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REVIEW ARTICLE

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Enteral nutrition and congestive heart failure: a systematic review

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Abstract

Introduction: Congestive heart failure (CHF) is a serious and growing public health problem worldwide. Approximately 23 million people are carriers of this disease and two million new cases are diagnosed each year. The clinical evolution of patients with CHF is moving towards variable malnutrition, making it necessary to adhere to enteral nutrition (EN). This picture can occur due to inadequate intake, altered metabolism, proinflammatory state, increased oxidative stress, and greater loss of nutrients, even due to drug interactions. **Objective:** It was to carry out a systematic review of the main clinical outcomes that demonstrate the importance of enteral nutrition in patients with congestive heart failure. **Methods:** The systematic review rules of the PRISMA Platform were followed. The research was carried out from September to October 2022 in 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:** A total of 122 articles were found. A total of 87 articles were evaluated and 28 were included in this systematic review. Considering the Cochrane tool for risk of bias, the overall assessment resulted in 7 studies with a high risk of bias and 8 studies that did not meet GRADE. There is moderate scientific evidence of the effectiveness of enteral nutrition in increasing survival and reducing morbidity in patients with congestive heart failure, as there are few randomized clinical trials that have evaluated this issue, however, enteral nutrition is highly indicated in the attempt to mitigate weight loss in these patients.

Keywords: Congestive heart failure. Enteral therapy. Enteral nutrition. Clinical studies. Level of Evidence.

Introduction

Congestive heart failure (CHF) is a serious and growing public health problem worldwide, being the final common pathway of most heart diseases **[1,2]**. Although scientific and technological advances and better socioeconomic conditions have made it possible to increase the longevity of the general population and those with heart disease, there has been an increase in the incidence of CHF in the world **[3-5]**. Approximately 23 million people are carriers of this disease and two million new cases are diagnosed each year. CHF is an important public health issue, due to its high prevalence, severity of clinical manifestations, and poor prognosis **[4,5]**.

In this context, statistical data from the United States estimate that 5.7 million Americans over 20 years of age have CHF, an increase of approximately 46.0% between 2012 and 2030 is expected, resulting in more than 8 million adults **[5]**. In Brazil there are no epidemiological studies involving the incidence of heart failure, however, according to other countries, it can be estimated that up to 6.4 million Brazilians suffer from this syndrome **[6]**.

In this sense, CHF is caused by structural and functional abnormalities of the heart, leading to deficiencies in ventricular ejection and/or ventricular filling capacity **[6-8]**. In Brazil, the main causes of CHF are myocardial ischemia, systemic arterial hypertension, dilated cardiomyopathy, and Chagas disease, as well as a valvular disease **[6]**. After a cardiac injury, the consequent molecular, structural, and functional

ventricular changes are known as cardiac remodeling. This process is accompanied by cardiac and systemic inflammatory and neurohormonal activation, which adversely affects the heart in a vicious cycle and compromises different organs and systems [6].

In recent decades, it has become clear that pathological changes involve not only the cardiovascular system, but also the renal, neuroendocrinological, immune, hematological, gastrointestinal, and musculoskeletal systems, as well as nutritional status [2-4]. Currently, experimental and clinical studies have focused on the pathophysiology of systemic complications related to CHF, to establish treatments to improve quality of life and increase survival [7-9].

In this regard, the clinical evolution of patients with CHF is moving towards variable malnutrition [6-9], making it necessary to adhere to enteral nutrition (EN). This picture can occur due to inadequate intake, altered metabolism, pro-inflammatory state, increased oxidative stress, and greater loss of nutrients, even due to drug interactions. Anorexia is a consequence of reduced nutrient intake or the association of absorptive and metabolic changes (hypermetabolism, hypoxia, increased energy expenditure, inflammation) [8,9]. Edema of the intestinal loops in heart failure may be responsible for the presence of nausea, malabsorption of lipids, a sensation of gastric fullness, and protein losses [10].

