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Aspects related to enteral nutrition with food at home: an integrative literature review

Aspectos relacionados à nutrição enteral com alimentos no domicílio: uma revisão integrativa de literatura

Abstract

Introduction: The use of enteral nutrition (EN) has increased significantly, especially in home environments. Although promising, the application of food-based nutritional preparations raises concerns among nutrition professionals regarding safety and efficacy, thus impacting prescription. *Objective*: To identify the main factors influencing the prescription of home enteral nutrition (HEN) with food-based preparations. *Method*: An integrative literature review was carried out using the descriptors "Enteral Nutrition", "Enteral Feeding", "Formulated Foods", "Home", "Home Care", and "Home Patient", in English, Portuguese, and Spanish. The databases consulted were PubMed, Virtual Health Library, ScienceDirect, and SciELO. Two researchers selected the studies following previously established eligibility criteria, and the studies selected were organized in an extraction table for analysis. *Results*: Of the 81 articles identified, six were included in the final analysis. The studies addressed three main aspects: nutritional and energy, microbiological, and socioeconomic. The food-based preparations showed variation in the composition of micronutrients and macronutrients, allowing adaptations to different health conditions. Both food preparations and industrialized formulas presented microbiological risks, requiring care in home management. The food preparations were economically advantageous and could be adjusted according to seasonality and the financial reality of the families. *Conclusion*: The prescription of HEN with food is influenced by nutritional, microbiological, and socioeconomic factors, which should ensure the efficacy and safety of home treatment.

Keywords: Enteral nutrition. Food. Food Intake.

Resumo

Introdução: O uso da nutrição enteral (NE) tem aumentado expressivamente, especialmente em ambientes domiciliares. A aplicação de preparações nutricionais à base de alimentos, embora promissora, suscita preocupações entre os profissionais de Nutrição quanto à segurança e eficácia, impactando a prescrição. *Objetivo*: Identificar os principais fatores que influenciam a prescrição da nutrição enteral domiciliar (NED) com preparações à base de alimentos. *Método*: Realizou-se uma revisão integrativa da literatura,

utilizando os descritores "Nutrição Enteral", "Alimentação Enteral", "Alimentos Formulados", "Domicílio", "Assistência Domiciliar" e "Paciente Domiciliar", em inglês, português e espanhol. As bases de dados consultadas incluíram PubMed, Biblioteca Virtual em Saúde, ScienceDirect e SciELO. A seleção dos estudos foi feita por duas pesquisadoras, seguindo critérios de elegibilidade previamente estabelecidos, e os estudos selecionados foram organizados em uma tabela de extração para análise. ***Resultados***: Dos 81 artigos identificados, seis foram incluídos na análise final. Os estudos abordaram três principais: aspectos nutricionais e energéticos, microbiológicos e socioeconômicos. As preparações à base de alimentos mostraram variação na composição de micronutrientes e macronutrientes, permitindo adaptações a diferentes condições de saúde. Tanto as preparações com alimentos quanto as fórmulas industrializadas apresentaram riscos microbiológicos, exigindo cuidados no manejo domiciliar. As preparações com alimentos foram economicamente vantajosas, podendo ser ajustadas conforme a sazonalidade e a realidade financeira das famílias. ***Conclusão***: A prescrição da NED com alimentos é influenciada por fatores nutricionais, microbiológicos e socioeconômicos, que devem assegurar a eficácia e segurança do tratamento domiciliar.

Palavras-chave: Nutrição enteral. Alimentos. Ingestão de Alimentos.

INTRODUCTION

The accelerated aging of the Brazilian population has led to a concomitant increase in the incidence of chronic non-communicable diseases (NCDs).[1] Consequently, the demand for enteral nutrition (EN) has also grown. EN is a form of feeding administered by alternative routes, indicated for people who, due to clinical changes in the gastrointestinal tract or swallowing difficulties,[2] are unable to meet their nutritional needs autonomously orally.

Home enteral nutrition (HEN) has several therapeutic treatment characteristics, however, in most cases, it is used to preserve life, especially for people with sequelae of NCDs.[1] Regarding the quality of life of HEN patients, it can vary due to several factors, such as the emotional conditions of the patient and their family, who the responsible caregiver is, the model of tube used, the environment where the food is made and applied, and characteristics of the nutrition used (industrialized formula, food and mixed preparations, when industrialized products and foods are used). When the patient's clinical status is stable and the only change is the use of the alternative food route, HEN is indicated. When compared with hospital EN, it is observed that it is a more economical procedure, hospital expenses are reduced,[3] and it promotes well-being for patients and their families.

