



Nutrition in Patients with Chronic Obstructive Pulmonary Disease (COPD)

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Abstract

Chronic obstructive pulmonary disease (COPD) is a serious public health problem worldwide, whose statistics have unfortunately been increasing, projected to be the third cause of death in the year 2030. The nutrition of a patient with COPD is decisive to ensure a good prognosis of recovery, so an adequate, comprehensive and timely evaluation should be made to all patients with this diagnosis and a low-carbohydrate and high-fat dietary regimen should be indicated. There is evidence that the use of nutritional supplements would improve quality of life in people with COPD.

Keywords: Chronic Obstructive Pulmonary Disease; Malnourishment; Blood Gases; Calories; Proteins; Carbohydrates; Lipids; Respiratory Quotient

Introduction

Chronic Obstructive Pulmonary Disease (COPD) is a preventable and treatable disease. It is characterized by being inflammatory and non-transmissible that affects the airways including the alveoli and pulmonary circulation. The inflammation produces thickening of the bronchial wall decreasing the caliber of the pathway, generating a persistent reduction in airflow. In addition to producing alveolar destruction due to the enlargement of the airspaces causing as consequences the obstruction of the airflow, expiratory collapse of the bronchial tree and loss of elasticity [1,2].

The Global Strategy for the Diagnosis, Management and Prevention of Chronic Obstructive Pulmonary Disease of the World Health Organization the diagnosis of COPD should be considered when a patient presents productive cough, dyspnea and/or history of exposure to risk factors to the disease (tobacco, inhalation of small toxic particles, obesity, dyslipidemia, etc) [3]. The confirmatory examination of flow obstruction is spirometry, this lung function test, however, the equipment required to conduct this review is not easily accessible in all countries.



Figure 1: COPD Guide - Peruvian Ministry of Health (MINSA).

It is recognized as a complicated disease to diagnose, since the symptoms of this disease are common for multiple pathologies. Therefore, it is often underdiagnosed, which results in inadequate treatment for the disease [4]. In the PLATINO study (Latin American Lung Obstruction Research Project) conducted in 2008 in different Latin American cities, it was shown that there is an underdiagnosis in 88.7% of patients and an erroneous diagnosis in 63.7% of patients, while only 34% reported having undergone spirometry before the study. In Latin America, under-diagnosis represents an important problem since in this region there are not many establishments that can count on spirometry as a diagnostic test [4–6].

According to the report of the World Health Organization (WHO) in 2020 COPD is the third cause of death in the world [1]. The global prevalence of COPD is only 1%, however, it is considered as a public health problem since when extracting data from people over 40 years of age the prevalence increases to more than 10%. This increase is partly explained by differences in risk exposure or population characteristics, determinants of contracting this disease [5]. The AVISA Peru study of disease burden, considers COPD among the 50 diseases with the highest burden, so its study and management is relevant.

This pathology not only affects the lungs, but can also affect skeletal muscle and body fat generating consequences such as muscle weakness or cachexia in patients. Chronic Obstructive Pulmonary Disease (COPD) evolves with caloric protein malnutrition as a result of the state of hypercatabolism in this disease. This malnutrition is associated with a poor prognosis since it favors the addition of infections, reduction of the strength of the respiratory muscles in addition to affecting the quality of life of the patient with COPD [2].

However, these existing data on the prevalence of COPD in Latin America are quite old. Therefore, studies that identify adequate nutritional management or investigate a nutritional intervention are scarce. It is for this reason that the present study aims to carry out a state of the art in order to provide different nutritional approaches that can improve or contribute to the treatment of patients with COPD.

Chronic obstructive pulmonary disease (COPD)

The pathophysiology of chronic obstructive pulmonary disease is extremely complex, starting with a leve infection that generates an abnormality in the small airways, which generates a limitation

of air flow to the lung. This limitation occurs both as air outlet and inlet [7].

The causes of this obstruction are multiple can be the destruction of these small pathways, the presence of mucus blocking the pathway, inflammation or swelling in the pathway [7].

