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Review Article

Nutritional status in patients with COPD and its impact on biochemical status: A narrative review

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ABSTRACT

A progressive respiratory disease marked by continuous airflow restriction and major systemic repercussions including nutritional imbalances, COPD is Disease progression, mortality rates, healthcare expenses, hospital stays, readmissions, muscular strength, and respiratory muscle function all are greatly influenced by nutrition and biochemical indicators. Common in COPD patients, malnutrition—especially protein-energy shortage and micronutrient insufficiency—contributes to muscle atrophy, lowered immunity, systemic inflammation, and poor pulmonary function. The purpose of this narrative review is to investigate in COPD how dietary status and biochemical indicators interact to influence disease outcomes. The review was conducted using PubMed, MEDLINE, and Scopus databases, employing keywords such as *COPD*, *nutritional status*, *biochemical markers*, *malnutrition*, and *disease outcomes*. Important results show how dietary deficits—such as low levels of vitamins (D, C, E) and minerals (magnesium, zinc)—cause changed metabolic parameters that contribute to oxidative stress and inflammation. On the other hand, dietary changes and supplements are part of nutritional therapies that show promise to enhance clinical and functional results. Dealing with the interaction between illness outcomes, biochemical indicators, and nutritional status emphasizes for COPD sufferers the need for integrated treatment plans. Standardized criteria for nutritional evaluation and treatments to maximize illness management require further study.

Keywords: COPD, Nutritional status, Biochemical markers, Malnutrition, Disease outcomes

Introduction

Chronic Obstructive Pulmonary Disease (COPD) is a complex respiratory condition distinguished by persistent airflow limitation and systemic symptoms that have a substantial impact on patient outcomes [1]. Among these systemic impacts, dietary status is crucial to illness progression and control. Malnutrition affects a large percentage of COPD patients, ranging from 19% to 60% depending on the population and evaluation methodologies utilized. This malnutrition is frequently followed by unintentional weight loss, which is significantly associated with clinical worsening, reduced quality of life, and a bad prognosis for COPD [2].

The causes of weight loss in COPD are diverse and not fully understood. However, higher resting energy expenditure (REE) and serum tumor necrosis factor-alpha (TNF-α) levels are identified as contributory variables. These physiological alterations not only worsen systemic inflammation but also cause an energy imbalance, hastening the loss of lean body mass and muscle strength. Such nutritional deterioration has serious effects, decreasing respiratory function and physical activity while also prolonging the illness progression cycle [3]. COPD exacerbations, which are commonly caused by infections or environmental stressors such as dust, pollution, or cigarette smoke, are key events in the disease's progression. These acute episodes raise metabolic demands as the body responds to stress

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and infection, typically resulting in severe nutritional decline. The loss of lean body mass during exacerbations is especially concerning since it has been related to reduced survival rates, lower quality of life, and longer recovery times. Frequent hospitalizations and related absenteeism from work impose a significant financial burden on healthcare systems and society as a whole, highlighting the socioeconomic consequences of inadequate dietary management in COPD.

This narrative investigates the complex link between dietary status, biochemical indicators, and illness outcomes in COPD. By summarizing existing evidence, the review aims to emphasize the mechanisms behind weight loss and malnutrition in COPD patients, as well as their clinical and socioeconomic implications. This approach emphasizes the crucial importance of including nutritional assessment and focused therapies into standard therapy for COPD patients in order to slow disease progression, enhance quality of life, and minimize healthcare costs.

Evaluating nutritional status and its role in COPD progression

Malnutrition poses significant risks for COPD patients, as it can lead to reduced respiratory muscle mass and strength, impaired wound healing, weakened cellular immunity, and a diminished ventilatory response to hypoxia. These factors collectively increase the likelihood of respiratory failure. Recognizing and addressing this issue promptly through appropriate nutritional interventions is crucial. Doekel RC Jr *et al*. have demonstrated that refeeding malnourished COPD patients can enhance both immune function and muscle performance, highlighting the importance of targeted nutritional support in managing these patients effectively [4]. Up to 40% of COPD patients experience malnutrition regularly. In the more advanced phases of the illness, this prevalence is larger, which may be related to many things such as decreased appetite, dyspnea during meals, and systemic inflammation. One common symptom of COPD is unintended weight loss, which is often caused by breathing-related increases in energy expenditure that lead to an imbalance between energy intake and expenditure. Malnutrition in individuals with COPD is often associated with a reduced calorie intake. Breathlessness might cause patients to skip meals, or the physical strain of eating itself can make them avoid eating altogether, which lowers their intake of vital nutrients overall [5].

