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REVIEW ARTICLE

Nutrological therapy as a fundamental basis for the treatment of chronic patients and with obesity: a systematic review

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Abstract

Introduction: In the scenario of chronic diseases, patients admitted to the intensive care unit (ICU) are increasingly obese, with an incidence of up to 40%. **Objective:** It was to describe the main considerations of the importance of nutritional therapy as a fundamental basis for the treatment of chronic patients and with obesity. **Methods:** The PRISMA Platform systematic review rules were followed. The search was carried out from August to September 2024 in the Scopus, PubMed, Science Direct, Scielo, and Google Scholar databases. The quality of the studies was based on the GRADE instrument and the risk of bias was analyzed according to the Cochrane instrument. **Results and Conclusion:** 134 articles were found. A total of 57 articles were evaluated in full and 43 were included and developed in the present systematic review study. Considering the Cochrane tool for risk of bias, the overall assessment resulted in 11 studies with a high risk of bias and 20 studies that did not meet GRADE and AMSTAR-2. Most studies showed homogeneity in their results, with X^2=77.4%>50%. Patients admitted to the intensive care unit (ICU) are increasingly obese. Obesity is observed by nutritional imbalance that alters the qualities of individuals' micronutrient status through a concentrated intake of minerals such as iron, calcium, magnesium, zinc, and copper, as well as vitamins. The goals of nutritional therapy are to prevent morbidity and mortality directly attributable to macro- and micronutrient deficiency and to minimize the loss of lean body mass. There are still gaps in information by ASPEN and ESPEN regarding optimal nutritional therapy for patients with obesity during critical illness. International guidelines, therefore, recommend measuring energy expenditure versus energy savings with indirect calorimetry in obese patients.

Keywords: Obesity. Chronic patients. Intensive care unit. Nutrological therapy.

Introduction

In the chronic disease setting, patients admitted to intensive care units (ICUs) are increasingly obese, with an incidence of up to 40% [1]. Worldwide, an estimated 1.6 billion adults are overweight, and at least 400 million are currently obese. In the US, the reports that the prevalence of obesity has been steadily increasing over the past two decades. More than 16 million Americans are severely obese [2,3]. Obesity is a significant public health problem. It is now one of the leading causes of preventable death. A recent survey determined that obesity-related medical costs in the US are now $168,000 trillion per year, or 17% of total US medical costs [4,5].

In 2000, obesity (BMI≥30 kg/m^2) was recognized as a distinct disease, describing the condition as a global pandemic. A condition in which excessive or abnormal accumulation of body fat increases health risks [6]. As the prevalence of obesity continues to increase, the number of obese and morbidly obese patients admitted to ICUs also continues to increase. They are at greater risk of morbidity and mortality than non-obese patients. They will require specialized nutritional therapy to contribute to their overall recovery. Patients admitted to ICUs are increasingly obese, with rates reported between 28% and 36% [7,8].

The COVID-19 pandemic highlights the risks of obesity for the general population, and the complex presentation and clinical needs of patients with obesity. Approximately 50.8% of patients diagnosed with COVID-19 were obese. Obesity has been identified as a significant risk factor for mortality in these patients [9-11], implying the worsening of obesity comorbidities. It is necessary to understand the mechanisms by which obese patients are at greater risk of developing severe forms of the disease, even death.

In this sense, immunity plays a decisive role in SARS-CoV-2 infection. The lack of regulation and the excessive immune response to viral stimuli are caused in an exacerbated manner by pro-inflammatory cytokines (cytokine storm), reaching a state of hyperinflammation, with consequent damage to various tissues caused by obesity [11].

In addition, studies highlight that obesity is related to several diseases, such as type II diabetes, hypertension, cardiovascular diseases, dyslipidemia, atherosclerosis, obstructive sleep, osteoarthritis, stroke, and some forms of cancer, among others. In people with a BMI between 18 and 25 (ideal weight), there are approximately 8.0% of diabetics. In individuals with a BMI above 40 (severe obesity), this percentage reaches 43.0% [12].

