol Habits

Smoking emerged as a significant risk factor, with 34.7% of patients being active smokers and 29.7% being ex-smokers, consistent with global data identifying smoking as the primary risk factor for COPD [1] Passive smoking was also significant (21.8%), aligning with studies highlighting the harmful effects of secondhand smoke[84]

Our study revealed that malnutrition was more frequent among current smokers, and this association was statistically significant. This relationship is well supported by international literature. Cigarette smoking not only contributes to the pathogenesis of COPD but also has a catabolic effect on body composition, appetite suppression, and systemic inflammation, all of which can lead to weight loss and muscle wasting. Landbo et al.[85] and Schols et al.[29] have demonstrated that smoking correlates with increased metabolic demand and reduced dietary intake, particularly in patients with chronic respiratory disease. From an Indian perspective, Mathur et al.[86] observed a higher prevalence of undernutrition among current smokers with COPD, underscoring the dual harm posed by continued tobacco use—both pulmonary and nutritional.

Alcohol consumption, while less prevalent than smoking, was still notable, with 20.8% of patients being regular drinkers. There was no statistically significant association between alcohol consumption and nutritional status This result is consistent with several Indian and global studies where alcohol use in COPD patients has not consistently shown a strong or independent association with malnutrition, especially when compared to more dominant factors like smoking, disease severity, and socioeconomic status. However, in some populations, chronic heavy alcohol use has been linked to lower BMI, protein-calorie malnutrition, and micronutrient deficiencies, especially when combined with poor dietary intake and liver dysfunction.This is more often observed in alcohol-dependent individuals than in occasional or moderate drinkers.

Patel et al.[87] in a study on lifestyle factors in Indian COPD patients, reported that alcohol use was not a significant independent predictor of poor nutritional status. Dalrymple et al.[88] observed that in elderly patients with chronic diseases, alcohol's impact on nutrition was secondary to smoking and comorbidity burden.

3. Comorbidities

Another significant association observed in our cohort was between malnutrition and the presence of comorbidities, including diabetes mellitus, hypertension, and cardiovascular disease. This is consistent with global studies such as that by Mekov et al.(89) who found that comorbid chronic illnesses increase the risk of malnutrition by compounding physical inactivity, polypharmacy, and nutritional neglect. In India, Koul et al.(83) observed that COPD patients with multiple comorbid conditions, especially in rural areas, were more likely to be undernourished and sarcopenic. These patients often face diagnostic delays, inconsistent follow-up, and poor access to integrated care services, all of which exacerbate nutritional risk.

4. Nutritional Status

In the assessment of nutritional status among 101 COPD patients, Body Mass Index (BMI) alone classified 39 patients (38.6%) as underweight, 47 patients (46.5%) as having a normal BMI, 13 patients (12.9%) as overweight, and only 2 patients (2.0%) as obese. These numbers suggest that the majority of the study population maintains a seemingly adequate or healthy body weight. However, a closer look using the Mini Nutritional Assessment (MNA) tool paints a markedly different picture. Nutritional assessment using the Mini Nutritional Assessment (MNA) tool revealed that among the 101 patients, 42 (41.6%) are identified as "at risk of malnutrition," which is the largest group. This was followed by 27 (26.7%) patients who are categorized as malnourished, and 32 (31.7%) patients who had a normal nutritional status. Underweight individuals had the highest proportion of malnourished (42.1%) and at risk of malnutrition (47.4%) cases, with only 10.5% having normal nutritional status.Among those with normal BMI, 52.2% had normal nutritional status, while

13% were malnourished and 34.8% were at risk.In the overweight category, a majority (58.3%) were at risk of malnutrition, while 25% had normal nutritional status and 16.7% were malnourished.Obese individuals showed a 50-50 distribution between "at risk" and "normal" nutritional status, with no malnourished cases. In contrast, BMI alone identified far fewer cases, missing many patients with “normal” weight but underlying nutritional deficits. The association between MNA classification and BMI was statistically significant, underscoring the discrepancy between the two measures. This shows that BMI alone may fail to identify early or functional nutritional deficits, especially in overweight or obese individuals where low body weight is not evident.

These findings closely mirror those of Stephenson et al.[11] , who in a cohort of 86 COPD patients found 22% malnourished and 43% at risk per MNA, yet only 28% had a low BMI — reinforcing that BMI underestimates the true burden of malnutrition. They also reported a significant correlation between MNA and CAT scores , which was similarly reflected in the current study

Benedik et al.(8) studied 108 hospitalized COPD patients and found that while BMI identified only 14% as malnourished, MNA flagged 55% at risk. They reported significant differences in functional parameters across MNA categories.

Mete et al.(9) reported 17% malnourished and 52% at risk in a Turkish outpatient COPD cohort using MNA, with strong statistical significance between MNA and BMI categories (p = 0.001) and notably lower MNA scores in malnourished patients . The findings of this study align closely with this distribution and statistical pattern.

Another Indian study by Mathur et al.[86] also supports these conclusions. In their study, 37.9% of COPD patients were underweight, but nearly 60% were nutritionally deficient when assessed via MNA or FFMI. They observed significant associations between BMI, MNA, and GOLD stages

In summary, this study reaffirms a now well-documented trend: BMI alone is insufficient to identify malnutrition in COPD, and MNA is a far more reliable and comprehensive tool, capturing nutritional risks that BMI tends to overlook, especially in patients with preserved body weight but impaired dietary intake, mobility, or muscle mass.

5. Disease Severity and Pulmonary Function

In our prospective observational study involving 101 COPD patients, we observed a statistically significant association between increasing GOLD stage and declining nutritional status, as assessed by the Mini Nutritional Assessment (MNA) tool. This finding substantiates the broader clinical understanding that malnutrition is not merely a complication of advanced COPD but a progressive consequence that begins to manifest as early as the moderate stage of disease.

Our cohort was primarily composed of patients in GOLD II (moderate) and GOLD III (severe) stages. When stratified by GOLD stage, the distribution of nutritional status was as follows:

- In Grade I COPD patients, Only 22.2% were at risk of malnutrition, and none were malnourished.
- In Grade II COPD patients, 52.8% were at risk of malnutrition, and 20.8% were malnourished.
- In Grade III COPD patients 40.9% of patients were malnourished and an equal proportion (40.9%) were at risk.

- In Grade IV COPD patients, 80% were malnourished, and the remaining 20% were at risk—none had normal nutritional status.

These distributions revealed that while malnutrition was largely absent in mild COPD, its prevalence increased progressively through moderate and severe stages. The most nutritionally vulnerable group in our study was GOLD III, where over half were already malnourished and nearly all the rest were at risk. A statistically significant correlation was established between GOLD stage and MNA classification , confirming the trend that as airflow limitation worsens, nutritional reserves decline.

The findings resonate closely with global data. Mete et al.(9) conducted a study on 105 stable COPD patients in Turkey and reported a similar trend: the prevalence of malnutrition increased with GOLD severity, with 41.2% of GOLD IV patients malnourished, and a total of 85% of GOLD III and IV patients being either malnourished or at risk. Their study reported a strong statistical association between GOLD stage and nutritional deterioration. Interestingly, like our cohort, they noted that a large share of at-risk patients were in the GOLD II category.

Benedik et al.(8) studied 108 hospitalized patients in Slovenia and reported a sharp decline in MNA scores with advancing GOLD stages, particularly GOLD III and IV, with a significant p-value .Their conclusion reinforced the idea that nutritional status in COPD deteriorates in tandem with pulmonary function.

In a smaller Japanese study by Furutate et al(73) involving 68 elderly COPD patients, researchers found a strong inverse correlation between MNA scores and FEV_1% predicted—a spirometric proxy for GOLD stage. Their findings were statistically significant, supporting the observation that malnutrition intensifies as lung function declines.

From an Indian standpoint, the study by Koul et al.[83] is particularly relevant. Conducted on 122 COPD patients in rural North India, the researchers reported that malnutrition was present in 41% of GOLD III and 59% of GOLD IV patients. They observed only 5% malnutrition in GOLD I, but the trend sharply escalated with each GOLD stage, similar to our own findings.

What sets our study apart is the emphasis on GOLD II as a critical inflection point. While most studies highlight GOLD III and IV as the stages where malnutrition becomes overt, we observed that even in GOLD II, a majority (73.6%) were either malnourished or at risk. This has profound clinical implications because it emphasizes the need for early screening and intervention, even before the disease becomes severe. Our results align with the GOLD 2023 guidelines, which advocate for comprehensive assessment of comorbidities, including nutrition, starting from moderate COPD.

6. CAT Score and mMRC Grading

This Study identified a statistically significant association between symptom burden—measured by the COPD Assessment Test (CAT)—and nutritional status. It was observerd that 60.4% of patients belonged to the medium CAT category (scores 10–20), and 24.8% were in the high-impact range (>20). This distribution illustrates that a substantial proportion of COPD patients experience moderate-to-severe symptom burden.It was observed that among

- In Low CAT Impact category, 66.7% had normal nutritional status, and 33.3% were at risk for malnutrition. Importantly, none were malnourished, indicating that those with well-controlled symptoms tend to maintain adequate nutrition
- In Medium CAT Impact category nearly half of the patients (48.3%) were at risk of malnutrition, and 10% had malnourishment.

