

Recommendations for providing nutritional care to COVID-19 inpatients. A literature review

Recomendaciones para la atención nutricional hospitalaria en pacientes con COVID-19. Revisión de la literatura

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Abstract

Introduction: Coronavirus disease (COVID-19) may require the hospitalization of patients in the most severe cases. Therefore, it is necessary to establish theoretical and practical recommendations for nutritional interventions at hospitals.

Objective: To identify recommendations given to hospital health care teams for providing nutritional care to inpatients over 18 years of age infected with COVID-19.

Materials and methods: A literature review was conducted in PubMed using the following search strategy: publication period: December 2019 to March 2020; publication language: English and Chinese; search terms: "Coronavirus Infection", "Severe Acute Respiratory Syndrome" and "Nutrition for Vulnerable Groups".

Results: A total of 283 articles were retrieved after completing the initial search, of which 6 were selected to analyze nutrition care practices in the hospital setting. The areas of research of these publications were nutritional support, the evaluation of interventions aimed to manage and reduce the severity of pulmonary and hepatic complications, and the effects of antioxidants and omega-3 fatty acids in adults with acute respiratory distress syndrome.

Conclusion: Recommendations for providing nutritional care to COVID-19 inpatients are based on nutritional care processes and food service management. According to these recommendations, nutritional risk assessment strategies should be established, nutritional support interventions aimed at reducing the risk of malnutrition should be carried out, and the risks associated with the administration of nutritional support, as well as COVID-19-related metabolic disorders, should be monitored.

Keywords: Coronavirus Infections; Spike Protein, SARS-CoV-2; Nutrition Therapy; COVID-19 (MeSH).

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Resumen

Introducción. La enfermedad por coronavirus 2019 (COVID-19) puede llevar a la hospitalización de los pacientes en los casos más graves; por tanto, es necesario establecer recomendaciones teórico-prácticas de intervención nutricional hospitalaria.

Objetivo. Identificar las recomendaciones dirigidas a los equipos de salud hospitalarios para brindar atención nutricional a pacientes hospitalizados mayores de 18 años e infectados con COVID-19.

Materiales y métodos. Se realizó una revisión de la literatura en PubMed mediante la siguiente estrategia de búsqueda: periodo de publicación: diciembre 1 de 2019 a marzo 21 de 2020; idiomas de publicación: inglés y chino; términos de búsqueda: "Coronavirus Infection", "Severe Acute Respiratory Syndrome" y "Nutrition for Vulnerable Groups".

Resultados. Se identificaron 283 artículos en la búsqueda inicial, de los cuales se seleccionaron 6 para analizar las prácticas de atención nutricional hospitalaria. Las áreas de investigación de estas publicaciones fueron soporte nutricional; evaluación de intervenciones para abordar y disminuir la severidad de las complicaciones pulmonares y hepáticas, y efectos de antioxidantes y ácidos grasos omega-3 en adultos con síndrome de dificultad respiratoria aguda.

Conclusión. Las recomendaciones para la atención nutricional hospitalaria en pacientes con COVID-19 se basan en procesos de cuidado nutricional y en la gestión de los servicios de alimentación; según estas recomendaciones, se deben establecer estrategias de evaluación de riesgo nutricional, realizar intervenciones de soporte nutricional que reduzcan el riesgo de desnutrición y vigilar los riesgos asociados a la administración del soporte nutricional y las alteraciones metabólicas asociadas a esta enfermedad.

Palabras clave: Infecciones por coronavirus; SARS-CoV-2; Terapia nutricional; COVID-19 (DeCS).

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Introduction

In December 2019, in the city of Wuhan, China, a new coronavirus (SARS-CoV-2) was discovered, and the disease that it causes is the coronavirus disease 2019 (COVID-19). The virus spread rapidly, and by the end of January 2020, more than 830 cases of COVID-19 had been confirmed in 9 countries, mainly in Asia. This situation led the World Health Organization (WHO) to declare the outbreak of this disease as a public health emergency of international concern on January 30, 2020. Then, on March 11, 2020, due to the alarming levels of spread and the few actions taken to prevent infection, the same organization declared COVID-19 a pandemic.¹ Although it has not been demonstrated, the origin of the virus is believed to be related to a seafood market in Wuhan.²