According to the latest assessment carried out by ISFO in 2017, overweight and obesity are specific risk factors for 13 types of cancer, with risk estimates per 5kg/m2 varying considerably depending on the location of the tumor. Obesity is also related to a worse prognosis for some types of cancer, especially breast and colon cancer. One of the main causes of obesity is an imbalance in the energy balance favored by a diet rich in processed foods, red meat, trans and saturated fatty acids, foods and beverages with a high glucose content, and low in fruits and vegetables, legumes, and whole grains. The main national and international recommendations to reduce the prevalence of obesity are to have a balanced diet and regular physical activity [13].

Additionally, there are potential factors that complicate the management of critically ill patients with obesity: available nutritional guidelines are inconsistent, posing challenges to calculations of caloric and protein requirements; patients with obesity may be less likely to receive screening, assessment, and diagnosis of malnutrition; stigma and prejudice may influence the quality of care provided; they may have altered pharmacokinetics and/or response to supplementation; excess adiposity may pose a challenge to an accurate nutrition-focused physical examination; bariatric equipment may be unavailable; sarcopenia may be underrecognized in this patient population; repositioning and ambulation may be more difficult for nursing staff to perform; all of this adds to associated comorbidities [14].

The goals of nutritional therapy are to prevent morbidity and mortality directly attributable to macro and micronutrient deficiencies and to minimize the loss of lean body mass. There are clinical challenges in nutritional therapy to improve protein anabolism, avoid worsening of premorbidcomplications of obesity, and hypoglycemia, avoid overfeeding, avoid greater accumulation of fat mass, establish nutritional goals, etc. [1,13].

Given this, the present systematic review study described the main considerations of the importance of nutrological therapy as a fundamental basis for the treatment of critically ill and obese patients.

METHODS

Study Design

The present study followed an international systematic review model, following the PRISMA (preferred reporting items for systematic reviews and meta-analysis) rules. Available at: http://www.prisma-statement.org/?AspxAutoDetectCookieSupport=1. Accessed on: 08/26/2024. The AMSTAR-2 (Assessing the methodological quality of systematic reviews) methodological quality standards were also followed. Available at: https://amstar.ca/. Accessed on: 08/26/2024.

Data Sources and Search Strategy

The literature search process was carried out from August to September 2024 and developed based on Scopus, PubMed, Lilacs, Ebsco, Scielo, and Google Scholar, covering scientific articles from various periods to the present day. The following descriptors (DeCS /MeSH Terms) were used: "Obesity. Chronic patients. Intensive care unit. Nutrological therapy", and using the Boolean "and" between the MeSH Terms and "or" between the historical discoveries.

Study Quality and Risk of Bias

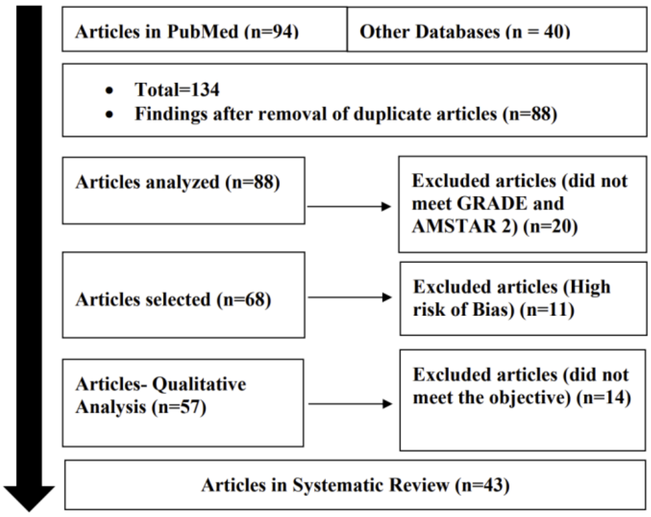
Quality was classified as high, moderate, low or very low regarding the risk of bias, clarity of comparisons, precision, and consistency of analyses. The most evident emphasis was on systematic review articles or meta-analyses of randomized clinical trials, followed by randomized clinical trials. Low quality of evidence was attributed to case reports, editorials, and brief communications, according to the GRADE instrument. The risk of bias was analyzed according to the Cochrane instrument by analyzing the Funnel Plot graph (Sample size versus Effect size), using Cohen's test (d).