Another way to know COPD is “emphysema” or “chronic bronchitis.” The first mentioned refers to the destruction of the small air sacs that are located at the end of the entire respiratory system within the lung. On the other hand, chronic bronchitis refers to a chronic cough, which is accompanied by the production of phlegm. This ends up inflaming the airways, generating an obstruction [1,7].

Symptoms of COPD patients are coughing, wheezing at the time of aspiration, and shortness of breath. Those described are shared with another lung condition called Asthma. Because the symptoms of the disease are shared with other types of conditions, confirmation of diagnosis is given by a breathing test, Spirometry. In this, the patient’s lung function is measured, demonstrating the ratio of forced expiratory volume in the first second (FEV1) and forced vital capacity (FVC) [7,8]. For a positive diagnosis, the presence of FEV1 < 80% of the predicted value in combination with a FEV1/FVC < 70% must be available to confirm the presence of air limitation [3,9].

Palliative treatment for some COPD patients is salbutamol or corticosteroid inhalers. These help decrease airway inflammation by improving airflow. There are also other treatments such as steroids or antibiotics, which help prevent the progression of infections by opportunistic pathogens that can infect COPD patients, since they have a depressed immune system [1].

Malnutrition in COPD patient

Patients with diseases such as COPD tend to raise their energy requirements due to the inflammatory process that their body is enduring. Se recognizes that there is a poor gas exchange, which generates fatigue and early satiety in the patient. This causes a significant energy imbalance that results in imminent malnutrition in these patients, since although they require a high caloric intake, their lack of appetite causes them to develop nutritional deficit.

In addition, studies such as that of Ouchi., *et al.* in 2011 describe the involvement of adipokines, bioactive proteins secreted by adipose tissue, on appetite and nutritional status [10]. Within the spectrum of these proteins we find leptin, adiponectin, IL – 6

and TNF - α . On the other hand, in 2012 Breyer’s research group showed that a dysregulation of adipokines generates systemic inflammation in patients with COPD [11]. This demonstrates the need for a greater nutritional contribution, since inflammation generates catabolism within the body, increasing the energy requirement.

Oral nutritional supplementation

Patients with COPD suffer from a significant energy imbalance, since as described above for different reasons there is a greater expenditure than consumption, thus generating malnutrition. This can be remedied by energy supplementation. While there is little information on the exact recommendation of supplementation for these patients, due to the limited literature that exists on the subject. It is indicated that the studies carried out to optimally maintain the health and quality of life of a patient with COPD is improving or maintaining a good nutritional status.

It is indicated that stable patients with respiratory problems can be supplemented with foods not necessarily specialized, but if densely caloric. On the other hand, patients who are in critical or severe condition or even with difficult prognoses; a specialized food is recommended. These are described as those supplements that are specially designed to meet the needs of patients without worsening their state of health (respiratory function).

Nutritional requirements

To understand the nutritional needs of a patient with lung disease, certain aspects must be taken into account, among which is the respiratory quotient (CR) of food which is defined by the following equation: $CR = VCO_2 \text{ produced} / VO_2 \text{ consumed}$.

This quotient represents is the ratio between the carbon dioxide produced between the consumption of oxygen during the metabolism of macronutrients of this fraction is known that the results are those presented in table 1.

Nutritious	CR
Carbohydrates	1
Fats	0,7
Proteins	0,8
Source: Ireton-Jones CS. Intake: Energy. In: Mahan L, Escott-Stump S, Raymond J, eds. Krause’s Food and the Nutrition Care Process. St. Louis, MO.: Saunders Elsevier; 2012:19-31	

Table 1: Respiratory ratios of macronutrients.

With these results, it is intuited that patients with respiratory problems should consume a balanced diet based on the CR of the macronutrients to avoid problems of metabolic acidosis due to the increase in CO_2 produced by the diet. In 2004, Shankar et al, propose that by replacing the calories from carbohydrates with that of fats in the diet of patients with lung disease, you can expect CO_2 production to be reduced, as well as CR [12]. Therefore, a caloric distribution such as that shown in table 2 would be recommended.

Nutritious	%VCT
Fats	50-60
Proteins	15-20
Carbohydrates	20-35

Table 2: Caloric distribution.