Malnutrition and muscle loss in COPD patients are strongly linked. Nutritional deficits, especially in the limbs, cause a decrease in lean body mass. This muscular atrophy contributes significantly to the muscle weakness and exercise intolerance found in COPD patients, making it more difficult for them to perform daily activities and reducing their quality of life. Mulnutration-induced muscle wasting in COPD is accompanied by a loss of muscular strength [6]. COPD patients with malnutrition-induced muscle atrophy comprehend an apparent decrease in muscular strength. The decrease in muscle power exacerbates patients' physical limitations and impairs their ability to stay independent. Muscle atrophy impairs COPD patients' ability to exercise effectively. Reduced muscle mass causes a cycle of deconditioning and further muscle loss since it degrades endurance and reduces one's ability to resist physical exercise [7]. Malnutrition causes muscle wastage, which contributes to the functional worsening of COPD. Sarcopenia is a sickness characterized by a progressive and widespread loss of skeletal muscle mass and strength, which plays an important role in its development. Sarcopenia is strongly connected to poor COPD outcomes, such as increased mortality [8].

In COPD, the phenomenon of muscle wasting encompasses the diaphragm as well as additional respiratory muscles. The experience of dyspnea, along with the patient's perception of it, can be exacerbated by insufficient respiratory muscle strength. In individuals with COPD, the reduction of muscle mass is a significant and common concern [9]. It affects not just physical well-being but also contributes to the overall disease burden. Exhaustion and dyspnea often result in individuals with COPD adopting sedentary lifestyles, leading to muscular atrophy and disuse. Individuals with COPD often face challenges related to malnutrition and inadequate calorie consumption, leading to potential protein deficiencies and muscle wasting. A reduction in appetite, challenges in feeding due to dyspnea, and metabolic irregularities all play a role in nutritional deficiencies [10].

Two defining characteristics of COPD that help the condition to develop are increased oxidative stress within the respiratory system and ongoing systemic inflammation. Those with COPD show increased oxidative stress inside the respiratory system, which is typified by an imbalance between free radicals and antioxidants. Reactive nitrogen species (RNS) and reactive oxygen species (ROS) compromise cellular integrity and help pathogenic diseases and inflammatory reactions advance [11]. The inflammatory process influences the airway system, therefore causing bronchial blockage, more mucus generation, and reduced pulmonary capacity. The amplification of oxidative stress effects is evident. The diminished consumption of essential minerals and antioxidants that mitigate oxidative stress frequently results from malnutrition. The cellular damage is intensified due to inadequate antioxidant protection. The immune system of the patient could be compromised due to insufficient nutrition, leading to a diminished ability to regulate inflammation in the body. This leads to more severe and prolonged inflammatory responses. Malnutrition results in muscular atrophy, which negatively affects bodily functions and increases inflammation, as muscle tissue produces cytokines that contribute to inflammatory responses [12].

Malnutrition and its influence on biochemical profiles in COPD

Research has shown that malnutrition impacts the biochemical state, particularly inflammatory markers, which is a significant concern for individuals with COPD. Numerous investigations have recorded variations in the levels of inflammatory markers, including interleukin-6 (IL-6) and C-reactive protein (CRP),

during episodes of COPD. While certain studies indicate moderate or inconsistent changes, others distinctly demonstrate an increase in these markers [13]. These variations may arise from differences in patient demographics and the intervals at which samples are collected. Increased concentrations of pro-inflammatory cytokines, including TNF-α and IL-6, are associated with COPD. Tissue damage, the aggravation of airway inflammation, and the inflammatory reaction all depend on these cytokines in significant proportion. For patients with COPD, muscle loss is a major obstacle especially because of rising TNF-α and IL-6 levels. Muscle loss causes the respiratory system to deteriorate and general nutritional condition to drop [14].