- In High CAT Impact category: Among those with a high CAT score, the majority—56.5%—were malnourished, and 39.1% were at risk. Only 4.3% retained normal nutritional status, indicating a significant deterioration in nutritional health with increasing symptom severity.
- In Very High CAT Impact category about 83.3% of patients were malnourished, and the remaining 16.7% were at risk. Specifically, patients who were malnourished or at risk of malnutrition had significantly higher CAT scores, highlighting the interplay between symptom severity and nutritional decline. Importantly, these higher CAT scores were predominantly observed among patients with compromised nutritional status, suggesting that worsening symptoms are either a consequence of malnutrition or contribute to its progression.

Furutate et al.[73], in a study involving 68 elderly COPD patients, observed that patients with CAT scores ≥10 had significantly lower MNA scores, establishing a clear link between symptom severity and poor nutrition. Their analysis indicated that even moderate symptom levels could reflect underlying nutritional vulnerability, especially in older adults.

Stephenson et al[11] further supported this association in a cohort of 86 Australian COPD patients. They reported that malnourished individuals had a median CAT score of 23, significantly higher than the median score of 14 in well-nourished individuals, with a statistically significant inverse correlation between MNA and CAT. This finding emphasizes that as symptom burden increases, nutritional status deteriorates, either due to increased metabolic demands, fatigue-related anorexia, or dyspnea interfering with food intake.

From the Indian perspective, Koul et al.[83] evaluated 122 COPD patients and observed that 40% of malnourished patients had CAT scores ≥20, indicating high symptom impact. They confirmed a statistically significant association between CAT scores and sarcopenia/malnutrition. Their study, conducted in a rural Indian setting, echoes our own findings and reinforces that in resource-limited settings, patients with high symptom burden are particularly vulnerable to nutritional compromise.

Taken together, these findings across different populations reveal a consistent and clinically meaningful association: patients with worsening CAT scores are far more likely to be malnourished or at risk. This relationship may be bidirectional. On one hand, malnutrition leads to fatigue, weakness, and reduced exercise tolerance, thereby exacerbating subjective symptom burden. On the other, patients with severe symptoms may experience decreased appetite, increased dyspnea while eating, or depression, all of which contribute to poor intake and nutritional decline.

The implications of these findings are significant. CAT is already widely used as a symptom monitoring tool in COPD, but its correlation with nutritional status highlights its potential role in identifying patients who need dietary intervention. When a patient presents with a CAT score in the high-impact range (>20), clinicians should be prompted to screen for malnutrition using structured tools like MNA—even in the absence of low BMI.

In our study of 101 COPD patients, we observed a statistically significant association between dyspnea severity, as measured by the Modified Medical Research Council (mMRC) scale, and nutritional status. Among the participants, 41.6% were classified as mMRC grade 2, and 20.8% were grade 3.

In mMRC Grade 0 (No Breathlessness) group 25% were at risk of malnutrition while in mMRC Grade 1 (Mild Breathlessness) group. 57.7% were at risk for malnutrition

In mMRC Grade 2 (Moderate Breathlessness) group more than one-fourth (27.5%) of the patients were malnourished while 45% were at risk of malnutrition

In mMRC Grade 3 (Severe Breathlessness) group nearly two-thirds of the patients (65%) were malnourished, and 30% were at risk of malnutrition. This highlights the finding that as severity of breathlessness increases, nutritional status of the patient starts to fall.

Malnutrition was markedly more common in patients with mMRC grade ≥2, indicating a strong and clinically relevant correlation between breathlessness and undernutrition.

These findings are similar tom hose reported by Mete et al.[9], who observed that COPD patients with mMRC grade 3 had a 7-fold increased risk of malnutrition, while those with grade 4 had 22 times higher risk. Their study confirmed a statistically significant association between worsening dyspnea and nutritional status. Scichilone et al.[74] also reported a similar correlation in elderly COPD patients, where higher mMRC scores were inversely correlated with MNA scores, further supporting the functional-nutritional interplay in advanced COPD.

Koul et al.[83] also observed that malnutrition and sarcopenia were significantly more prevalent in patients with higher mMRC grades (≥3), suggesting that functional limitation due to dyspnea may have a cascading effect on muscle mass and nutritional intake. Increased dyspnea not only reflects disease severity but also contributes to reduced caloric intake, anorexia, and physical inactivity, all of which aggravate nutritional decline.

Severe breathlessness can limit a patient's ability to eat, walk, or engage in activities of daily living, leading to anorexia, muscle loss, and sarcopenia. Conversely, malnutrition further weakens respiratory and peripheral muscles, worsening the sensation of dyspnea. This creates a vicious cycle, well recognized in COPD literature, in which functional impairment and malnutrition perpetuate each other and accelerate disease progression.

From a clinical perspective, the mMRC scale is a simple yet powerful tool not only for assessing breathlessness but also for identifying patients at risk of nutritional decline. Our study reinforces the need to integrate mMRC grading into nutritional screening protocols, particularly in resource-limited settings where advanced tools like body composition analysis or CT imaging are not feasible.

Both CAT score and mMRC grade emerged as strong indicators of nutritional vulnerability in COPD patients Incorporating CAT and mMRC assessments into routine screening can help clinicians identify patients who would benefit from early nutritional intervention and pulmonary rehabilitation, thereby improving overall COPD management.

7. Treatment Patterns

In the present study, we examined whether different pharmacological treatment regimens—ranging from monotherapy to dual and triple inhaler therapy—had any association with nutritional status as. Among the participants, 34.7% were newly diagnosed and not yet initiated on inhalers, while 19.8% were on triple therapy, and others were receiving either LABA/LAMA combinations or single bronchodilators. Our results showed no statistically significant association between the type of inhaler therapy and MNA category, suggesting that the choice of inhaled treatment does not independently predict nutritional outcomes.

It was observed that patients on Dual and Triple therapy had better nutritional status with very few being malnourished. These findings suggest that patients on optimized or stable treatment regimens are more likely to have better nutritional outcomes, possibly due to better disease control and improved quality of life.Patients on SABA or Single Inhaler therapy and newly diagnosed cases had higher proportion of cases that were malnourished or were at risk of malnutrition

This observations were similar to the findings from global studies. Agustí et al.[26] emphasized that pharmacological treatment in COPD primarily reflects disease severity, symptom burden, and exacerbation risk, rather than nutritional status per se. Moreover, the GOLD 2023 guidelines reaffirm that treatment intensity—such as escalation to dual or triple therapy—is guided by clinical need and not nutritional markers. To date, no major international study has demonstrated a direct causal relationship between inhaler use and malnutrition in COPD.

In India, Mathur et al.[86] examined the nutritional status and treatment profiles of 97 stable COPD patients and reported that *t*here was no statistically significant difference in nutritional markers, including BMI and FFMI, among patients on different treatment regimens. Nutritional status was more closely associated with GOLD stage and symptom severity than with the type of pharmacological therapy employed.

The high percentage of untreated or newly diagnosed patients (34.7%) in our study may reflect delayed diagnosis, lack of awareness, or economic barriers, particularly in low-resource settings. These patients may already be in advanced stages of the disease when they present, and without proper symptom control, they are more susceptible to weight loss, fatigue, and functional decline.

Furthermore, while our study and others show no direct pharmacological-nutritional link, it is reasonable to hypothesize that patients receiving optimal therapy may experience improved appetite, reduced dyspnea, and enhanced activity levels, all of which can positively influence nutrition. This underlines the need for holistic COPD care, which includes not only pharmacologic optimization but also nutritional screening and intervention.

Occupational and Environmental Factors

Although the association between occupation and MNA classification was not statistically significant, certain occupational trends emerged:

Among housewives, 28.6% were malnourished and 47.6% at risk of Malnutrition. Farmers showed a similar trend: 25% malnourished and 50% were at risk of malnutrition. Among labourers, 15% were malnourished and 45% at risk, while 40% maintained normal nutritional status. Traffic police workers had similar outcomes, with 26.7% malnourished and 46.7% at risk. Despite physically active roles, these groups still show high nutritional vulnerability—possibly due to irregular eating patterns, stress, or inadequate diet. These findings may reflect socioeconomic limitations or limited access to nutrition education and healthcare.

An important observation in our study was the notable proportion of COPD patients with biomass fuel exposure who had poor nutritional status. Among the 37.6% of patients with a history of biomass fuel exposure, 36.8% were malnourished and another 36.8% were at risk of malnutrition. This highlights a potential link between biomass exposure and compromised nutritional status

These results closely mirror findings from other Indian studies. Kurmi et al.(82) reported a strong link between biomass smoke exposure and increased malnutrition risk among rural Indian women , while Koul et al.(83) observered significantly poorer nutritional outcomes in patients with rural residence and biomass exposure. The impact is compounded by socioeconomic deprivation, poor diet quality, and limited healthcare access. Our study reflects this demographic reality, especially among women and manual laborers exposed to indoor or occupational pollutants.

International studies supports these findings as well. Po et al.[90] and Hnizdo et al[23] documented that occupational dust and fume exposure contributes to non-smoking-related COPD and often affects nutritionally vulnerable groups. Our results also suggest that biomass and occupational exposures may play a contributory role not only as respiratory risk factors but also as potential indicators of poor nutritional status, especially in resource-limited settings. Clinicians should consider environmental history when assessing COPD patients and integrate nutritional support with preventive strategies like clean fuel adoption and workplace protections.

Our study underscores that malnutrition in COPD is a multifactorial issue closely associated with increasing disease severity (GOLD grade), symptom burden (CAT score), dyspnea (mMRC grade), and environmental exposures such as biomass fuel and occupational pollutants. The Mini Nutritional Assessment (MNA) proved to be a more sensitive tool than BMI, effectively identifying at-risk patients even in moderate stages of COPD. We also found significant associations between malnutrition and smoking status, comorbidities, advanced age, and female gender—particularly among rural, biomass-exposed housewives—highlighting the interplay of clinical, environmental, and socioeconomic factors. While treatment type did not directly correlate with nutritional status, the high proportion of untreated patients suggests delayed diagnosis may indirectly contribute to nutritional decline.