Results and Discussion

Summary of Findings

A total of 134 articles were found that were submitted to eligibility analysis, and 43 final studies were selected to compose the results of this systematic review. The listed studies presented medium to high quality (Figure 1), considering the level of scientific evidence of studies such as meta-analysis, consensus, randomized clinical, prospective, and observational. Biases did not compromise the scientific basis of the studies. According to the GRADE instrument, most studies presented homogeneity in their results, with X^2=77.4%>50%. Considering the Cochrane tool for risk of bias, the overall assessment resulted in 11 studies with a high risk of bias and 20 studies that did not meet GRADE and AMSTAR-2.

Figure 1. Flowchart showing the article selection process.



Source: Own authorship.

Highlights- Approaches and Results

Screening and assessment of malnutrition is a key challenge in overweight and obese patients and may not be routinely performed. Malnutrition as a diagnosis may be underestimated in these patients. Many screening tools consider low BMI when calculating nutritional risk. It is essential to understand that BMI as a single indicator is not directly predictive of poor outcomes, especially among critically ill patients with obesity [14]. Therefore, tools such as MUST, which include BMI as a risk marker, may be of limited value [15-19].

In this context, regarding the cause of obesity, there is a complex relationship between biological, psychosocial, and behavioral factors, which include genetic makeup, socioeconomic status, and cultural influences. In addition, obesity has been associated with microorganisms, epigenetics, increased maternal age, increased fertility, lack of sleep, endocrine disruptors, pharmaceutical iatrogenesis, and intrauterine and intergenerational effects [14,17].

Co-morbid conditions and their treatments may also be a factor in the development of obesity. To date, the best non-invasive interventions have been dietary management and behavior modification. The best results are associated with bariatric surgery. Drug therapy has limited efficacy, especially in children. Genetic testing applies to a small group of obese patients [14].

In hospitalized and intensive care unit patients and patients with chronic diseases, a J-shaped relationship between BMI and mortality has been demonstrated, with overweight and moderate obesity being protective compared with normal BMI or more severe obesity. Despite this protective effect on mortality, in the setting of critical illness, morbidity is compromised with an increased risk of respiratory and cardiovascular complications, requiring adapted management. Obesity is associated with an increased risk of infection, requiring adapted medication and nutrition dosing, and is associated with diagnostic and logistical challenges. Furthermore, negative attitudes toward obese patients (the social stigma of obesity) affect both healthcare professionals and patients [20, 21].

Energy and Protein Requirements

There are still gaps in information regarding the optimal nutritional therapy for obese people during critical illness [22]. Obesity as defined by BMI may occur with increased, normal, or low muscle mass. Low muscle mass or sarcopenia occurs mainly with aging and may be substantial and not immediately obvious in critically ill patients with a higher BMI. Relative muscle and fat mass have a stronger relationship with outcomes than BMI alone [23]. Regardless of body build, the preferred route of nutritional therapy is enteral [23-25].

Estimating caloric and protein requirements in obese and ill patients may require an alternative approach to that used for patients with normal BMI. Furthermore, the underlying metabolic syndrome may require more intensive monitoring for hyperglycemia and hyperlipidemia. Furthermore, international guidelines therefore recommend measuring resting energy expenditure with indirect calorimetry in obese patients. However, as indirect calorimetry is not always available, calculations remain a pragmatic estimate of energy expenditure [22].