At first, it was believed that COVID-19 affected older people only, but this notion has been proven wrong since people of all ages are susceptible to infection. In addition, regardless of the viral load, the clinical characteristics of this disease vary and can range from an asymptomatic state to acute respiratory distress syndrome (ARDS) and multiple organ failure, which require transferring patients to the intensive care unit (ICU). The most reported symptoms are fever, cough, sore throat, headache, fatigue, myalgia, dyspnea, and even conjunctivitis.²

Considering the impact of COVID-19 worldwide, several studies on this disease are currently underway. Adhikari *et al.*³ carried out a scoping review that analyzed 65 research articles published between January 1 and 31, 2020, which helped to understand its epidemiology, clinical diagnosis, prevention, control, and causes. This work raised the need to implement preventive measures such as the use of face masks, good hand hygiene practices, among others. The authors also reported that no specific antiviral treatment is effective to date and, therefore, infected people depend mainly on symptomatic treatment and supportive care. In this regard, the researchers highlighted the need for new, high-quality, and valid studies on the virus to establish short- and long-term solutions.³

COVID-19 is a global challenge given its impact on health systems around the world. According to the study

by Lai *et al.*,⁴ which included 278 patients in 3 studies of the clinical characteristics of patients with pneumonia caused by the Wuhan SARS-CoV-2, 25.9% of participants were admitted to an ICU, 20.1% developed ARDS, and 8.3% and 3.2% required invasive mechanical ventilation and extracorporeal membrane oxygenation due to refractory hypoxemia, respectively. Concerning the outcome of this disease, Cunningham *et al.*⁵ described a mortality rate of about 2% based on the findings reported by Lai *et al.*,⁴ who described a mortality rate of 2.5%.

As mentioned above, and according to various studies, SARS-CoV-2 can affect different age groups.⁶⁻¹⁰ However, Lloyd-Sherlock *et al.*¹¹ show that the risk of mortality from COVID-19 increases in people over 60 years of age, especially those with chronic conditions such as cardiovascular disease. This is a worrying situation because the largest number of people in this age group are in low- and middle-income countries where health systems are weak and unable to meet the needs of these patients, who also require nutritional support adapted to their clinical evolution and specific conditions.

With this in mind, the objective of the present literature review was to identify research recommendations given to hospital health care teams for providing nutritional care to inpatients over 18 years of age infected with COVID-19.

Materials and methods

A literature review was conducted in PubMed taking into account the PRISMA guidelines¹²⁻¹⁴ and based on the following search strategy: Language of publication: English and Chinese; Publication period: December 1, 2019, to March 21, 2020; Search terms: "Coronavirus Infection", "Severe Acute Respiratory Syndrome", and "Nutrition for Vulnerable Groups". All clinical trials, clinical practice guidelines, original articles, and reviews (systematic or narrative) describing nutritional support practices in COVID-19 adult inpatients were included.

The initial search yielded 283 studies, of which 231 were eliminated because they were not relevant to the research objective. The remaining 52 articles were checked to confirmed if they met the inclusion criteria and 6 were finally selected for a comprehensive analysis (Figure 1).

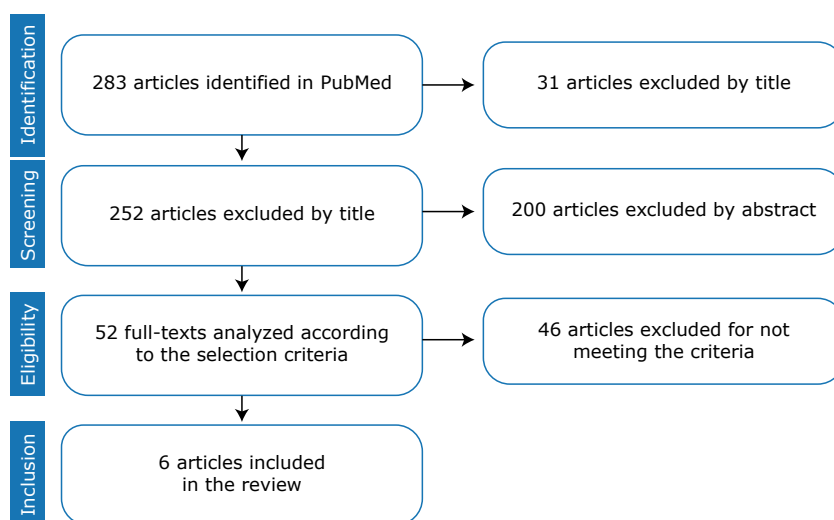


Figure 1. Scientific article selection flowchart.
Source: Own elaboration.