STRENGTHS AND LIMITATIONS OF THE STUDY

Strengths of the study

1. **Comprehensive Data Collection**:

   The study collected detailed demographic, clinical, and nutritional data from a cohort of 101 COPD patients, providing a holistic view of the factors influencing disease progression and outcomes. This comprehensive approach allowed for a thorough analysis of the interplay between lifestyle factors, comorbidities, and nutritional status.

2. **Use of Validated Tools**:

   The study employed validated tools such as the Mini Nutritional Assessment (MNA) for nutritional screening, the COPD Assessment Test (CAT) for symptom evaluation, and GOLD guidelines for disease severity classification. The use of these standardized tools enhances the reliability and comparability of the findings with other studies

3. **Focus on Nutritional Status**:

   The study highlighted the high prevalence of malnutrition (22.8%) and malnutrition risk (51.5%) among COPD patients, emphasizing the importance of nutritional interventions in disease management. This focus on nutrition addresses a critical but often overlooked aspect of COPD care [3]

4. **Identification of Key Risk Factors**:

   The study identified smoking, alcohol consumption, and occupational exposures as significant risk factors for COPD, aligning with global trends and providing valuable insights for targeted prevention strategies

5. **Multidisciplinary Approach**:

   The study considered multiple dimensions of COPD management, including pharmacological treatments, pulmonary rehabilitation, and nutritional support. This multidisciplinary approach reflects real-world clinical practice and underscores the need for integrated care.

LIMITATIONS OF THE STUDY

1. **Sample Size and Representativeness**:

   The study included 101 patients, which, while sufficient for initial analysis, may limit the generalizability of the findings. A larger sample size would provide more robust statistical power and allow for subgroup analyses, such as comparisons between urban and rural populations or different occupational groups.

2. **Single-Center Study**:

   The study was conducted at a single center, which may introduce selection bias and limit the generalizability of the results to other populations or healthcare settings. Multi-center studies involving diverse patient populations would enhance the external validity of the findings.

3. **Cross-Sectional Design**:

   The cross-sectional design of the study limits the ability to establish causal relationships between variables. For example, while the study found associations between malnutrition and disease severity, it cannot determine whether malnutrition causes worse outcomes or vice versa. Longitudinal studies are needed to explore these causal relationships.

4. **Self-Reported Data**:

   Some data, such as smoking status and alcohol consumption, were self-reported, which may introduce recall bias or underreporting. Objective measures, such as cotinine levels for smoking or biomarkers for alcohol use, could improve the accuracy of these findings.

5. **Limited Exploration of Environmental Factors**:

   While the study identified occupational exposures and biogas exposure as potential risk factors, it did not extensively explore other environmental factors, such as air pollution or indoor biomass fuel use. Future studies should include detailed assessments of environmental exposures to better understand their impact on COPD.

6. **Lack of Follow-Up Data**:

   The study did not include follow-up data to assess the long-term impact of interventions, such as nutritional support or smoking cessation programs, on patient outcomes. Longitudinal studies with follow-up assessments would provide valuable insights into the effectiveness of these interventions.

7. **Potential Confounding Factors**:

   The study did not account for all potential confounding factors, such as socioeconomic status, access to healthcare, or genetic predispositions, which may influence COPD outcomes. Future studies should incorporate these variables to provide a more comprehensive understanding of the disease

CONCLUSION

In this prospective observational study assessing the role of the Mini Nutritional Assessment (MNA) in detecting malnutrition among COPD patients, it was observed that 26.7% were malnourished and 41.6% were at risk, despite nearly half of the cohort having a normal BMI (46.5%). In contrast, BMI identified only 38.6% of patients as underweight, missing a substantial portion of nutritionally compromised individuals. This highlights the superior sensitivity of MNA over BMI, as it captures broader indicators such as dietary intake, mobility, and psychological status—making it especially useful in detecting early or hidden malnutrition. A statistically significant association was observed between MNA classification and GOLD grading ($p < 0.05$). As the severity of airflow limitation increased, so did the prevalence of malnutrition. Patients in GOLD 3 and GOLD 4 exhibited a marked increase in malnutrition rates, with 80% of GOLD 4 patients being malnourished.

Similarly, CAT score impact showed a strong association with nutritional status ($p < 0.05$). Patients with higher CAT scores—reflecting greater symptom burden and reduced quality of life—were significantly more likely to be malnourished. In particular, 83.3% of patients with very high CAT impact were malnourished. The mMRC dyspnea grading also demonstrated a statistically significant association with MNA status ($p < 0.05$). Patients with higher mMRC grades, particularly grade 3, had the worst nutritional profiles.

Early identification of malnourished or at-risk COPD patients should be done routinely using the MNA scale that will allow for timely interventions like nutritional supplementation and counseling. These measures can improve outcomes and enhance quality of life, and should be integrated into routine COPD care.

SUMMARY

The study included 101 COPD patients, with 63.4% males and 36.6% females.

- The median age was 60 years; older patients, especially those above 65, had higher rates of malnutrition.

- Rural patients (47.5%) had worse nutritional status than urban patients; 35.4% of rural patients were malnourished versus 18.9% of urban.

- Active smokers comprised 34.7% of the cohort and had significantly higher malnutrition rates ($p < 0.05$); passive smoking was also prevalent (21.8%).

- Alcohol use was observed in 20.8% of patients but showed no significant correlation with nutritional status.

- Biomass fuel exposure was present in 37.6% of patients, predominantly among rural women and laborers, and was significantly linked to malnutrition ($p = 0.012$).

- MNA tool detected 26.7% of patients as malnourished and 41.6% as at risk, whereas BMI alone identified only 38.6% as underweight.

- Many patients with normal BMI (46.5%) were actually nutritionally compromised, showing the limitation of BMI alone; MNA was statistically more sensitive ($p < 0.001$).

- Among those with more than one comorbidity (34.7%), the malnutrition rate was significantly higher.

- In GOLD I stage, no patients were malnourished; in GOLD II, 66% were either malnourished or at risk; in GOLD III, 92% had nutritional compromise; and in GOLD IV, 100% were either malnourished or at risk.

- A statistically significant association was found between GOLD stage and nutritional status ($p = 0.003$).

- Patients with higher CAT scores had worse nutritional profiles; 83.3% of those with very high CAT scores were malnourished ($p = 0.004$).

- A strong relationship was observed between mMRC grading and malnutrition; 65% of patients with grade 3 dyspnea were malnourished ($p = 0.002$).

- Patients with rhonchi on examination were more likely to be malnourished compared to those with NVBS ($p = 0.004$).

- Occupational trends showed that housewives, traffic police, and laborers had higher malnutrition prevalence, but no statistically significant link was found with occupation ($p = 0.657$).

- 34.7% of the cohort were newly diagnosed and untreated; no direct association was found between inhaler regimen and nutritional status ($p = 0.148$).

- Significant nutritional decline was noted even in moderate COPD (GOLD II), highlighting the need for early screening.

- Environmental, functional, and clinical factors such as smoking, symptom burden, comorbidities, and biomass exposure strongly influence nutritional outcomes.

- Routine use of MNA is recommended for early detection of malnutrition, especially in moderate-to-severe COPD and among socioeconomically vulnerable populations.

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ANNEXURES – I

KAHERs JNMC BELAGAVI

<u>INFORMED CONSENT FORM</u>

“Role of Mini Nutritional Assessment (MNA) tool to Detect malnutrition in patients with COPD: Prospective Observational Study”

Introduction: Malnutrion is an important risk factor which can determine the severity of COPD in a patient. We are doing this procedure to find out how many COPD patients visiting our hospital are at risk of being malnourished

Explanation of procedure: Height and weight will be checked to determine BMI. Various other antropometric measurements will be taken to assess your nutritional status.you will undergo a test called spirometry to determine the functional capacity of your lungs You will be interviewed based on MNA which is a questionnaire to determine your risk of malnutrition.

Withdrawal from participation in the study: Your decision regarding participation in study will not change present or future health care services offered to you at KLES Dr. Prabhakar Kore Hospital Belgaum. You would simply be excluded from the study if you wish to, and all your details shall be kept confidential and you will get routine line of management

Participation in this study in voluntary. You will be free to decide whether to participate in this study or continue participation once enrolled. In case you decide to withdraw your participation, you are free to do so. However, please convey the decision to the principal investigator.

Possible benefits from participating in the study: You will not get any individual benefits by participating in this study however the data gathered will help population at large.

Possible risks from participating in the study: There are no risks involved in participating in this study.

Privacy and confidentiality: The information collected from you will be coded, to prevent any person to identify you. Your identity will never be revealed. The data collected from you will be kept confidential and only processed or aggregated data will be used for publication. **Financial incentives:** You will not receive any payment for participating in this study. **Cost of investigations** done during the course of study will be paid by the **principal investigator**

Authorization for publication of aggregated data: Results obtained after processing of the aggregated data will be published for scientific purpose and or presented to scientific groups. However, your identity will never be revealed.

Questions: In case of any questions with regard to this study, you are free to contact:

If you have any question or complaints with regard to your right as study participant you may contact Dr Harsha Hegde, Chairperson, Ethical committee of JNMC, 0831-2473777 Extension 4052.