It is also argued that the amount of fat is required to be balanced with essential fatty acids and easily absorbed. Therefore, the use of medium chain triglycerides (MCT) is recommended, which are very easy to digest and absorb. Similarly, an appropriate mixture of essential fatty acids such as Omega 3 and 6 is needed, which function as anti-inflammatory agents, helping the patient to reduce the metabolic stress suffered by the disease [13].

Such a high fat value could be harmful if these recommendations are not taken into account. Adding to the above, a consumption of high percentage of fat promotes a slow gastric emptying, so it leads to prolonged satiety. If a supplement contains a high amount of fat it should be calorically dense to avoid problems of malnutrition due to lack of intake.

The value of protein to be carried to the diet should adequate to avoid the problems of sarcopenia or weakness in the patient. It is recommended in a delicate patient is 1-1.5 g of protein/kg of weight. It is important to indicate the necessary supply of proteins, of high quality, in these patients since it is crucial to strengthen both skeletal and respiratory muscles to observe improvements in the patient.

The cells of the organism continue to tend as the main source of energy to carbohydrates, so they must be provided with caution and in low amounts to avoid the problems already mentioned. Foods high in fiber that help the patient’s digestion should be sought. Avoid foods with simple sugars or high in simple sugars;

opt for complex carbohydrates of slow absorption. With these it will be achieved that the patient does not have glycemic peaks that could generate acidosis.

To use an SNO, it is necessary to take into account the contribution of micronutrients, since these are vital to have an adequate metabolism of macronutrients. In addition, many of them work as antioxidants, such as vitamin C, E, selenium, etc. The antioxidant characteristic of these compounds is vital to keep free radicals and pro-inflammatory agents neutralized, a situation that is usually a problem in these patients.

Studies such as that of Cai, *et al.* indicate that with the use of supplements with the aforementioned characteristics I help to improve different parameters not only respiratory but quality of life in people with COPD. The study indicated the use of a specialized oral nutritional supplement (ANS) high in fat and calorically dense 2 times a day for 3 weeks, showed that there were improvements with respect to the CR of patients, as a result of the decrease in CO₂ production. This concludes that supplementation with a specialized SNO meets the nutritional needs of COPD patients. It also indicates that a formula high in lipids and low in carbohydrates improves some parameters of lung function, contributing to an increase in the quality and life expectancy of patients [14].

In addition, the study by Frankfort, *et al.* evaluated the effect of a high and a low-carbohydrate supplement during maximum resistance in chronic airflow obstruction. They found that subjects with COPD who consumed a specialized SNO had a better tolerance to the maximum exercise load. It was also found that, during rest, the volume of CO₂ per minute was lower than the control and feeding groups with high carbohydrate SON. The results of this study suggest that meals with a higher fat content and a lower CHO content are less likely to impair the performance of COPD patients than meals with a low fat content and a higher CHO content [15].

On the other hand, Kuo, *et al.* compared the ventilatory response of patients with COPD and normal subjects against different diets (high in fat and high in carbohydrates). Their results showed that a high-fat diet has very little effect against the parameters of gas exchange and ventilation compared to a high-carbohydrate diet. In addition, following the trend of the studies already shown, they found that the volume of CO₂ was higher in a diet high in CHO. This study suggested that a high-fat diet is more beneficial

for COPD patients than a high-CHO diet, and that the gas exchange and energy utilization of COPD patients following a high-CHO diet might be different from that of normal control subjects [16].

Conclusion

As discussed and reviewed above, nutritional treatment in COPD patients is crucial for survival. By avoiding the impending malnutrition that lung disease brings, they improve the patient's life expectancy, as demonstrated in the various studies reviewed.

In addition, it is not only about indicating a high-calorie diet, but it is necessary to supplement the patient with a specialized supplement or formula for their condition and thus ensure that their nutritional requirements are covered. It is observed in the studies that the use of a specialized oral nutritional supplement, high in fat and low in CHO is necessary to avoid the increase in carbon dioxide production, thus evading respiratory acidosis and fatigue caused by a high carbohydrate diet.

On the other hand, it is known that the indication of antioxidants and essential fatty acids is of utmost importance to neutralize the inflammatory process and improve airflow in patients.

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