Malnutrition is caused by either inadequate diet or poor absorption of essential nutrients. It usually causes a vitamin, mineral, and antioxidant deficit. Reduction of inflammation and immune system maintenance depend on essential nutrients. These comprise minerals (zinc, selenium), vitamins (e.g., vitamin C, vitamin D), and antioxidants (beta-carotene). The growth and homeostasis of the immune system depend on chemokines, which are indeed fundamental signaling molecules [15]. Along with guiding movement, they also start adhesions, cell migration, and other migratory processes in tandem. Furthermore suggesting their larger influence on cell biology are chemokine receptors found on several cell types other than leukocytes. Binding to atypical chemokine receptors, interactions with the extracellular matrix, and post-translational changes shape the intricate structure of the chemokine network. C-reactive protein (CRP) an acute-phase protein increases in the presence of inflammation. Rising CRP levels in COPD reflect the disease's advancement and are linked to the development of the medical condition. After tissue damage, inflammation, or infection, the liver produces CRP, which is then circulated. A characteristic of COPD is persistent inflammation of the respiratory system and airways. Constantly inflammatory processes can cause CRP levels to rise. High CRP levels in COPD patients can show the degree of the condition. Higher CRP levels have been connected in patients to more symptoms and effects **(Figure 1)** [16].

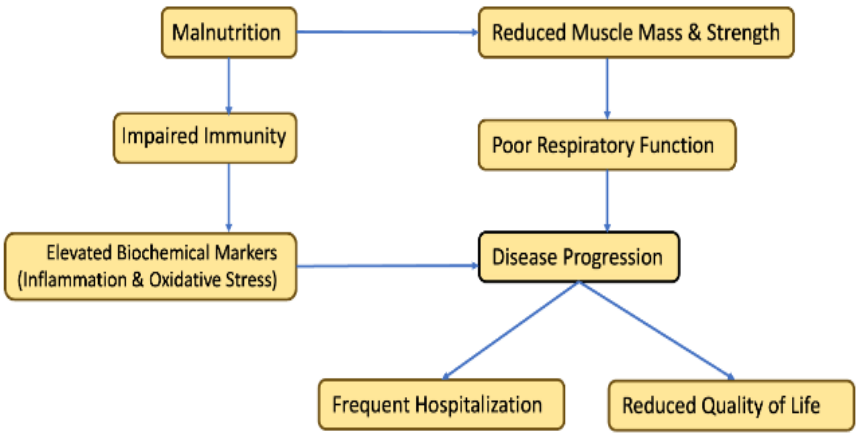

Figure 1. Health complications from malnutrition, illustrating impaired immunity and reduced muscle mass leading to elevated biomarkers, poor respiratory function, and increased disease progression, resulting in frequent hospitalization and reduced quality of life.

Nutritional deficiencies and their impact on immune function among COPD patient

Malnutrition can significantly deteriorate the immune system, diminishing its ability to protect the body from various kinds of illnesses. The immune system's deterioration frequently occurs due to COPD, with ongoing inflammation exacerbating immune impairment. People with COPD who also have nutritional deficiencies are at an increased risk of respiratory infections, especially bronchitis, and pneumonia, because their immune function is weakened. Malnutrition greatly impairs the body's capacity to fight infections, resulting in a reduction in the quantity of disease-fighting white blood cells. Reduced levels of essential immune components signify one of the immune-related biochemical markers modified by malnutrition in individuals with COPD. The imbalance between pro- and anti-inflammatory markers is affected by insufficient nutritional status, exacerbating the chronic inflammation linked to COPD. Mitigating the vulnerability of individuals with COPD to respiratory infections can be achieved by identifying malnutrition and implementing dietary and nutritional interventions. To improve patient outcomes and reduce hospitalization rates, the thorough management of COPD should focus on both nutritional status and immune system performance [17].