Legal rights: By signing this consent form, we are not waving any of your legal rights

CONSENT STATEMENT

I am making a voluntary decision to participate in the study "**Role of Mini Nutritional Assessment (MNA) tool to Detect malnutrition in patients with COPD: Prospective Observational Study**". My signature below indicates that I have decided to participate and I have read the information provided above or the information provided above has been read to me in the language that I understand best. I was given the opportunity to ask questions and that they have been answered to my satisfaction.

Name of the participant:

Signature or left thumb impression of the participant: Name of the witness:

Signature or left thumb impression of the witness: Name of the investigator:

Signature of the investigator:

ANNEXURES – II

IN KLE'S DR. PRABHAKAR KORE HOSPITAL AND MEDICAL RESEARCH CENTRE, BELAGAVI.

PROFORMA

CASE NO		IP/OP NO	
NAME			
AGE/SEX		ADDRESS	
OCCUPATION			
RELIGION			

Complaints and Case history	
CAT SCORE	
mMRC Grading	
Past history	
Previous hospitalization in the last 2years due to COPD exacerbations	

Family history		
Personal history • ALCOHOLISM • SMOKING • COMORBIDITIES		
Treatment history		
Vitals :		
Temperature		
Pulse		
Respiratory rate		
Blood pressure		
PHYSICAL EXAMINATION:	Yes	No
Pallor		
Icterus		
Cyanosis		
Clubbing		
Lymphadenopathy		
Edema		
ANTHROPOMETRY VALUES		
HEIGHT		
WEIGHT		
BMI		

MID ARM CIRCUMFERENCE	
CALF CIRCUMFERENCE	
SPIROMETRY VALUE PERCENTAGE	
FEV1	
FVC	
FEV1/FVC	
STAGE OF COPD (According to GOLD 2023)	

MODIFIED MRC DYSPNEA SCALE[a]

PLEASE TICK IN THE BOX THAT APPLIES TO YOU | ONE BOX ONLY | Grades 0 - 4

mMRC Grade 0.	I only get breathless with strenuous exercise.	☐
mMRC Grade 1.	I get short of breath when hurrying on the level or walking up a slight hill.	☐
mMRC Grade 2.	I walk slower than people of the same age on the level because of breathlessness, or I have to stop for breath when walking on my own pace on the level.	☐
mMRC Grade 3.	I stop for breath after walking about 100 meters or after a few minutes on the level.	☐
mMRC Grade 4.	I am too breathless to leave the house or I am breathless when dressing or undressing.	☐

[a] Fletcher CM. BMJ 1960; 2: 1662.

Name: Today's Date:

COPD Assessment Test

How is your COPD? Take the COPD Assessment Test (CAT)

This questionnaire will help you and your healthcare professional measure the impact COPD (Chronic Obstructive Pulmonary Disease) is having on your wellbeing and daily life. Your answers and test score, can be used by you and your healthcare professional to help improve themanagement of your COPD and get the greatest benefit from treatment.

Example: I am very happy (0) (X) (2) (3) (4) (5) I am sad

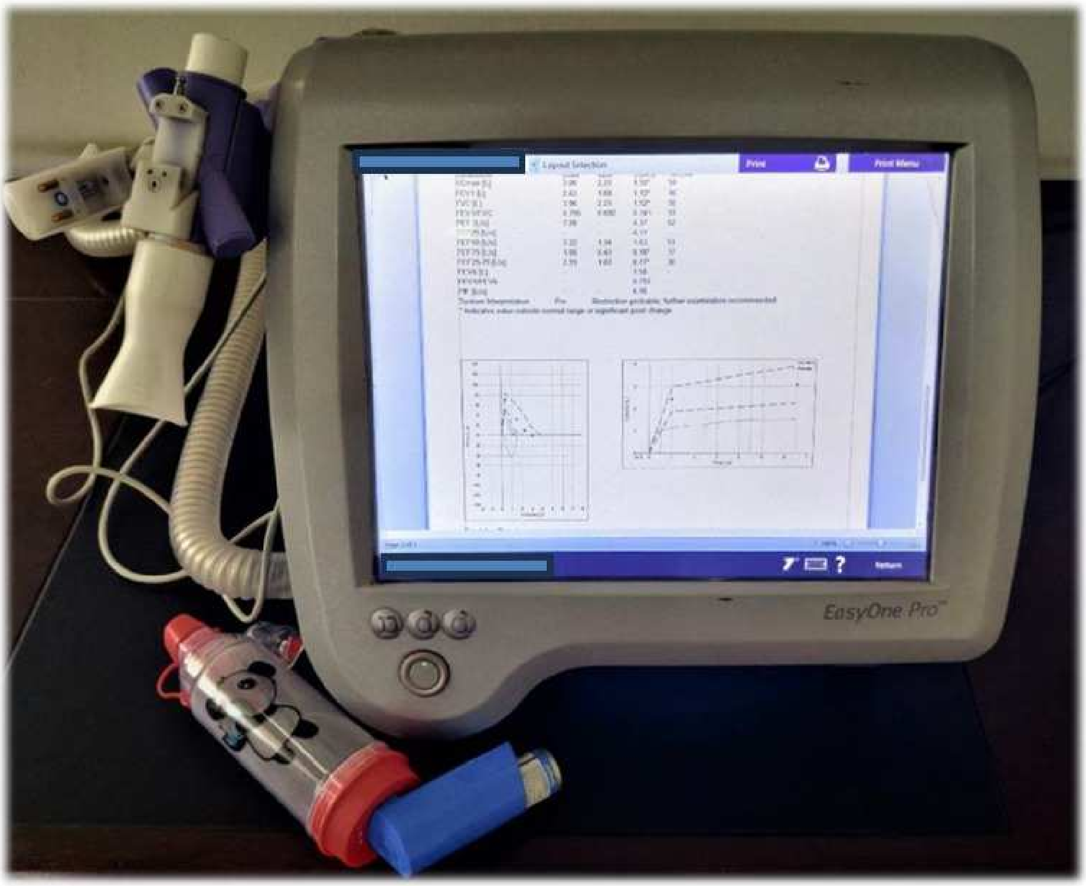
			SCORE
I never cough	0 1 2 3 4 5	**I cough all the time**	
I have no phlegm (mucus) in my chest at all	0 1 2 3 4 5	**My chest is full of phlegm (mucus)**	
My chest does not feel tight at all	0 1 2 3 4 5	**My chest feels very tight**	
When I walk up a hill or one flight of stairs I am not breathless	0 1 2 3 4 5	**When I walk up a hill or one flight of stairs I am very breathless**	
I am not limited doing any activities at home	0 1 2 3 4 5	**I am very limited doing activities at home**	
I am confident leaving my home despite my lung condition	0 1 2 3 4 5	**I am not at all confident leaving my home because of my lung condition**	
I sleep soundly	0 1 2 3 4 5	**I don't sleep soundly because of my lung condition**	
I have lots of energy	0 1 2 3 4 5	**I have no energy at all**	

CLICK TO GET YOUR TOTAL SCORE!