The American Society for Parenteral and Enteral Nutrition (ASPEN) guidelines recommend that 65-70% of resting energy expenditure be given to obese patients and propose using 11–14 kcal/kg actual body weight/day (for BMI 30–50 kg/m^2) or 22-25 kcal/kg ideal body weight/day (for BMI >50 kg/m2) to calculate this target [24]. The European Society for Clinical Nutrition and Metabolism (ESPEN) guidelines [22] recommend 20-25 kcal/kg adjusted body weight/day without further adjustment below resting energy expenditure in obese patients after the initial acute phase. The amount of protein to be given to critically ill obese patients is also controversial. The ASPEN guidelines suggest a hypocaloric hypercaloric diet with 2.0–2.5 g/kg ideal body weight/day [24], whereas the ESPEN guidelines do not support this high protein intake and recommend 1.3 g/kg adjusted body weight/day [22].

Furthermore, in obese ICU patients, the percentage of protein oxidation contributing to basal metabolic rate may be reduced with increased utilization of ketone bodies. Excess energy storage in adipose tissue may therefore attenuate muscle wasting during critical illness [26]. In obese and elderly critically ill patients, a high-protein, hypocaloric diet increased blood urea concentrations, indicating that a high-protein diet may not be appropriate for all patients [27]. The ESPEN guidelines suggest assessing lean body mass and nitrogen balance in obese patients, while no specific recommendations are provided for monitoring and managing glucose, urea, or triglycerides [28].

Micronutrients

Obesity is characterized by nutritional imbalance that negatively alters the micronutrient status of individuals through inadequate intake of minerals such as iron, calcium, magnesium, zinc, and copper, as well as vitamins (folate, vitamins A, D, and B12) [30-33]. In this sense, micronutrients act as cofactors for the functioning of enzymes, regulating many vital metabolic processes in the body [31,34]. Deficiencies or lack of homeostasis of micronutrients can cause serious implications for human health, such as congenital disabilities, stunted growth, learning disabilities, immune dysfunction, cancer, cardiovascular diseases, defective antioxidant defense mechanisms, osteoporosis, neurodegenerative disorders, malfunction of the intestinal microbiota, deterioration in the functionality of most organs and systems and the aggravation of many diseases [17]. Furthermore, since micronutrients are involved in the metabolism of fats and carbohydrates, in the metabolic pathways of glucose, in the insulin signaling cascade, and the function of pancreatic β cells, their deficiency worsens the development of obesity [30,32,34,35]. Poor diet quality leads to nutritional deficiencies in obesity due to the excessive consumption of processed foods (poor in dietary fiber, protein, micronutrients, and phytochemicals), which are high in calories and have low nutrient density [30]. Ultra-processed foods (UPFs) account for more than 60% of dietary energy intake and almost 90% of added sugars in the diets of adults in the United States [36-38].

In addition, another cause of nutritional changes may be the increased need for nutrients resulting from pathophysiological and metabolic changes in individuals with obesity [30,39]. For example, obese patients have higher needs for zinc, magnesium, chromium, manganese, and vanadium because they are involved in the metabolism of carbohydrates and fats. Thus, obese patients are at greater risk of developing nutritional deficiencies related to these micronutrients [32].

In addition, increased adiposity and systemic inflammation related to obesity may impair the absorption, distribution, metabolism, and elimination of micronutrients [30,31]. For example, some lipophilic minerals and vitamins (vitamin D and A) can be absorbed into adipose tissue, affecting their distribution, decreasing circulating concentrations, and reducing bioavailability to metabolically active tissues [31,32]. Obesity is also associated with deficiencies of water-soluble vitamins, including thiamine, folate, and ascorbic acid, in part because their excretion increases due to their high expenditure [32]. Elevated levels of triglycerides, cholesterol, and free fatty acids in the bloodstream of obese individuals can affect the distribution of micronutrients bound to proteins (enzymes). Furthermore, minerals with chemical similarities to other compounds in the food matrix can compete for transport proteins or other absorption mechanisms, hindering their absorption and bioavailability [30,31,39].