Glucose homeostasis in COPD patients and the impact of corticosteroid use

Corticosteroids are frequently prescribed in the treatment of Chronic Obstructive Pulmonary Disease (COPD) to reduce inflammation and control exacerbations. Although corticosteroids are quite effective, long-term use—especially via

oral or systemic routes—may cause moderate to severe adverse effects. A significant consequence is the disruption of the glucose balance, which could cause diabetes or steroid-induced hyperglycemia. Through improved gluconeogenesis, reduced insulin sensitivity, and hampered glucose absorption in peripheral tissues, corticosteroids increase blood glucose levels [18]. Along with its effects on glucose control, corticosteroids can have catabolic effects on muscular tissue that cause muscle atrophy and consequent weight loss. Apart from reducing general physical capacity, the declining muscle mass compromises the nutritional well-being of the patient. Fascinatingly, corticosteroids can sometimes induce appetite, which in individuals predisposed could cause weight increase or obesity [19]. These opposing effects—muscle loss mixed with possible adiposity—can aggravate malnutrition or cause an imbalance in body composition. Furthermore, the way corticosteroids affect appetite control and catabolism could aggravate the previously existing nutritional problems for COPD sufferers. These elements can lead to a never-ending cycle of poor diet, metabolic problems, and disease progress. Therefore, especially in those on continuous corticosteroid treatment, an all-encompassing approach for controlling COPD has to include the evaluation of nutritional state, blood glucose levels, and body composition [20].

Protein-energy malnutrition in COPD

A common and clinically important type of malnutrition that greatly affects people with chronic obstructive pulmonary disease (COPD) is protein-energy malnutrition (PEM). This disorder results from a severe mismatch between protein and calorie intake and expenditure, therefore compromising nutritional state. In COPD, PEM results from a confluence of elements including decreased appetite brought on by dyspnea, higher energy demands resulting from the effort needed to breathe, and systemic inflammation linked with the condition. These linked systems aggravate the dietary problems experienced by COPD sufferers. A classic result of PEM is the development of muscular atrophy and the loss of skeletal muscle mass, which especially influences respiratory muscles. Reduced exercise tolerance, worse physical performance, and a general decrease in functional capacity follow from this loss in respiratory muscle strength. Often a visible sign of PEM, unintentional weight loss is a major clue to malnutrition in COPD sufferers [21]. Their general health and quality of life suffer even more from this weight loss, which fuels a vicious cycle of decreasing physical and respiratory ability. PEM has consequences beyond only the physical ones. Malnourished COPD patients have quicker disease progression marked by more frequent exacerbations and hospitalizations. These flare-ups not only increase healthcare expenses but also greatly compromise long-term results, which fuels more morbidity and death rates [22]. Therefore, addressing PEM in COPD is very important since appropriate dietary interventions can reduce these negative consequences, increase respiratory and muscle performance, and improve the general prognosis of affected people.

Maintaining adequate caloric intake in COPD

For those with Chronic Obstructive Pulmonary Disease (COPD), maintaining appropriate caloric intake is essential to fulfill their increased energy requirements, reduce symptoms, and enhance general health outcomes. Because of its systemic and respiratory effects, COPD greatly raises the metabolic needs of the organism. Factors including difficult breathing, frequent coughing, and general increased work of breathing help to explain higher energy expenditure [23]. Appropriate calorie intake meets several important physiological demands necessary for the control of COPD:

Energy for respiratory effort

Because of their greater airway resistance and decreased lung compliance, COPD sufferers burn far more energy on breathing than healthy people. This increased respiratory effort requires a sufficient calorie intake to run the respiratory muscles and maintain good ventilation, therefore lowering the risk of respiratory failure and tiredness [24].

Preservation of muscle mass and strength

Malnutrition and accidental weight loss are common among COPD sufferers, which usually results in a loss of lean body mass including respiratory and skeletal muscles. Maintaining muscle integrity, optimizing respiratory muscle efficiency, and increasing physical performance—all of which are necessary for everyday activities and general quality of life—are dependent on enough calories, especially from high-quality proteins [25].