ANNEXURES – III

PHOTOGRAPHS

SPIROMETER



Patient ID	Sex	Age	Residence	Smoking Status	Alcohol Habits	Occupation	Biogas	Comorbidities	Weight (kg)	Height (cm)	BMI	BMI Interpretation	Mid Arm Circu	Calf Circu	CAT Score	CAT Score Impact	mMRC	Pulse	Blood Pressure	Spo2	Physical Exami	Respiratory Syste	FEV1	FVC	FEV1/ FVC Ratio	GOLD Grading
6383336	Male	64	Hindalga	Smoker	Non-drinker	Traffic police	No	None	66	180	20.462963	#NAME?	26.7	38	13	#NAME?	1	96	123/81	98	WNL	Rhonchi	73	108	67.5925926	#NAME?
6861999	Female	63	Yellur	Passive smoker	Non-drinker	Housewife	Yes	Diabetes	52	168	18.4240363	#NAME?	22	32	22	#NAME?	2	98	129/86	99	WNL	Rhonchi	53	81	65.4320988	#NAME?
6618716	Female	75	Shahapur	Ex-smoker	Non-drinker	Housewife	No	CVA	49	165	17.9981635	#NAME?	25.7	33	10	#NAME?	1	84	115/83	98	WNL	Rhonchi	60	95	63.1578947	#NAME?
7810370	Male	69	Ramdurg	Passive smoker	Non-drinker	Farmer	No	Diabetes	76	198	19.2642828	#NAME?	24.4	36	11	#NAME?	1	84	117/72	95	WNL	NVBS	85	112	75.8928571	#NAME?
6757998	Female	56	Athani	Non-smoker	Non-drinker	Housewife	Yes	CVA, Hypertension	44	158	17.6253805	#NAME?	25.7	37	16	#NAME?	1	61	113/88	100	WNL	Rhonchi	54	90	60	#NAME?
7250156	Male	68	Sulebhavi	Ex- Smoker	Ex-Drinker	Farmer	Yes	IHD,CVA, Epilepsy	50	174	16.5147311	#NAME?	21	30	34	#NAME?	3	60	123/73	96	WNL	Rhonchi	29	57	50.877193	#NAME?
7235143	Male	65	Ramdurg	Non-smoker	Non-drinker	Farmer	No	Diabetes, Hypertension	65	172	21.8615406	#NAME?	29	37	10	#NAME?	2	71	135/87	97	WNL	NVBS	58	94	61.7021277	#NAME?
7148761	Female	61	Sadashiv Nagar	Passive smoker	Non-drinker	Housewife	Yes	CVA, Hypertension	50	170	17.3010381	#NAME?	24	33	24	#NAME?	3	90	134/81	100	WNL	Rhonchi	35	59	59.3220339	#NAME?
6772708	Female	54	Shahapur	Passive smoker	Occasional Drinker	Housewife	No	IHD	53	156	21.6006626	#NAME?	26.2	35	11	#NAME?	0	92	120/70	97	WNL	NVBS	82	100	82	#NAME?
6814252	Female	68	Ganeshpur	Smoker	Non-drinker	Housewife	Yes	IHD, Hypertension, CVA	46	163	17.3134104	#NAME?	20.5	30	35	#NAME?	3	73	118/84	97	WNL	Rhonchi	29	52	55.7692308	#NAME?
7275312	Male	70	Hindalga	Ex-smoker	Ex-Drinker	Traffic police	No	IHD,CVA	50	162	19.1373012	#NAME?	26.7	34	13	#NAME?	1	87	138/78	95	WNL	NVBS	64	100	64	#NAME?
7152376	Female	58	Athani	Passive Smoker	Occasional Drinker	Housewife	Yes	Hypertension	48	164	17.9558399	#NAME?	25.5	32	20	#NAME?	2	76	140/88	96	WNL	Rhonchi	51	98	52.0408163	#NAME?
7857622	Female	63	Nehru Nagar	Smoker	Non-drinker	Housewife	Yes	Diabetes, IHD, CVA	48	170	16.6089965	#NAME?	23	34	29	#NAME?	3	75	129/79	96	WNL	Rhonchi	39	62	62.9032258	#NAME?
6703154	Male	68	Shahapur	Smoker	Non-drinker	Traffic police	Yes	Diabetes, IHD	75	162	28.5779607	#NAME?	26	39	16	#NAME?	2	73	116/87	96	WNL	Rhonchi	55	103	53.3980583	#NAME?
7267052	Female	63	Bailhongal	Passive smoker	Non-drinker	Housewife	No	Nil	54	160	21.015625	#NAME?	24.2	36	8	#NAME?	0	62	114/83	100	WNL	NVBS	82	102	80.3921569	#NAME?
6896222	Male	67	Sadashiv Nagar	Smoker	Occasional Drinker	Traffic police	Yes	Hypertension, Diabetes, CVA	60	162	22.8623685	#NAME?	24	30	23	#NAME?	2	84	126/71	99	WNL	Rhonchi	59	91	64.8351648	#NAME?
6117072	Female	56	Bailhongal	Non-smoker	Non-drinker	Housewife	Yes	Hypertension, Diabetes	52	170	17.9930796	#NAME?	24.5	40	11	#NAME?	2	89	128/79	97	WNL	NVBS	60	91	65.9340659	#NAME?
7735809	Female	45	Hindalga	Ex-smoker	Occasional Drinker	Housewife	No	CVA	59	160	22.7377317	#NAME?	25.8	32	14	#NAME?	2	98	140/85	97	WNL	Rhonchi	58	90	64.4444444	#NAME?
6759455	Female	53	Bailhongal	Passive Smoker	Non-drinker	Housewife	No	IHD	72	166	26.1286108	#NAME?	26.5	40	20	#NAME?	2	91	120/86	97	WNL	Rhonchi	51	93	54.8387097	#NAME?
6715169	Female	48	Hindalga	Passive smoker	Non-drinker	Housewife	Yes	Hypertension, Diabetes	60	170	20.7612457	#NAME?	26.6	33	18	#NAME?	1	83	123/73	97	WNL	NVBS	60	99	60.6060606	#NAME?
6710108	Female	76	Ramdurg	Smoker	Non-drinker	Housewife	Yes	Diabetes	56	165	20.7549263	#NAME?	29.2	40	10	#NAME?	2	96	123/77	95	WNL	Rhonchi	63	104	60.5769231	#NAME?
6184444	Female	58	Hanuman Nagar	Passive smoker	Non-drinker	Housewife	Yes	CVA, IHD	65	160	25.390625	#NAME?	26	35	28	#NAME?	3	69	113/82	98	WNL	Rhonchi	40	62	64.516129	#NAME?
7687040	Female	62	Tilakwadi	Passive smoker	Non-drinker	Housewife	Yes	Hypertension	53	172	17.9150892	#NAME?	22	33	19	#NAME?	2	64	127/70	99	WNL	NVBS	44	69	63.7681159	#NAME?
7087007	Male	72	Shahapur	Smoker	Non-drinker	Traffic police	No	Hypertension, Osteoarthritis	45	160	17.578125	#NAME?	22.3	30	16	#NAME?	2	69	127/85	96	WNL	Rhonchi	61	99	61.6161616	#NAME?
6574684	Female	52	Kakti	Passive smoker	Non-drinker	Housewife	Yes	IHD, Hypertension	50	170	17.3010381	#NAME?	26	33	19	#NAME?	2	83	119/70	96	WNL	NVBS	52	80	65	#NAME?
6837548	Male	65	Maratha Colony	Ex-smoker	Regular	Traffic police	Yes	Hypertension	59	180	18.2098765	#NAME?	21	31	21	#NAME?	3	90	138/90	100	WNL	Rhonchi	38	70	54.2857143	#NAME?
7452503	Male	70	Anjaneya Nagar	Ex-Smoker	Regular	Traffic police	Yes	Hypertension, Diabetes, CVA	52	168	18.4240363	#NAME?	22	33	19	#NAME?	2	86	122/82	95	WNL	Rhonchi	37	60	61.6666667	#NAME?
7039216	Male	44	Bailhongal	Smoker (cigarettes)	Occasional Drinker	Farmer	No	Diabetes	66	163	24.5622943	#NAME?	26.3	34	11	#NAME?	1	61	128/81	97	WNL	NVBS	83	106	78.3018868	#NAME?
7249160	Male	70	Basavan Kudachi	Ex- Smoker	Ex-Drinker	Farmer	No	CVA,IHD	48	170	16.6089965	#NAME?	24	32	32	#NAME?	3	87	116/78	97	WNL	Rhonchi	29	57	50.877193	#NAME?
6148155	Male	68	Chavat Galli	Smoker	Occasional Drinker	Traffic police	No	Hypertension,IHD	72	160	28.125	#NAME?	28	36	20	#NAME?	2	69	132/76	96	WNL	NVBS	42	86	48.8372093	#NAME?
7940555	Male	57	Macche	Ex-smoker	Ex-Drinker	Farmer	No	Hypertension, Diabetes	68	180	20.9876543	#NAME?	26	35	22	#NAME?	3	85	114/81	99	WNL	NVBS	38	69	55.0724638	#NAME?
7873855	Male	60	Bailhongal	Passive Smoker	Regular	Farmer	No	Diabetes	65	171	22.0490334	#NAME?	30	37	15	#NAME?	2	71	126/80	98	WNL	Rhonchi	52	95	54.7368421	#NAME?
7251502	Female	60	Udyambag	Passive smoker	Non-drinker	Housewife	Yes	Diabetes, CVA	59	179	18.4139072	#NAME?	25	30	21	#NAME?	2	65	116/84	99	WNL	Rhonchi	51	79	64.556962	#NAME?
7290415	Male	64	Khanapur Road	Ex-smoker (beedis)	Regular	Traffic police	No	Hypertension, Diabetes	62	164	23.0517549	#NAME?	24	31	24	#NAME?	3	90	129/81	99	WNL	NVBS	78	92	84.7826087	#NAME?
6130607	Male	53	Bailhongal	Smoker	Regular	Farmer	No	Hypertension, Diabetes	46	159	18.1726169	#NAME?	28.4	33	20	#NAME?	2	84	140/87	99	WNL	Rhonchi	72	90	80	#NAME?
7757412	Male	41	Khanapur	Ex-smoker (beedis)	Non-drinker	Labourer	No	CKD, Hypertension	74	188	20.862137	#NAME?	25.8	35	9	#NAME?	1	76	110/70	97	WNL	NVBS	81	103	78.6407767	#NAME?
7264804	Female	84	Shahapur	Passive Smoker	Non-drinker	Bank	No	IHD, Hypertension	80	161	31.0555992	#NAME?	26.2	42	19	#NAME?	2	70	140/80	99	WNL	Rhonchi	62	107	57.9439252	#NAME?
6724540	Female	51	Khanapur	Ex-smoker	Non-drinker	Housewife	Yes	CVA, Diabetes	50	169	17.5063898	#NAME?	28.4	31	13	#NAME?	1	63	126/82	95	WNL	Rhonchi	55	100	55	#NAME?
7798707	Male	43	Bailhongal	Smoker	Non-drinker	Labourer	No	None	61	171	20.7972342	#NAME?	23.1	36	13	#NAME?	2	71	120/77	99	WNL	Rhonchi	59	109	54.1284404	#NAME?
7987396	Male	59	Hindalga	Ex-smoker (beedis)	Regular	Traffic police	Yes	Hypertension, Diabetes	56	166	20.4087221	#NAME?	29.1	33	5	#NAME?	0	83	138/86	97	WNL	NVBS	80	101	79.2079208	#NAME?