Furthermore, the presence of malnutrition is an important predictive factor for reduced survival in patients with CHF, regardless of important variables such as age, functional class, and ejection fraction [2,11,12]. Thus, NE becomes imperative in an attempt to treat or mitigate CHF comorbidities.

Thus, the present study carried out a systematic review of the main clinical outcomes that demonstrate the importance of enteral nutrition in patients with congestive heart failure.

Methods

Study Design

The systematic review rules of the PRISMA Platform (Transparent reporting of systematic review and meta-analysis - www.prisma-statement.org/) were followed.

Data Sources and Research Strategy

The search strategies for this systematic review were based on the keywords (MeSH Terms): *Congestive heart failure. Enteral therapy. Enteral nutrition. Clinical studies. Level of Evidence*. The research was carried out from September to October 2022 in Scopus, PubMed, Science Direct, Scielo, and Google Scholar databases. In addition, a combination of keywords with the Booleans "OR", "AND" and the operator "NOT" were used to target scientific articles of interest.

Study Quality and Risk of Bias

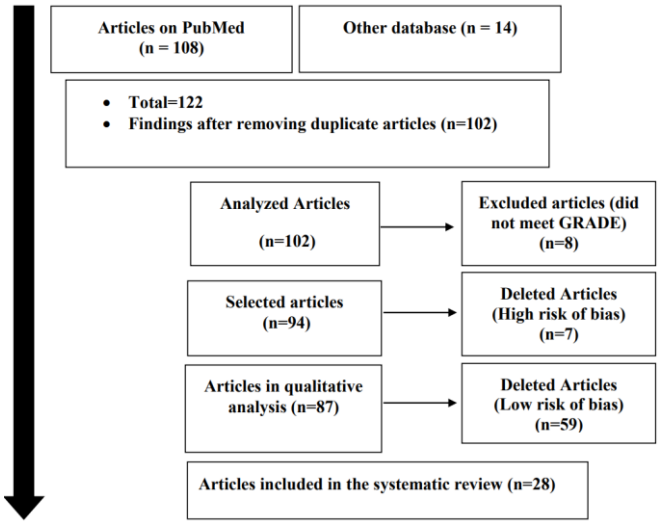
The quality of the studies was based on the GRADE instrument and the risk of bias was analyzed according to the Cochrane instrument.

Results and Discussion

Summary of Literary Findings

A total of 122 articles were found. Initially, duplicate articles were excluded. After this process, the abstracts were evaluated and a new exclusion was performed, removing the articles that did not include the theme of this article, resulting in 87 articles. A total of 28 articles were evaluated in full and included and developed in this systematic review study (Figure 1). Considering the Cochrane tool for risk of bias, the overall assessment resulted in 7 studies with a high risk of bias and 8 studies that did not meet GRADE.

Figure 1. Flowchart showing the article selection process.



Congestive heart failure (CHF) is a pathology in which circulatory, neurohormonal, and metabolic factors interact, causing cardiac muscle dysfunction, ventricular hypertrophy, and hemodynamic changes [1-3]. The symptoms cause major cardiac repercussions to the individual, with repeated hospitalizations and even death [4]. Mortality in CHF is related to age, with an increase of 27.0% per decade of life for men and 61.0% for women [5].

In this sense, in CHF there are multiple causal factors of malnutrition, known as cardiac cachexia [2-6]. It is necessary to distinguish in CHF the eutrophic individual from those with insufficient nutrition or with

severe malnutrition or cachexia, according to the classification of the New York Heart Association class III and IV [6]. Thus, the numerous hospitalizations make patients depressed and unreceptive to salt-restricted and unattractive food [6,7]. Dyspnea, muscle fatigue, and edema, including in the gastrointestinal tract, combine to reduce oral intake, requiring enteral nutritional support [8-12].

Also, patients with CHF need to be evaluated by a multidisciplinary team to determine the state of depletion in which the patient is and thus take measures to reduce the high catabolism caused by CHF, preserving the tissues and reducing the use of endogenous nutrients, the to recover organic functions to mitigate morbidity and mortality [13-16].