Support of immune function

Particularly during acute exacerbations, COPD patients are quite prone to infections. By supplying vital nutrients including vitamins, minerals, and amino acids that support the synthesis and activation of immune cells, an optimal diet strengthens immunological defenses. Reducing the frequency and severity of infections likely to aggravate COPD symptoms depends on a well-nourished immune system [26].

Improvement of oxygen transport

Enough calories help red blood cells and hemoglobin to be produced, both of which are very vital for effective oxygen flow to tissues. Derived from a balanced diet, nutrients including iron, vitamin B12, and folate are very important for hematopoiesis and maximizing oxygen transport capacity, which is sometimes reduced in COPD patients by persistent hypoxemia [27]. Through customized dietary plans, addressing these nutritional needs can dramatically affect disease progression, lower hospitalization rates, and enhance the general prognosis and quality of life for COPD patients.

Nutrient-dense foods in COPD management

Highly beneficial for those with Chronic Obstructive Pulmonary Disease (COPD), nutrient-dense foods are defined by their high concentration of vital vitamins, minerals, and macronutrients compared to calorie count. These foods not only help deal with the nutritional deficits usually seen in patients with COPD but also help with disease management and better quality of living [28]. Including nutrient-dense foods in COPD sufferers' diets has several main benefits.

Providing basic nutrients for general well-being

Foods high in nutrients provide vital micronuts needed for metabolic and physiological activities. Together with minerals like calcium and magnesium, vitamins C, D, and E help the immune system function, lower oxidative stress, and preserve skeletal and muscular integrity. A fundamental macronutrient, protein helps tissues heal and synthesizes hormones and enzymes needed for metabolic and respiratory processes [29].

Balance of weight

A feature of COPD is weight fluctuations; muscle atrophy and inadvertent weight loss abound. By giving enough energy without too many calories, nutrient-dense foods help patients to keep a good weight. Preventing undernutrition or inadvertent weight gain depends on this balance, which also helps to lower physical capability and aggravate the course of disease [30].

Maintaining muscle mass and preventing sarcopenia

Driven by chronic inflammation, decreased physical activity, and inadequate protein intake, muscle loss and sarcopenia are major issues in COPD. Lean meats, fish, lentils, dairy products, and other protein-rich, nutrient-dense diets help to synthesize muscles, therefore reducing muscular atrophy and preserving respiratory muscle function—qualities vital for effective breathing [31].

Addressing energy requirements without overconsumption

People with COPD often have lower physical activity levels, hence careful dietary planning is essential to provide energy needs without encouraging overconsumption. While reducing the danger of too high-calorie intake, which can cause weight increase and related comorbidities, nutrient-dense foods offer a concentrated supply of vital minerals [32].

Protection against decline in lung function

New research indicates that particular dietary components in nutrient-dense meals possibly have protective effects on lung function. Ting Zhai *et al*. for example found that improved lung function and lower disease burden are linked to vitamins A, C, D, E, and B12 as well as bioactive substances like carotenoids, flavonoids, curcumins, and resveratrol. Minerals such as magnesium and omega-3 fatty acids also support anti-inflammatory and antioxidative processes, therefore slowing down the course of COPD. Higher serum levels of vitamin C and selenium have been connected to enhanced pulmonary metrics, such as higher forced expiratory volume in one second (FEV1), therefore stressing the need for micronutrient sufficiency in respiratory health [33].

Including nutrient-dense foods in COPD patients' diets not only fills in dietary deficiencies but also improves respiratory function, lowers systemic inflammation, and supports general physical and metabolic health, improving clinical outcomes and quality of life.

Adequate protein intake

Chronic Obstructive Pulmonary Disease (COPD). Key determinants of physical capabilities and quality of life, muscle mass, and strength depend on protein, which also is crucial for supporting the immune system and general metabolic health. In COPD, muscle preservation is especially important as the condition is often accompanied by muscle wasting, which aggravates respiratory problems and lowers physical resilience [34, 35]. The cornerstone of a successful immune response, proteins form the structural basis for antibodies, enzymes, and immune cells [36]. Maintaining a strong immune system is essential in those with limited pulmonary function to prevent respiratory infections, which can aggravate conditions, hasten disease development, and compromise lung capacity.