Patient ID	A. Food intake	B. Weigh	C. Mobili	D. Psychological	E. Neuropsychologic	F. BMI (MNA)	G. Living indepe	H. Prescription	I. Pressure	J. Meals	K. Protei	L. Fruit/ Veget	M. Fluid	N. Mode	O. Self-view	P. Health	Q. Mid-arm circu	R. Calf circu	Screening Score	Assessment Score	Screening Interpretatio	Total Score	Nutritional Status Interp
6383336	1	3	2	2	2	#NAME?	1	1	1	2	1	1	1	2	2	1	#NAME?	1	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
6861999	1	1	2	2	2	#NAME?	1	0	1	1	0	0	0	2	1	1	#NAME?	1	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
6618716	2	1	2	2	2	#NAME?	1	0	1	1	1	1	1	2	1	1	#NAME?	1	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
7810370	1	3	2	2	2	#NAME?	1	0	1	2	1	1	1	2	2	2	#NAME?	1	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
6757998	2	2	2	2	2	#NAME?	1	0	1	2	1	0	1	2	1	1	#NAME?	1	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
7250156	1	0	2	2	0	#NAME?	1	0	1	0	0	0	0	2	0	0	#NAME?	0	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
7235143	2	1	2	2	2	#NAME?	1	0	1	2	1	0	1	2	2	1	#NAME?	1	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
7148761	1	0	2	0	2	#NAME?	1	0	1	0	1	1	1	2	0	0.5	#NAME?	1	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
6772708	2	3	2	0	2	#NAME?	1	1	1	2	1	1	1	2	2	2	#NAME?	1	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
6814252	0	0	2	0	2	#NAME?	1	0	1	1	0	0	0	2	0	0	#NAME?	0	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
7275312	1	2	2	2	2	#NAME?	1	0	1	2	1	1	0	2	1	2	#NAME?	1	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
7152376	1	2	2	2	2	#NAME?	1	0	1	2	1	0	1	2	1	1	#NAME?	1	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
7857622	0	1	2	2	0	#NAME?	1	0	1	0	0	0	1	2	1	0	#NAME?	1	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
6703154	1	3	2	2	2	#NAME?	1	1	1	2	1	0	1	2	1	1	#NAME?	1	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
7267052	1	2	2	2	2	#NAME?	1	1	1	2	1	1	1	2	2	2	#NAME?	1	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
6896222	0	0	2	0	2	#NAME?	1	0	1	1	0	0	1	2	1	0.5	#NAME?	0	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
6117072	2	3	2	2	2	#NAME?	1	1	1	2	1	1	1	2	2	2	#NAME?	1	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
7735809	1	1	2	2	2	#NAME?	1	1	1	1	1	1	1	2	1	2	#NAME?	1	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
6759455	2	2	2	2	2	#NAME?	1	0	1	1	1	0	1	2	1	1	#NAME?	1	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
6715169	2	3	2	2	2	#NAME?	1	1	1	2	1	1	1	2	2	2	#NAME?	1	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
6710108	1	2	2	2	2	#NAME?	1	0	1	2	1	1	1	2	1	1	#NAME?	1	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
6184444	1	1	2	2	2	#NAME?	1	0	1	0	1	0	1	2	0	0.5	#NAME?	1	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
7687040	1	3	2	2	2	#NAME?	1	0	1	1	1	1	1	2	1	1	#NAME?	1	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
7087007	0	0	2	0	1	#NAME?	1	0	1	1	1	0	1	2	1	0.5	#NAME?	0	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
6574684	0	0	2	2	2	#NAME?	1	0	1	0	1	0	1	2	0	0.5	#NAME?	1	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
6837548	2	3	2	2	2	#NAME?	1	1	1	2	1	0	1	2	1	1	#NAME?	1	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
7452503	0	1	2	2	2	#NAME?	1	0	1	1	0	0	1	2	0	0	#NAME?	1	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
7039216	2	3	2	2	2	#NAME?	1	1	1	2	1	1	1	2	2	2	#NAME?	1	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
7249160	1	1	2	2	2	#NAME?	1	0	1	1	1	1	1	2	1	0.5	#NAME?	1	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
6148155	1	2	2	2	2	#NAME?	1	0	1	2	1	1	0	2	1	1	#NAME?	1	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
7940555	1	1	2	2	2	#NAME?	1	0	1	0	1	0	0	2	0	0.5	#NAME?	1	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
7873855	1	1	2	2	1	#NAME?	1	0	1	1	1	1	1	2	2	1	#NAME?	1	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
7251502	1	0	2	0	1	#NAME?	1	0	1	0	1	1	1	2	1	0.5	#NAME?	0	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
7290415	1	1	2	0	2	#NAME?	1	0	1	0	0	0	0	2	1	0.5	#NAME?	1	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
6130607	1	3	2	2	2	#NAME?	1	1	1	1	1	0	1	2	1	1	#NAME?	1	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
7757412	2	3	2	0	1	#NAME?	1	0	1	2	1	1	1	2	2	2	#NAME?	1	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
7264804	1	2	2	2	2	#NAME?	1	0	1	2	1	0	1	2	1	1	#NAME?	1	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
6724540	2	3	2	2	2	#NAME?	1	0	1	1	1	1	1	2	2	1	#NAME?	1	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
7798707	2	3	2	2	2	#NAME?	1	1	1	2	1	1	1	2	2	2	#NAME?	1	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
7987396	2	0	2	2	2	#NAME?	1	0	1	2	1	1	1	2	2	1	#NAME?	1	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?