Severe malnutrition in patients with cardiomyopathy is multifactorial [17-19]. The metabolic imbalance occurs due to the high basal energy expenditure, around 20.0%, and there is not always adequate caloric replacement [20]. Recent articles report the action of cytokines in the pathogenesis of cardiac cachexia [1,2].

Furthermore, the tumor necrosis factor (TNF) has also correlated with its elevation in functional class IV patients, especially those with cardiac cachexia, which many believe to be due to the accelerated effect of skeletal muscle catabolism [21]. Only enteral nutrition (EN), associated or not with oral diet therapy, can recover the catabolism generated by CHF [21,22]. Other studies corroborate the onset of early EN in stable cardiomyopathy patients, around 24 to 48 hours after cardiac decompensation [3,4,23].

Also, EN is indicated for patients who do not meet the protein-caloric needs of oral diet therapy [4,24]. The use of the enteral route is well tolerated by patients, from 80.0 to 90.0% [2-4,6,25]. In malnourished patients due to cardiac decompensation, through enteral infusion, adequate nutritional support can be achieved, combined or not with an oral diet [6,26]. The elemental diet is indicated for patients with malabsorption, who have pre-digested proteins and free amino acids [27]. The polymeric diet contains 30.0 to 40.0% of lipids, proteins, and polysaccharides. If there is a decrease in gastric motility, the best choice is the elemental diet [27,28].

Besides, enteral diet therapy can be infused continuously or intermittently. Works have shown that more debilitated and less active patients better accept the diet via continuous probe, slowly and for a long period, even in patients with heart disease [3,7,8]. According to the authors, continuous infusion should decrease the likelihood of gastric distention, diarrhea, pulmonary aspiration, and metabolic abnormalities.

In case of diarrhea or intolerance, the diet formulation should be changed to fiber and ammonium acids to protect the gastrointestinal tract. In this sense, a higher rate of diarrhea was observed in the elderly when the enteral diet was administered intermittently [28]. Normally, diarrhea is not more frequent in patients with CHF, but rather a constipation due to less endogenous water and less physical movement [7,8].

In addition, pre-pyloric positioning is performed using a nasogastric tube or gastrostomy, and post-pyloric positioning using a nasojejunal tube or jejunostomy [9,10]. In the literature, a greater probability of aspiration of the diet via an intragastric or post-pyloric probe has not yet been confirmed. However, the clinical staff prefers post-pyloric positioning [10].

Moreover, enteral diet infusion access is percutaneous endoscopic gastrostomy, with low morbidity rates [4]. Due to the characteristics of the duodenal mucosa in patients with cardiomyopathy, the diet must be chosen by evaluating its osmolarity, caloric density, and infusion speed [4,5]. In this context, despite the support that EN provides, there may be gastrointestinal, metabolic, and mechanical complications [9]. In addition, infectious, respiratory, and psychological complications may also occur [10-13]. Gastrointestinal complications are the most common, including nausea and vomiting in 2.5 to 10% [13]. Gastric stasis harms much more in diabetic patients. Diarrhea is the most frequent, reaching up to 10.0 to 68.0% of cases [6].

In this regard, the reports of complications observed by the Enteral and Parenteral Nutritional Support Group in Brazil are notorious, which analyzed 80 patients who used vasoactive drugs, and 45.0% of them had some digestive complication, in 21.0%, of the complication was associated with the output through the tube and, in 10.0%, with diarrhea [6]. In another multicenter study carried out in the United States, it was verified in 360 patients that aspiration as a pulmonary complication was present in 88.0% of the cases [7].

In this scenario, although few studies or case reports show the efficacy of EN for the treatment of comorbidities in patients with CHF, there is an urgent need for randomized and controlled studies of nutritional treatment in this condition, to improve cardiac function through a greater supply of nutrients and energy. The other aim of such treatment is also to complement it with other therapies to provide extra protein during the treatment. In addition, other forms of nutritional support have been tested in a small number of patients with cachexia, particularly those undergoing cardiac surgery, in whom preoperative

feeding decreased the number of complications, mortality, and length of postoperative hospital stay [1,6].