In this context, Guan et al. [36] evaluated nutritional deficiencies in Chinese patients undergoing Roux-en-Y gastric bypass (RYGB) and sleeve gastrectomy (SG), finding vitamin D deficiency as the most severe (78.8%), followed by vitamin B1 (39.2%), vitamin B6 (28.0%), folate (26.8%), vitamin C (18.0%), transferrin (11.6%) and phosphorus (11.5%). In a preoperative evaluation of 200 candidates for bariatric surgery, the authors Pellegrini et al. [40] found that 85.5% of patients had a deficiency of at least one micronutrient. The most prevalent were vitamin D (74.5%), folate (33.5%), iron (32%), calcium (13%), vitamin B12 (10%) and albumin (5.5%).

Similarly, Asghari et al. [41] studied the micronutrient status of morbidly obese candidates for bariatric surgery (mean age: 37.8 years, mean BMI: 44.8 kg/m^2): deficiencies were identified for vitamin D (53.6%), vitamin B12 (34.4%) and serum iron (10.2%). In another study of 1,732 morbidly obese patients (age: 40 ± 12 years, mean BMI: 44 ± 9 kg/m2), data showed a high prevalence of micronutrient deficiency: 63.2% of patients were deficient in folic acid (<5.3 ng/mL), 97.5% in vitamin D (<75 nmol/L), 9.6% in iron (ferritin <15 µg/L), 6.2% in vitamin A (<1.05 µmol/L), and 5.1% in vitamin B12 (<188 pg/mL) [42]. McKay et al. [31] found associations between increased BMI and lower serum micronutrient levels in overweight and obese Australian adults (BMI: 25-40 kg/m2, age: 18–65 years) compared with clinical micronutrient references. Significant associations were found for vitamin D, folate, magnesium, and potassium.

Guidelines

Current guidelines recommend a low-calorie, high-protein nutritional regimen for patients with obesity and critical illness. The impact of advanced age presents unique challenges in that increased protein intake is required to overcome anabolic resistance associated with aging in the face of presumed decreased renal function [1].

According to ESPEN, previous guidelines for providing optimal medical nutrition therapy for critically ill patients have been updated. These guidelines define who are at risk patients, how to assess the nutritional status of an ICU patient, how to define the amount of energy to provide, the route to choose, and how to adapt according to different clinical conditions. When to start and how to progress with adequate nutrient delivery is also described. Better determination of the amount and nature of carbohydrates, fats, and proteins is suggested. Special attention is given to fatty acids, glutamine, and omega-3. Particular conditions frequently seen in intensive care, such as patients with dysphagia, frail patients, multiple trauma patients, abdominal surgery, sepsis, and obesity, are discussed to guide the practitioner toward the best evidence-based therapy [28].

Based on this and other evidence, the 2022 ASPEN/SCCM guidelines suggest a reduced-calorie, high-protein diet for patients with obesity [29]. Specifically, based on expert consensus, the guidelines state: "if available, an enteral formula with low caloric density and a reduced nonprotein calorie:nitrogen (NPC:N) ratio should be used in the obese adult ICU patient [43]."

Notably, the 2022 ESPEN guidelines did not recommend any specific tool for use in critically ill patients and instead stated that "Any critically ill patient who remains in the ICU for more than 48 hours should be considered at risk for malnutrition [28]." Meanwhile, the 2022 American Society of Parenteral and Enteral Nutrition (ASPEN) and Society of Critical Care Medicine, as well as the updated ASPEN guidelines, do not address the topic [26]. Neither guideline specifically highlights whether or how screening and assessment practices should differ for patients with obesity.

Conclusion

Patients admitted to the intensive care unit are increasingly presenting with obesity. Obesity is seen as a nutritional imbalance that alters the quality of the individual's micronutrient status through a concentrated intake of minerals such as iron, calcium, magnesium, zinc, and copper, as well as vitamins. The goals of nutritional therapy are to prevent morbidity and mortality directly attributable to macro- and micronutrient deficiency and to minimize the loss of lean body mass. There are still gaps in information from ASPEN and ESPEN regarding the optimal nutritional therapy for patients with obesity during critical illness. International guidelines therefore recommend measuring energy expenditure in savings with indirect calorimetry in patients with obesity.

CRediT

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Conflict of Interest

The authors declare no conflict of interest.

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