Not only does protein intake support muscular health, but it also directly influences pulmonary measurements. Sojung P. *et al*. demonstrated by strong correlation between protein consumption and important lung function indices in COPD—including forced expiratory volume in one second (FEV1), forced vital capacity (FVC), and the FEV1/FVC ratio [37]. These findings coincide with past research demonstrating the significance of proteins in optimizing vital capacity and hence lowering airway congestion. Moreover, a good intake of proteins is associated with improved respiratory muscle strength, which is crucial for COPD sufferers to maintain the higher effort required for breathing. By promoting tissue repair and reduction of systemic inflammation, dietary protein also helps to minimize the catabolic consequences of chronic inflammation, which are usually observed in COPD [38].

Given these various benefits, dietary adjustments stressing enough protein intake should be extremely crucial for COPD control. Customizing diet programs to include premium protein sources—such as lean meats, dairy products, legumes, and plant-based substitutes—helps fulfill the specific metabolic needs of COPD, raises lung function measurements, and finally improves patient outcomes [39].

Results and Discussion

The complicated and developing respiratory disorder known as Chronic Obstructive Pulmonary Disease (COPD) not only reduces lung capacity but also causes systemic changes that could greatly affect overall well-being, immunological response, and muscle mass. Although pharmaceutical therapies and pulmonary rehabilitation are still fundamental for managing COPD, new research indicates that good nutrition—especially protein intake—plays a vital, yet sometimes underappreciated, part in enhancing clinical results and quality of life in COPD patients.

The part protein consumption plays in COPD pathophysiology

COPD's condition is associated with a higher catabolic state that causes muscle wasting, therefore aggravating respiratory insufficiency and lowering physical performance. For those with COPD, respiratory failure is mostly caused by a decrease in skeletal muscle function, especially that of the respiratory muscles' strength. A vital macronutrient, protein helps to stop muscle tissue breakdown and stimulate muscle protein synthesis. Not only are peripheral muscles impacted by protein deprivation; but respiratory muscles, especially the diaphragm, depend on enough protein to retain their contractile strength, which is crucial for good breathing [40]. Given the higher metabolic demands linked with COPD, protein consumption is therefore essential for lowering muscle atrophy and improving muscle performance in this situation. The increased effort required for breathing increases the body's energy consumption, especially in aggravations when it strains muscular reserves even more [41-43]. To prevent the muscle wasting usually seen in people with COPD and to maintain the functioning of respiratory muscles, a sufficient intake of protein—especially from lean and high-quality sources—is very vital. Clinically, the link between protein intake and respiratory function—especially lung capacities and forced expiratory volumes (such as FEV1 and FVC—is becoming more and more clear. Studies by Sojung P. *et al*. show a clear correlation between protein intake and measures of improved lung function. The findings highlight the important part customized dietary strategies play in improving lung and muscular condition in COPD sufferers [44].

Nutritional strategies for improving immune function and stopping exacerbations

The maintenance of the immune system is a usually overlooked but vital part of controlling COPD. Because of persistent inflammation, airway remodeling, and a weakened immune response, those with COPD show increased sensitivity to respiratory infections and exacerbations. Essential for immunity cells and antibodies as well as for defense against infections, protein is found in great abundance in COPD, a weakened immune response could lead to recurring episodes that accelerate the course of the condition and support negative health effects. Recent research highlights how important an appropriate diet is for improving the immune system [45]. An inadequate diet, particularly a lack of protein, can reduce the body's ability to produce a strong immune response, therefore increasing the risk of infections including bronchitis and pneumonia. Providing enough protein for those with COPD helps immune cells function better, reduces infection rates, and finally helps to decrease the frequency of exacerbations. Protein is vital for strengthening a strong immune system since it directly affects the occurrence of respiratory infections as well as the body's capacity to heal from these infections, which often act as common triggers for COPD flare-ups [46].