Results

Of the 6 articles included in the analysis, 5 were published in English and only 1 in Chinese. Table 1 presents the main characteristics of the 6 studies that, in the

authors' opinion, present the most relevant results with respect to the objective of this review (nutritional support and dietary recommendations for adult in-patients with COVID-19) and propose strategies for clinical practice.

Table 1. Studies on nutritional intervention strategies.

Study	Purpose	Study design	Population/ studies included	Main findings
Li <i>et al.</i> ¹⁵ 2020	To describe cases of COVID-19 pneumonia	Case series	425 cases described	The median age of the patients was 59 years, ranging from 15 to 89 years, and 56.47% were men. Estimations are that the average incubation period of the virus is 5.2 days and the average time from onset to hospital admission is 12.5 days. Most of the cases (55%) that occurred before January 1, 2020, were related to consumption of food from the Wuhan seafood market.
Fung <i>et al.</i> ¹⁶ 2020	To compare SARS-CoV-2 with SARS-CoV, the Middle East respiratory syndrome coronavirus, community-acquired human coronaviruses, and other pathogenic viruses, including human immunodeficiency viruses.	Literature review	80 references	The first patients infected with SARS-CoV-2 were associated with food handling and consumption activities in the Huanan wholesale seafood market and other live animal markets in Wuhan. It was determined that 5-10% of patients require ICU care, and gastrointestinal symptoms are among the most common. Recommendations were made to adopt strategies to reduce morbidity and mortality caused by SARS-CoV-2: promoting social distancing and developing vaccines to eradicate the virus. Mitigation measures related to modes of transmission between people, including saliva droplets, close contact with potential sources of contamination, and fecal-oral transmission, were recommended.
Zhang & Liu ¹⁷ 2020	To identify control methods to prevent the spread of COVID-19.	Literature review	140 references	It was established that the nutritional status of patients with COVID-19 should be verified before implementing general treatments. Nutritional interventions should also be performed using omega-3 fatty acids, selenium, zinc, iron, and vitamins A, B, C and E. Moreover, to control the spread of the disease, it was advised to establish alternative methods, immunize uninfected persons and health workers, and implement all possible measures to control the virus.
Xu <i>et al.</i> ¹⁸ 2020	To review reports of liver injury caused by SARS-CoV, MERS-CoV, and SARS-CoV-2 infection.	Literature review	62 references	It was found that the incidence of liver injury varied between 14.8% and 53% and that albumin levels that were between 26.3 g/L and 30.9 g/L decreased in patients with severe COVID-19 symptoms. Therefore, it was recommended to monitor serum albumin levels during the nutritional assessment of patients diagnosed with COVID-19, as they are a predictor of disease severity.
Xu <i>et al.</i> ¹⁹ 2020	To report the care experience in the Zhejiang Province, China.	Expert consensus review	12 references	Some recommendations were made to evaluate all patients' nutritional and gastrointestinal function and implement nutritional support and the use of prebiotics or probiotics to regulate the balance of intestinal microbiota and reduce the risk of secondary bacterial translocation infection in COVID-19 patients.
Dushianthan <i>et al.</i> ²⁰ 2020	To review the effects of antioxidants and omega-3 fatty acids in adults with acute respiratory distress syndrome.	Cochrane Review	10 references	Studies that evaluated the effects of antioxidants and omega-3 fatty acids in adults with acute respiratory distress syndrome show that although immunonutrition can produce little or no difference in mortality, it can impact ventilation days, length of ICU stay or need for oxygen.

ICU: Intensive care unit.
Source: Own elaboration.