7880627	Male	70	Ganeshpur	Smoker	Regular	Traffic police	No	Diabetes	46	168	16.2981859	#NAME?	21	32	21	#NAME?	3	64	116/85	96	WNL	NVBS	44	84	52.3809524	#NAME?	2	3	2	2	2	#NAME?	1	1	1	2	1	0	1	2	1	1	#NAME?	1	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
7250674	Male	45	Bailhongal	Passive Smoker	Regular	Labourer	No	Hypertension, Diabetes	63	170	21.6970839	#NAME?	27.1	39	15	#NAME?	1	60	133/75	98	WNL	NVBS	62	99	62.6262626	#NAME?	1	2	2	2	1	#NAME?	1	0	1	1	1	1	1	2	2	1	#NAME?	1	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
6407453	Female	40	Macche	Ex-smoker	Non-drinker	Housewife	Yes	IHD, Hypertension, Diabetes	59	169	20.65754	#NAME?	21	31	23	#NAME?	2	80	112/77	97	WNL	Rhonchi	54	84	64.2857143	#NAME?	0	0	2	0	1	#NAME?	1	0	1	1	1	0	1	2	1	0.5	#NAME?	1	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
6854266	Male	74	Athani	Non-smoker	Occasional	Labourer	No	Hypertension	60	177	19.099744	#NAME?	29.1	37	13	#NAME?	0	72	121/78	96	WNL	Rhonchi	82	101	81.1881188	#NAME?	1	2	2	2	2	#NAME?	1	0	1	2	1	1	1	2	2	1	#NAME?	1	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
6634383	Female	76	Ramdurg	Non-smoker	Non-drinker	Housewife	No	Hypertension, Diabetes	50	161	19.2893793	#NAME?	26	34	9	#NAME?	1	90	112/70	98	WNL	Rhonchi	68	99	68.6868687	#NAME?	2	3	2	2	2	#NAME?	1	0	1	2	1	1	1	2	2	2	#NAME?	1	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
7691620	Male	56	Rani Chennamma Nagar	Smoker	Non-drinker	Traffic police	No	Hypertension	88	178	27.7742709	#NAME?	25	36	16	#NAME?	2	95	123/73	98	WNL	NVBS	45	86	52.3255814	#NAME?	2	3	2	2	2	#NAME?	1	1	1	2	1	1	1	2	2	2	#NAME?	1	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
6947424	Male	40	Tilakwadi	Ex-smoker (beedis)	Non-drinker	Traffic police	No	Hypertension, Diabetes	47	161	18.1320165	#NAME?	22.9	31	12	#NAME?	2	84	113/88	95	WNL	NVBS	52	80	65	#NAME?	1	1	2	0	2	#NAME?	1	0	1	1	0	0	0	2	0	0.5	#NAME?	1	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
6239247	Male	66	Bailhongal	Smoker	Regular	Labourer	Yes	Hypertension, IHD, CVA	76	174	25.0735629	#NAME?	26.1	36	12	#NAME?	1	63	114/73	100	WNL	Rhonchi	50	91	54.9450549	#NAME?	2	3	2	2	1	#NAME?	1	0	1	1	1	0	1	2	1	1	#NAME?	1	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
6994290	Female	82	Hindalga	Non-smoker	Non-drinker	Bank	Yes	Hypertension,IHD	51	166	18.507766	#NAME?	26.6	34	13	#NAME?	2	87	138/75	96	WNL	Rhonchi	63	92	68.4782609	#NAME?	2	2	2	2	2	#NAME?	1	1	1	2	1	1	1	2	2	2	#NAME?	1	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
7828406	Female	43	Ramdurg	Non-smoker	Non-drinker	Cook	Yes	CKD, Hypertension	45	162	17.0997517	#NAME?	24.3	35	10	#NAME?	0	63	121/74	100	WNL	NVBS	81	101	80.1980198	#NAME?	1	2	2	2	2	#NAME?	1	0	1	2	1	1	1	2	1	1	#NAME?	1	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
7372573	Female	58	Mandoli Road	Smoker	Non-drinker	Bank	No	IHD, CVA	53	169	18.5567732	#NAME?	26	29	18	#NAME?	2	61	131/77	99	WNL	Rhonchi	51	90	56.6666667	#NAME?	0	1	2	2	2	#NAME?	1	0	1	1	1	0	0	2	0	0.5	#NAME?	0	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
6661427	Male	63	Athani	Smoker	Ex-Drinker	Labourer	Yes	Hypertension, Diabetes	60	160	23.2331067	#NAME?	25.2	36	10	#NAME?	2	86	126/81	99	WNL	Rhonchi	63	100	63	#NAME?	2	3	2	2	1	#NAME?	1	0	1	1	1	0	0	2	1	1	#NAME?	1	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
7816635	Female	69	Bhagya Nagar	Smoker	Non-drinker	Bank	No	CVA, IHD	50	165	18.3654729	#NAME?	23.5	32	31	#NAME?	3	94	120/80	99	WNL	Rhonchi	41	69	59.4202899	#NAME?	1	0	2	0	0	#NAME?	1	0	1	1	1	0	1	2	0	0.5	#NAME?	1	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
7151954	Male	48	Udyambag	Ex-Smoker	Non-drinker	Traffic police	No	Nil	68	170	23.5294118	#NAME?	24	32	12	#NAME?	2	72	132/86	95	WNL	NVBS	48	80	60	#NAME?	2	3	2	2	2	#NAME?	1	1	1	2	1	1	1	2	2	2	#NAME?	1	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
7396458	Male	49	Athani	Smoker	Non-drinker	Labourer	No	Hypertension, Diabetes	71	161	27.2891252	#NAME?	26	36	11	#NAME?	2	60	112/83	98	WNL	NVBS	64	95	67.3684211	#NAME?	2	2	2	0	2	#NAME?	1	0	1	1	1	1	1	2	1	1	#NAME?	1	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
7076646	Male	42	Shahapur	Ex-smoker (cigarettes)	Occasional Drinker	Traffic police	No	Diabetes	72	179	22.6033264	#NAME?	25.3	35	6	#NAME?	0	89	124/80	97	WNL	NVBS	81	109	74.3119266	#NAME?	1	2	2	2	2	#NAME?	1	0	1	2	1	1	1	2	1	1	#NAME?	1	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
7954775	Female	48	Bailhongal	Passive smoker	Occasional Drinker	Cook	Yes	CVA	75	160	29.1509381	#NAME?	24.6	40	11	#NAME?	1	70	134/80	98	WNL	Rhonchi	61	100	61	#NAME?	1	1	2	2	2	#NAME?	1	1	1	1	1	0	1	2	1	1	#NAME?	1	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
7052253	Male	68	Bailhongal	Ex-smoker (beedis)	Regular	Labourer	Yes	Hypertension, Diabetes	73	180	22.578995	#NAME?	28.7	40	14	#NAME?	0	95	133/88	97	WNL	NVBS	81	108	75	#NAME?	2	3	2	2	2	#NAME?	1	0	1	2	1	1	1	2	2	0	#NAME?	1	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
6136627	Male	55	Shahapur	Ex-smoker	Regular	Business	No	IHD	62	174	20.3695553	#NAME?	28.3	35	13	#NAME?	1	87	131/78	97	WNL	NVBS	53	97	54.6391753	#NAME?	2	2	2	2	2	#NAME?	1	0	1	1	1	1	0	2	1	1	#NAME?	1	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
6049740	Male	65	Shahapur	Smoker (beedis)	Regular	Business	No	Hypertension, Diabetes	63	166	22.9366496	#NAME?	24.1	40	14	#NAME?	0	62	110/75	100	WNL	NVBS	83	101	82.1782178	#NAME?	1	2	2	2	2	#NAME?	1	0	1	2	1	1	1	2	2	2	#NAME?	1	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
7527474	Male	54	Ramdurg	Passive Smoker	Regular	Labourer	Yes	Hypertension, Diabetes	85	175	27.755102	#NAME?	26.9	38	13	#NAME?	1	62	136/78	98	WNL	NVBS	59	99	59.5959596	#NAME?	2	1	2	2	2	#NAME?	1	1	1	1	1	0	1	2	1	1	#NAME?	1	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
6876437	Male	69	Yellur	Smoker	Regular	Labourer	No	Hypertension, Diabetes	59	169	20.65754	#NAME?	26	35	26	#NAME?	3	72	113/89	95	WNL	Rhonchi	36	68	52.9411765	#NAME?	1	0	2	2	0	#NAME?	1	0	1	1	1	1	1	2	0	0.5	#NAME?	1	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
6397872	Male	48	Bailhongal	Smoker (beedis)	Ex-Drinker	Labourer	No	Hypertension, Diabetes	90	164	33.3401372	#NAME?	23	36	15	#NAME?	0	79	113/73	99	WNL	NVBS	81	102	79.4117647	#NAME?	2	3	2	2	1	#NAME?	1	0	1	2	1	1	1	2	2	2	#NAME?	1	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
6790734	Male	42	Ramdurg	Ex-smoker	Ex-Drinker	Labourer	No	Hypertension, Diabetes	70	169	24.5841735	#NAME?	29.1	35	11	#NAME?	2	82	118/73	98	WNL	Rhonchi	52	94	55.3191489	#NAME?	2	2	2	0	2	#NAME?	1	0	1	2	1	1	1	2	1	1	#NAME?	1	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
7431747	Female	59	Angol	Passive smoker	Non-drinker	Bank	Yes	IHD,Diabetes, CVA	51	169	17.8565176	#NAME?	21	30	30	#NAME?	3	64	124/70	100	WNL	Rhonchi	28	55	50.9090909	#NAME?	0	1	2	2	0	#NAME?	1	0	1	0	1	0	1	2	1	0.5	#NAME?	0	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
6335895	Female	46	Bailhongal	Non-smoker	Non-drinker	Cook	Yes	Nil	62	160	24.0892681	#NAME?	24.5	36	7	#NAME?	1	77	118/74	99	WNL	NVBS	84	99	84.8484848	#NAME?	2	3	2	2	2	#NAME?	1	1	1	2	1	1	1	2	2	2	#NAME?	1	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
6063250	Male	59	Hanuman Nagar	Ex- Smoker	Occasional Drinker	Business	No	IHD, Hypertension, Diabetes	59	175	19.2653061	#NAME?	22	31	33	#NAME?	3	93	135/75	99	WNL	Rhonchi	28	60	46.6666667	#NAME?	0	0	2	0	0	#NAME?	1	0	1	0	0	0	0	2	0	0	#NAME?	1	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
6621207	Female	76	Hindalga	Passive smoker	Non-drinker	Cook	No	Diabetes	56	163	21.0771952	#NAME?	28.7	40	9	#NAME?	1	81	119/70	97	WNL	NVBS	52	94	55.3191489	#NAME?	2	3	2	2	2	#NAME?	1	1	1	2	1	1	1	2	2	2	#NAME?	1	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
6316605	Female	49	Sambra	Smoker	Occasional Drinker	Cook	Yes	Hypertension, IHD, CVA	44	159	17.4043748	#NAME?	24	30	21	#NAME?	3	72	124/73	96	WNL	Rhonchi	58	90	64.4444444	#NAME?	1	1	2	0	2	#NAME?	1	0	1	0	1	1	1	2	0	1	#NAME?	0	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
7687799	Female	42	Bailhongal	Non-smoker	Non-drinker	Cook	Yes	Hypertension	50	168	17.7154195	#NAME?	23.1	34	13	#NAME?	1	61	129/87	96	WNL	NVBS	51	98	52.0408163	#NAME?	1	3	2	2	2	#NAME?	1	1	1	2	1	1	1	2	2	2	#NAME?	1	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
6053526	Male	85	Nehru Nagar	Ex-smoker (beedis)	Regular	Business	Yes	Hypertension, Diabetes, IHD	70	162	26.6727633	#NAME?	28	38	19	#NAME?	2	90	135/83	95	WNL	Rhonchi	58	90	64.4444444	#NAME?	0	1	2	0	2	#NAME?	1	0	1	0	1	0	0	2	1	1	#NAME?	1	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
7262589	Male	57	Athani	Ex-smoker	Non-drinker	Labourer	Yes	IHD, Diabetes, CVA	47	165	17.1533517	#NAME?	29.1	33	11	#NAME?	2	94	138/88	100	WNL	NVBS	63	96	65.625	#NAME?	2	3	2	2	2	#NAME?	1	0	1	2	1	1	1	2	1	1	#NAME?	1	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
6304598	Female	55	Shahapur	Passive smoker	Non-drinker	Cook	Yes	IHD	80	174	26.4235698	#NAME?	25	34	13	#NAME?	2	60	115/76	99	WNL	NVBS	48	90	53.3333333	#NAME?	2	3	2	2	2	#NAME?	1	1	1	2	1	1	1	2	2	2	#NAME?	1	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
6164275	Male	48	Sambra	Smoker	Ex-Drinker	Labourer	No	Hypertension, Diabetes, IHD	45	165	16.5289256	#NAME?	23	30	21	#NAME?	3	78	112/87	96	WNL	NVBS	42	65	64.6153846	#NAME?	1	0	2	0	2	#NAME?	1	0	1	1	0	1	0	2	1	0.5	#NAME?	0	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
6071879	Male	71	Shahapur	Smoker	Non-drinker	Business	No	None	62	173	20.9218418	#NAME?	28	39	15	#NAME?	1	96	130/90	97	WNL	Rhonchi	62	97	63.9175258	#NAME?	2	3	2	2	2	#NAME?	1	1	1	2	1	1	1	2	1	1	#NAME?	1	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
6545902	Male	56	Mandoli Road	Smoker	Regular	Business	No	Hypertension, Diabetes, CVA	48	170	16.6089965	#NAME?	24	31	24	#NAME?	2	71	113/78	97	WNL	Rhonchi	39	70	55.7142857	#NAME?	0	0	2	2	0	#NAME?	1	0	1	1	0	0	0	2	1	0.5	#NAME?	1	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
6334400	Female	68	Khanapur	Passive smoker	Ex-Drinker	Cook	Yes	Diabetes	56	155	23.4831141	#NAME?	26.5	36	13	#NAME?	0	89	118/88	100	WNL	Rhonchi	81	94	86.1702128	#NAME?	2	3	2	2	2	#NAME?	1	1	1	2	1	1	1	2	2	2	#NAME?	1	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
7109702	Male	56	Bailhongal	Ex-smoker	Non-drinker	Labourer	No	Hypertension, Diabetes	52	169	18.2066454	#NAME?	29.5	34	11	#NAME?	2	75	131/70	99	WNL	NVBS	60	97	61.8556701	#NAME?	1	3	2	2	2	#NAME?	1	0	1	2	1	1	1	2	1	2	#NAME?	1	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
7626195	Male	48	Hindalga	Ex-smoker	Non-drinker	Bank	No	Hypertension	62	169	21.8369449	#NAME?	27.6	36	17	#NAME?	2	72	139/88	98	WNL	Rhonchi	62	99	62.6262626	#NAME?	1	2	2	2	2	#NAME?	1	1	1	2	1	1	0	2	1	1	#NAME?	1	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
6351888	Female	52	Khanapur	Non-smoker	Occasional	Cook	No	Hypertension	52	153	21.9852886	#NAME?	28.6	36	12	#NAME?	1	73	140/73	98	WNL	NVBS	81	106	76.4150943	#NAME?	2	3	2	2	2	#NAME?	1	1	1	2	1	1	1	2	2	2	#NAME?	1	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
6056063	Male	43	Athani	Non-smoker	Occasional Drinker	Labourer	No	Diabetes	49	168	17.402521	#NAME?	23.7	32	11	#NAME?	1	95	119/87	99	WNL	NVBS	70	104	67.3076923	#NAME?	1	2	2	2	2	#NAME?	1	1	1	2	1	0	1	2	2	1	#NAME?	1	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?