The effect of diets high in nutrients on COPD outcomes

Beyond only protein intake, a nutrient-dense diet with a range of vitamins, minerals, and vital fatty acids offers many advantages for those with COPD. Effective therapy of COPD depends on micronutrients such as vitamins C, D, and E as well as omega-3 fatty acids, which help greatly reduce oxidative stress, inflammation, and muscle wasting. For instance, whilst antioxidants like vitamins C and E can help to lower the inflammatory damage caused by free radicals in the lungs, vitamin D is very essential for muscle action and immunological control. Comparably, omega-3 fatty acids have been linked to lower systemic inflammation and improved respiratory performance. Given that those with COPD often suffer from systematic inflammation and oxidative damage, these nutrients are very important [17]. In this regard, foods high in nutrients that provide a good supply of vital vitamins and minerals while keeping a low caloric count are very important. Many people with COPD struggle with anorexia, early satiety, or trouble following a normal diet because of dyspnea or other related symptoms; this nutritional strategy is therefore absolutely vital. A nutrient-dense diet ensures that patients get enough nutrients without overindulging—which is vital for controlling the weight fluctuations sometimes observed in COPD. Moreover, particular micronutrients such as selenium and zinc have been associated with improved measures of lung function, suggesting that some vitamins and minerals help to preserve lung health. Increased FEV1, a crucial gauge of lung function, has been linked to raised serum levels of selenium and vitamin C. The findings underline the important need for maintaining protein intake as well as obtaining a balanced intake of vitamins and minerals to improve lung function and general well-being in people with COPD [47].

Relevance for low- and middle-income countries

Low- and Middle-Middle-income countries (LMICs) significantly show the need for enough nutrition—especially protein—in the management of COPD since access to healthcare resources and nutritional support can be limited. In these

locations, mostly because of low knowledge and weak healthcare infrastructures, the frequency of COPD usually goes unnoticed and is poorly controlled. Moreover, many people in low- and middle-income nations experience concurrent malnutrition, which aggravates COPD symptoms and produces worse clinical outcomes. Protein deficiency seriously reduces muscle mass, weakens the immune system, and increases susceptibility to infections, therefore aggravating the problems with COPD management [48, 49]. Low- and middle-income countries need targeted nutritional policies. In these settings, improving knowledge of the vital roles played by different nutrients and proteins in the management of COPD can lead to appreciable improvement in patient outcomes. Moreover, improving COPD care in low- and middle-income countries depends on addressing the challenges to adequate nutrition including food insecurity, limited availability of nutrient-dense foods, and budgetary constraints. For those with COPD, nutritional supplementation can greatly improve their prognosis and help to reduce the general load of the condition on medical systems [50].

Given the vital part that proper nutrition plays in controlling COPD, global health projects in low- and middle-income nations must include nutritional interventions in the regular patient treatment plans. This could involve stressing the need for nutritional assessments to medical practitioners, encouraging access to foods high in proteins, and, where necessary, developing a low-cost supplements program.

Conclusion

For those with Chronic Obstructive Pulmonary Disease (COPD), malnutrition is a critical issue that influences general health and shapes the course of the illness. Particularly in the more severe phases of COPD, this study emphasizes how widespread malnutrition is and how it affects muscle mass, immune system, and inflammation. Malnutrition lowers the body's capacity to fight infections, weakens muscle strength, and increases the energy required for breathing, therefore increasing patient vulnerability to problems. Long-term irritation it generates also might aggravate the lungs further. Managing these problems, maintaining muscle, boosting immunological health, and enhancing general well-being all depend on proper nutrition—especially about appropriate protein and nutrient-dense meals. Early identification and treatment of malnutrition is crucial considering the higher rates of hospitalizations and higher risk of mortality among malnourished COPD sufferers. While improving patient outcomes, addressing malnutrition in COPD could greatly lower the financial and societal cost in low- and middle-income nations where healthcare may not be as freely available. Improving patients' quality of life, lowering flare-ups, and so supporting their health in a more all-encompassing sense depend on including dietary care in COPD treatment.

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