Except for a series of cases in the adult population,¹⁵ all publications were literature reviews. The main topics addressed by the selected studies were the implementation of practices related to the evaluation and monitoring of nutritional status;^{17,19} the evaluation of interventions to manage and reduce the severity of lung and liver complications,¹⁸ which is one of the objectives of specialized nutritional intervention; and the review of the effects of antioxidants and omega-3 fatty acids in patients with ARDS.²⁰

Discussion

The International Committee on Taxonomy of Viruses named the disease caused by the SARS-CoV-2 virus COVID-19,¹⁶ which the WHO declared as a public health emergency of international concern on January 30, 2020, and as a pandemic on March 11 of that same year.¹ It has a wide range of clinical manifestations that are determined mainly by virus-host interaction and the action of pro-inflammatory cytokines.²¹⁻²³ Therefore, it is necessary to understand the mechanisms by which SARS-CoV-2 acts to design and establish effective therapies for infected patients.¹⁶

Although there is no specific treatment for COVID-19, it is known that respiratory support is essential to improve oxygenation and reduce mortality.²⁴ Likewise, it has been established that alternative methods should be found to control the development of the disease, including the evaluation of the nutritional status of each patient with COVID-19 before providing general treatment.^{16,25,26}

Nutritional support practices

Nutritional support should be one of the key measures for the comprehensive treatment of patients with COVID-19.^{27,28} The main aspects to be considered about hospital nutritional care of people who have contracted SARS-CoV-2 virus are presented below.

Identification of nutritional risk

As stated by Zhang & Liu,¹⁷ nutritional risks should be established for hospital stays of more than 48 hours, as well as the initiation and objectives of nutritional support in such a way that energy, proteins, and water balance are monitored, ensuring a daily contribution of 20-30 kcal and 1.2-2g protein/kg, as validated by Singer *et al.*²⁹ Furthermore, according to the Spanish Academy of Nutrition and Dietetics and the General Council of Dieticians-Nutritionist of Spain,²⁷ in case of enteral nutrition, it is necessary to consider measures to reduce the risk of aspiration pneumonia and the loss of respiratory protection.

Other important aspects should be considered when designing treatments for patients with COVID-19. For example, Barazzoni *et al.*³⁰ recommend detecting patients with malnutrition and undernutrition because these conditions are associated with a higher mortality rate from this disease. In this regard, strategies should be implemented to improve nutritional status and ensure supplementation of vitamins and minerals in the general population, as well as to promote physical activity taking into account appropriate biosafety precautions and protocols.

Also, before starting any treatment for COVID-19, it should be established whether the patient requires oral nutritional supplements to meet their specific needs.

Nutritional support formulation

Regarding the formulation of nutritional support, Siger *et al.*²⁹ and Fan *et al.*³¹ suggest, first, evaluating muscle function through dynamometry and then prescribing formulas enriched with omega-3 fatty acids. This recommendation is based on the fact that this protocol results have a positive impact on the length of hospital stay, ventilation requirement time, and even mortality in patients with ARDS, acute lung injury, and sepsis.³²⁻³⁵

Other researchers also propose administering antioxidants as high-dose monotherapy only in cases of proven deficiency because oxidative stress occurs in severe critical care conditions that require mechanical ventilation due to ARDS.^{36,37} Reeves *et al.*³⁸ also suggest evaluating the coverage of nutritional requirements in non-ventilated patients, as energy and protein intake may be inadequate, leading to the requirement and increase of time under non-invasive ventilation.

On the other hand, the benefits of using selenium to treat COVID-19 remain unclear, as research results in this regard are uncertain and, therefore, more clinical trials are required to establish its effectiveness.^{27,39}

De Waele *et al.*⁴⁰ reported that in pulmonary insufficiency, classically manifested as ARDS, proteins should initially be delivered at low volume and progressively increased to 1.3 g/kg/day after septic shock symptoms decrease, using both the enteral and parenteral route, or through mixed nutritional support to cover protein and caloric targets. Concerning pharmaconutrition, these authors do not recommend supplementation with arginine or selenium, but they do advise giving a low dose of glutamine to patients receiving parenteral nutrition.

It is worth noting that, as a result of the search for alternatives to curb the COVID-19 pandemic, vitamin C consumption has increased considerably thanks to its antiviral action, which has been reported for decades in multiple publications that recommend its use to prevent and treat infectious diseases.^{17,41,42} In this regard, Zhang & Liu,¹⁶ based on the Hemilä study⁴³ and an analysis of SARS-CoV infection, state that this vitamin stimulates immune function and protects against infections caused by a coronavirus.

Moreover, recent publications report that vitamin D supplements can be used as a measure to reduce the risk of infection in general.^{44,45} In this way, Grant *et al.*⁴⁶ established 10 000 Iu/day as the suggested dose and reported that higher doses of vitamin D3 may be useful for the treatment of patients with COVID-19.