6662525	Male	46	Bhagya Nagar	Smoker	Ex-Drinker	Bank	No	Hypertension	54	174	17.8359096	#NAME?	24	30	20	#NAME?	3	68	135/87	100	WNL	Rhonchi	46	78	58.974359	#NAME?	1	2	2	2	2	#NAME?	1	1	1	2	1	1	1	2	1	1	#NAME?	0	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
7344651	Male	73	Kakati	Smoker	Ex-Drinker	Labourer	Yes	IHD, CVA, Diabetes	75	170	25.9515571	#NAME?	26	36	27	#NAME?	3	##	135/78	95	WNL	Rhonchi	34	68	50	#NAME?	1	1	2	0	0	#NAME?	1	0	1	1	0	0	1	2	0	0.5	#NAME?	1	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
6706394	Male	52	Shahapur	Ex-smoker	Occasional Drinker	Bank	No	None	62	162	23.6219636	#NAME?	23.2	39	13	#NAME?	2	76	139/74	98	WNL	NVBS	60	91	65.9340659	#NAME?	2	3	2	2	2	#NAME?	1	1	1	2	1	1	1	2	2	1	#NAME?	1	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
7816104	Male	72	Vadgaon	Smoker	Non-drinker	Bank	No	Hypertension, Diabetes, CVA	50	175	16.3265306	#NAME?	24.5	32	21	#NAME?	2	92	122/84	100	WNL	Rhonchi	54	88	61.3636364	#NAME?	0	0	2	2	1	#NAME?	1	0	1	1	0	0	1	2	0	0	#NAME?	1	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
6451197	Male	67	Shahapur	Ex-smoker (beedis)	Ex-Drinker	Bank	No	Hypertension, Diabetes	66	177	21.1220698	#NAME?	27.4	40	7	#NAME?	0	68	124/79	99	WNL	NVBS	81	103	78.6407767	#NAME?	2	3	2	2	2	#NAME?	1	0	1	2	1	1	1	2	2	2	#NAME?	1	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
6232399	Male	43	Bailhongal	Non-smoker	Occasional Drinker	Labourer	No	Nil	73	197	18.719223	#NAME?	24.7	35	12	#NAME?	1	84	136/75	98	WNL	Rhonchi	84	102	82.3529412	#NAME?	2	2	2	2	2	#NAME?	1	1	1	2	1	1	1	2	2	2	#NAME?	1	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
6649153	Male	65	Shahapur	Smoker	Occasional Drinker	Bank	No	CVA	51	155	21.3111342	#NAME?	23.7	37	12	#NAME?	2	84	120/88	96	WNL	Rhonchi	71	93	76.344086	#NAME?	2	2	2	2	2	#NAME?	1	1	1	2	1	1	1	2	2	1	#NAME?	1	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
6875195	Male	69	Shahapur	Smoker	Regular	Bank	No	Hypertension, Diabetes	68	171	23.0444864	#NAME?	25.9	35	18	#NAME?	1	86	119/78	98	WNL	Rhonchi	69	100	69	#NAME?	2	2	2	2	2	#NAME?	1	0	1	1	1	0	1	2	1	1	#NAME?	1	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
7533498	Male	46	Shahapur	Smoker	Occasional Drinker	Bank	No	Hypertension,IHD	47	162	18.0835897	#NAME?	24	32	10	#NAME?	2	68	125/87	95	WNL	Rhonchi	70	105	66.6666667	#NAME?	1	2	2	2	2	#NAME?	1	1	1	2	1	0	1	2	1	1	#NAME?	1	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
7124102	Male	62	Jadhav Nagar	Ex-smoker	Ex-Drinker	Priest	No	Hypertension, Diabetes	75	180	23.1481481	#NAME?	24	30	24	#NAME?	3	72	118/90	97	WNL	NVBS	48	75	64	#NAME?	1	1	2	2	0	#NAME?	1	0	1	2	1	1	1	2	1	1	#NAME?	0	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
6887610	Male	64	Khanapur	Non-smoker	Non-drinker	Labourer	No	CKD, Hypertension	67	176	21.7188884	#NAME?	24.2	37	9	#NAME?	0	67	129/74	99	WNL	NVBS	81	107	75.7009346	#NAME?	1	2	2	2	2	#NAME?	1	0	1	2	1	1	1	2	2	1	#NAME?	1	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
6969706	Male	68	Hindalga	Smoker	Non-drinker	Priest	No	Hypertension	80	164	29.7441999	#NAME?	24	38	18	#NAME?	2	75	139/89	98	WNL	NVBS	59	86	68.6046512	#NAME?	0	1	2	0	1	#NAME?	1	0	1	1	1	0	0	2	1	0.5	#NAME?	1	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
7896766	Female	42	Ramdurg	Non-smoker	Non-drinker	Cook	Yes	Hypertension	50	165	18.3654729	#NAME?	25.3	32	16	#NAME?	2	61	115/72	97	WNL	Rhonchi	58	93	62.3655914	#NAME?	2	3	2	2	2	#NAME?	1	0	1	2	1	1	1	2	1	1	#NAME?	1	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
7601783	Male	79	Ramteerth Nagar	Smoker	Regular	Priest	No	Hypertension, Diabetes	48	170	16.6089965	#NAME?	22	33	18	#NAME?	2	62	139/90	98	WNL	Rhonchi	48	82	58.5365854	#NAME?	2	2	2	2	2	#NAME?	1	0	1	2	1	0	1	2	1	1	#NAME?	1	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
7556713	Male	62	Angol	Smoker	Regular	Priest	No	Hypertension, Diabetes	48	169	16.8061342	#NAME?	23.7	33	21	#NAME?	3	97	122/81	95	WNL	Rhonchi	58	90	64.4444444	#NAME?	1	0	2	0	2	#NAME?	1	0	1	0	0	1	0	2	0	0	#NAME?	1	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
6639545	Female	68	Ramteerth Nagar	Passive smoker	Non-drinker	Cook	No	Diabetes	58	165	21.3039486	#NAME?	24	32	21	#NAME?	3	89	110/83	98	WNL	Rhonchi	42	65	64.6153846	#NAME?	2	3	2	2	2	#NAME?	1	0	1	2	1	1	1	2	1	1	#NAME?	1	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
7947921	Male	42	Khanapur	Ex-smoker	Occasional Drinker	Military	No	CVA	52	170	18.1314879	#NAME?	24.1	34	16	#NAME?	1	74	110/77	96	WNL	NVBS	52	110	47.2727273	#NAME?	1	2	2	2	2	#NAME?	1	1	1	2	1	1	1	2	1	1	#NAME?	1	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
7780787	Male	58	Shivaji Nagar	Smoker	Ex-Drinker	Stone cutter	No	Diabetes, Hypertension	60	180	18.5185185	#NAME?	26	34	19	#NAME?	2	60	125/79	98	WNL	NVBS	42	80	52.5	#NAME?	2	3	2	2	2	#NAME?	1	0	1	2	1	1	1	2	1	0.5	#NAME?	1	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
6663320	Male	76	Khanapur	Ex-smoker	Regular	Labourer	No	Diabetes	50	172	16.8422244	#NAME?	25.8	31	13	#NAME?	1	76	115/84	100	WNL	NVBS	65	102	63.7254902	#NAME?	1	3	2	2	2	#NAME?	1	0	1	2	1	0	1	2	1	3	#NAME?	1	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?
7845216	Male	72	Hindalga	Ex-smoker	Regular	Stone cutter	No	Hypertension, Diabetes	49	163	18.2992351	#NAME?	29.4	33	13	#NAME?	1	99	135/87	98	WNL	NVBS	77	93	82.7956989	#NAME?	2	2	2	2	2	#NAME?	1	0	1	2	1	1	1	2	1	1	#NAME?	1	#NAME?	#NAME?	#NAME?	#NAME?	#NAME?