However, an important disadvantage of these favorable nutritional studies on CHF is the fact that they were all performed in the era before modern standard treatment with angiotensin and converting enzyme inhibitors and beta-blockers [3]. There is evidence that angiotensin-converting enzyme inhibitors prevent weight loss [6].

Conclusion

It was concluded that there is still moderate scientific evidence of the effectiveness of enteral nutrition in increasing survival and reducing morbidity in patients with congestive heart failure, as there are few randomized clinical trials that have evaluated this issue, however, enteral nutrition is highly indicated in an attempt to mitigate weight loss in these patients.

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Ethical Approval

Not applicable.

Informed consent

Not applicable.

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Data sharing statement

No additional data are available.

Conflict of interest

The authors declare no conflict of interest.

Similarity check

It was applied by Ithenticate@.

References

1. Zhang D, Li H, Tian X, Zhang S. Effects of enteral nutrition on heart function, inflammatory markers and immune function in elderly patients with chronic heart failure. Pak J Med Sci. 2022 Jan-Feb;38(1):302-309. doi: 10.12669/pjms.38.1.4451.
2. Jiang M, Sun M, Zhang X, Li R. Nutritional status and its association with inhospital major adverse cardiac events in patients with severe heart failure: a prospective study. Nutr Hosp. 2022 Mar 29;39(2):256-265. English. doi: 10.20960/nh.03846.
3. Saijo T, Yasumoto K, Ohashi M, Momoki C, Habu D. Association between early enteral nutrition and clinical outcome in patients with severe acute heart failure who require invasive mechanical ventilation. JPEN J Parenter Enteral Nutr. 2022 Feb;46(2):443-453. doi: 10.1002/jpen.2118.
4. Lewis KD, Conway J, Cunningham C, Larsen BMK. Optimizing Nutrition in Pediatric Heart Failure: The Crisis Is Over and Now It's Time to Feed. Nutr Clin Pract. 2017 Jun 1:884533617712502. doi: 10.1177/0884533617712502.
5. Sahu MK, Singal A, Menon R, Singh SP, Mohan A, Manral M, Singh D, Devagouru V, Talwar S, Choudhary SK. Early enteral nutrition therapy in congenital cardiac repair postoperatively: A randomized, controlled pilot study. Ann Card Anaesth. 2016 Oct-Dec;19(4):653-661. doi: 10.4103/0971- 9784.191550.
6. Okoshi MP, Capalbo RV, Romeiro FG, Okoshi K. Cardiac Cachexia: Perspectives for Prevention and Treatment. Arq Bras Cardiol. 2016.
7. Pinho RA, Araújo MC, Ghisi GLM, Benetti M. Coronary heart disease, physical exercise and oxidative stress. Arq Bras Cardiol 2010;94:549-55.
8. Anker SD, John M, Pedersen PU, Raguso C, Cicoira M, Dardai E, Laviano A, Ponikowski P, Schols AMWJ, Becker DGEM HF, Bohm M, Brunkhorst FM, Vogelmeier C. ESPEN Guidelines on Enteral Nutrition: Cardiology and Pulmonology. Clinical Nutrition. 2006, 25, 311–318.
9. Singer P, Berger MM, Van den Berghe G, Biolo G, Calder P, Forbes A, et al. ESPEN guidelines on parenteral nutrition: intensive care. Clin Nutr 2009;28: 387e400.
10. Kreymann KG, Berger MM, Deutz NE, Hiesmayr M, Jolliet P, Kazandjiev G, et al., DGEM (German Society for Nutritional Medicine), Ebner C, Hartl W, Heymann C, Spies C, ESPEN (European Society for Parenteral and Enteral Nutrition). ESPEN guidelines on enteral nutrition: intensive care. Clin Nutr 2006;25:210e23.
11. McClave SA, Taylor BE, Martindale RG, Warren MM, Johnson DR, Braunschweig C, et al., Society

of Critical Care Medicine, American Society for Parenteral and Enteral Nutrition. Guidelines for the provision and assessment of nutrition support therapy in the adult critically ill patient: Society of Critical Care Medicine (SCCM) and American Society for Parenteral and Enteral Nutrition (A.S.P.E.N.). J Parenter Enter Nutr 2016;40:159e211.