Other nutritional recommendations given by Barazzoni *et al.*³⁰ focus on providing, at least for a month, at least 400 kcal/day of oral nutritional supplements that include 30g or more of protein per day. These authors also recommend prescribing enteral nutritional support to patients in whom oral nutritional needs cannot be met and evaluating the prescription of parenteral nutrition when enteral nutrition is contraindicated, or nutritional goals are not achieved by this route.

Nutritional therapy monitoring

Another recommendation to treat COVID-19 is to monitor diet and/or tolerance to enteral nutritional support in inpatients. Surveillance should be carried out based on the experience of the 2002 SARS outbreak, where between 16% and 73% of patients had gastrointestinal symptoms, mainly diarrhea during the first week of the disease.⁴⁷

Feng *et al.*⁴⁸ stated that coronavirus receptors, including angiotensin-converting enzyme 2 (ACE2) for SARS-CoV and SARS-COV-2, are digestive enzymes that can affect enterocytes in humans. Therefore, the use of probiotics or prebiotics is suggested since, in patients with COVID-19, gut dysbiosis has also been found with reduced probiotics such as lactobacillus and bifidobacterium. Also, Xu *et al.*¹⁹ suggested implementing nutritional support and supplying prebiotics or probiotics to regulate the balance of the gut microbiota and reduce the risk of secondary infection due to bacterial translocation.

Similarly, it is important to evaluate the passage of enteral nutrition through the nasogastric tube in intubated and ventilated patients or through the postpyloric tube in patients at high risk of aspiration or with gastric intolerance after prokinetic treatment.

The prone position per se is not a limitation or a contraindication to enteral nutrition according to Barazzoni

et al.,³⁰ who further recommend, on the one hand, to evaluate the benefit of switching to supplementary parenteral nutrition after one week of enteral nutrition and, on the other, consider the adaptation of food textures in ICU patients with dysphagia after extubation. To this end, it is necessary to assess the need to continue enteral nutrition by tube to meet the nutritional needs of patients.

In relation to nutritional biochemical parameters, levels of albumin, lymphocytes, lactate dehydrogenase, neutrophils, and C-reactive protein should be monitored as these parameters are highly correlated with acute lung injury. Liu *et al.*,⁴⁹ from a study of 12 cases of patients infected with SARS-CoV-2 who developed pneumonia, described the laboratory characteristics and potential biomarkers for predicting the severity of COVID-19. They stated that 50% of cases develop ARDS, which presents with hypoalbuminemia; decreased CD8, lymphocytes and neutrophils count; and elevated C-reactive protein and lactate dehydrogenase. Based on such observations, the authors concluded that age, viral load, lung injury score, and blood biochemistry measures could be predictors of disease severity.

The following are the basic recommendations for clinical practice regarding the prescription and follow-up of nutritional support according to the literature reviewed (Table 2).

Table 2. Basic recommendations for clinical practice for the prescription and follow-up of nutritional support.

Purpose	Recommendations
To establish nutritional risk	Applying a nutritional screening tool within the first 24-48 hours of hospital stay.
To intervene nutritionally patients at risk of malnutrition or undernutrition	Establishing the start and objectives of nutritional support; monitoring energy, protein, vitamins, minerals, and water balance levels according to the established goals; starting enteral nutrition support (where applicable) in continuous infusion if the patient requires prone position; and using prokinetic agents according to the prescribed drugs.
To monitor the risks associated with enteral nutrition administration	Establishing measures to reduce the risk of aspiration pneumonia.
To monitor the presence of gastrointestinal symptoms	Evaluating tolerance to enteral nutritional support and the need for nutritional support and supply of prebiotics or probiotics to regulate the balance of the intestinal microbiota.

Source: Own elaboration based on Zhang & Liu,¹⁷ Xu *et al.*,¹⁸ Xu *et al.*,¹⁹ Li *et al.*²⁸ and Singer *et al.*²⁹

Finally, according to Heymann & Shindo,⁵⁰ it is necessary to continue to design communication strategies that provide the general population and vulnerable populations with actionable information to know what follows regarding hospital nutritional care in the context of the coronavirus disease for self-protection. The following flowchart presents the aspects to be considered to care for inpatients with COVID-19 (Figure 2).