12. Singer P, Hiesmayr M, Biolo G, Felbinger TW, Berger MM, Goeters C, et al. Pragmatic approach to nutrition in the ICU: expert opinion regarding which calorie protein target. Clin Nutr 2014;33:246e51.
13. Dvir D, Cohen J, Singer P. Computerized energy balance and complications in critically ill patients: an observational study. Clin Nutr 2006;25:37e44.
14. Alberda C, Gramlich L, Jones N, Jeejeebhoy K, Day AG, Dhaliwal R, et al. The relationship between nutritional intake and clinical outcomes in critically ill patients: results of an international multicenter observational study. Intensive Care Med 2009;35:1728e37.
15. Faisy C, Candela Llerena M, Savalle M, Mainardi JL, Fagon JY. Early ICU energy deficit is a risk factor for Staphylococcus aureus ventilator-associated pneumonia. Chest 2011;140:1254e60.
16. Petros S, Horbach M, Seidel F, Weidhase L. Hypocaloric vs normocaloric nutrition in critically ill patients: a prospective randomized pilot trial. J Parenter Enter Nutr 2016;40:242e9.
17. Villet S, Chiolero RL, Bollmann MD, Revelly JP, Cayeux MC, Delarue J, et al. Negative impact of hypocaloric feeding and energy balance on clinical outcome in ICU patients. Clin Nutr 2005;24:502e9.
18. Eyland DK, Dhaliwal R, Wag M, Day AG. The prevalence of iatrogenic underfeeding in the nutritionally 'at-risk' critically ill patient: results of an international, multicenter, prospective study. Clin Nutr 2015;34:659e66.
19. Petros S, Engelmann L. Enteral nutrition delivery and energy expenditure in medical intensive care patients. Clin Nutr 2006;25:51e9.
20. Genton L, Dupertuis YM, Romand JA, Simonet ML, Jolliet P, Huber O, et al. Higher calorie prescription improves nutrient delivery during the first 5 days of enteral nutrition. Clin Nutr 2004;23:307e15.
21. Oshima T, Heidegger CP, Pichard C. Supplemental parenteral nutrition is the key to prevent energy deficits in critically ill patients. Nutr Clin Pract 2016;31: 432e7.
22. Oshima T, Deutz NE, Doig G, Wischmeyer PE, Pichard C. Protein-energy nutrition in the ICU is the power couple: a hypothesis forming analysis. Clin Nutr 2016;35:968e74.
23. Pichard C, Oshima T, Berger MM. Energy deficit is clinically relevant for critically ill patients: yes. Intensive Care Med 2015;41:335e8.
24. Heidegger CP, Berger MM, Graf S, Zingg W, Darmon P, Costanza MC, et al. Optimisation of energy provision with supplemental parenteral nutrition in critically ill patients: a randomised controlled clinical trial. Lancet 2013;381: 385e93.
25. Gramlich L, Kichian K, Pinilla J, Rodych NJ, Dhaliwal R, Heyland DK. Does enteral nutrition compared to parenteral nutrition result in better outcomes in critically ill adult patients? A systematic review of the literature. Nutrition 2004;20:843e8.
26. Evans RA, Strauss BJ. Cost and benefit of hospital, hospital-in-the-home and ambulatory care nutrition support services. Asia Pac J Clin Nutr 1998;7: 241e4.
27. Wei X, Day AG, Ouellette-Kuntz H, Heyland DK. The association between nutritional adequacy and long-term outcomes in critically ill patients requiring prolonged mechanical ventilation: a multicenter cohort study. Crit Care Med 2015;43:1569e79.
28. Reignier J, Darmon M, Sonneville R, Borel AL, Garrouste-Orgeas M, Ruckly S, et al. Impact of early nutrition and feeding route on outcomes of mechanically ventilated patients with shock: a post hoc marginal structural model study. Intensive Care Med 2015;41:875e86.