Practices in hospital food services

Because of the impact that COVID-19 has had around the globe and the complications it can cause in infected patients, actions should be proposed to respond to the health emergency that this disease has caused, prevent foodborne diseases, contribute to the containment of the virus, and establish theoretical-practical recommendations for hospital nutritional intervention.

In order to achieve this, first of all, workflows should be created, and the food service staff divided into two groups, one in charge of the provision of hospital food to patients with COVID-19 and another in charge of feeding the care and administrative staff. This is necessary because the virus has high transmissibility from person to person by air, through droplets and contact, so the strict application of protocols is required to isolate infected patients and prevent nosocomial spread.^{15,51,52}

Secondly, systematic processes of risk analysis and critical control points should be strengthened.⁵³ In this sense, it is essential to plan the safe transport of the food to be supplied to patients with suspected or diagnosed COVID-19. Similarly, food service workers in hospitals, in general, should be educated on the disease, biosafety protocols in the framework of the pandemic, and specific recommendations for infected patients.²⁵

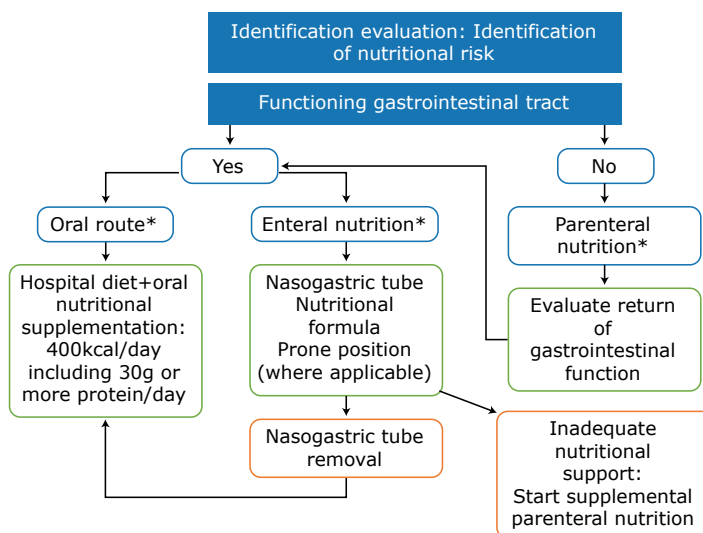


Figure 2. Flowchart for hospital nutritional care in COVID-19 patients.

* A nutritional intake of 20-30 kcal/day and 1.2-2g protein/kg/day should always be guaranteed.

Source: Own elaboration.

The following are the actions aimed at mitigating the spread associated with food services based on the authors' experience and the recommendations found in the literature:

From the perspective of patient safety, every health institution (medical centers, clinics, hospitals, etc.) must have a protocol to ensure nutritional care for patients. Such protocol should include indications of diet-based therapy and nutritional counseling for food supply service companies^{41,54} and it should also implement sequence checklists for work teams in charge of preparing the menus to minimize the movement of personnel, control infection, and prevent cross-contamination.²⁵

Finally, to ensure good hydration, nutrition, and food for patients with COVID-19, hospital food services should adopt the recommendations stipulated by the Spanish Academy of Nutrition and Dietetics and the General Council of Dietitians-Nutritionists of Spain.²⁷ Also, as stated by Ren *et al.*,⁵⁵ it is necessary to share open and transparent information with the general public about the outbreak.

Currently, evidence on nutritional interventions in the context of the COVID-19 pandemic is incipient, so methodological research should be developed to propose medium- and long-term solutions to treat these patients.

The limitation of the present research was that most publications found were literature reviews. Therefore, other studies of greater methodological rigor should be reviewed in the future to have more concrete evidence.

Conclusions

Given the complex and constantly evolving dynamics of SARS-CoV-2 infection and its outcomes, theoretical-practical nutritional intervention guidelines should be implemented to respond immediately to each patient's requirements.

Recommendations for hospital nutritional care of patients with COVID-19 are based on nutritional care processes and food services management. According to these recommendations, strategies for nutritional risk assessment should be established, as well as nutritional support inter-

ventions that reduce the risk of malnutrition by ensuring a caloric and nutritional contribution that favors clinical outcomes. It is also necessary to monitor the risks associated with the administration of nutritional support and metabolic alterations associated with this disease.

Conflicts of interest

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