Food preparations, also called homemade, seem to be more accessible from an economic point of view and, if well planned and prepared, can be an alternative for HEN patients.[4]

Studies show that the complications of HEN have a quick resolution. The most frequent are related to gastrointestinal issues that vary from patient to patient, the tubelocation, and the form of nutrition administration.[5] According to the characteristics of EN, industrialized formulas tend to present a lower risk of microbiological contamination, due to their preparation having less contact between the handler and the product. However, there are still questions about the microbiological quality of food preparations, and there are few studies on the subject,[6] which generates controversies about the recommendation or not of this category of EN.

Nutrition professionals often feel insecure when prescribing food-based preparations, due to uncertainty about nutritional quality. In order to support decisions in the prescription of EN, this study aims to identify the main factors that influence the prescription of home enteral nutrition with food-based preparations.

METHOD

This is an integrative literature review that seeks to synthesize the understanding of the application of non-theoretical studies[7] to investigate existing knowledge on a given topic. The guiding question for this research was: "What are the aspects to be considered in the prescription of HEN with food?".

For the bibliographic survey of the review, searches were carried out in the PubMed, Scielo, Lilacs (VHL), and ScienceDirect databases, from September 2021 to March 2022. The descriptors were defined in the science and health platform (DeCs/MeSH) – Enteral Nutrition, Enteral Feeding, Formulated Foods and Home, Home Care, Home Patient –, using the Boolean operators "OR" and "AND".

In all databases, the following filters were used: language (English, Spanish, and Portuguese), also adding the full-text option, according to availability.

The inclusion criteria established for the selection of studies were: original, interventional, and observational articles addressing HEN in adults (>18 years), and that were journals with public access in the

languages cited in the searches. Review articles (systematic and integrative) or meta-analysis, articles that were not available in full and that dealt only with industrialized formulas, were excluded. There was no restriction regarding the publication date of the selected articles.

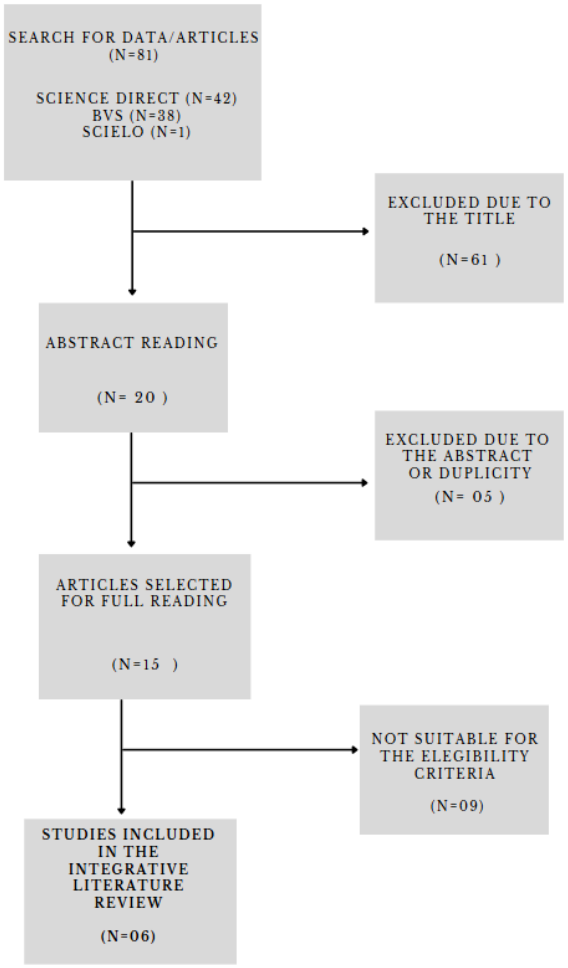
The article selection and analysis were made independently by two researchers, first to read the title and later to read the abstracts, to carry out the classification. If there were divergences in the studies classification, the results obtained were analyzed together, so that a consensus could be established. With the final sample of the selected studies, an extraction table was elaborated, in ascending order according to the year of publication, with the main information of the articles: author, journal, title, objective, methodology, results, and conclusion.

After analyzing the studies, the main thematic axes of each article were defined, which are the nutritional (energy and macronutrients), microbiological, and economic aspects. Subsequently, the Venn diagram[8] was created to discuss the established themes.

RESULTS

Of the 81 articles found, 15 were read in full, and after complete reading, 6 were selected for this review, according to the flowchart shown in Figure 1.

Figura 1. Fluxograma das etapas de seleção dos artigos.



Adapted PRISMA flowchart for systematic reviews.

Among the studies evaluated, four analyzed food and/or mixed preparations[9-12] used for patients in HEN considering nutritional, microbiological, and economic aspects. The variation of up to 110% between the estimated and analyzed values stands out.[10] Another study evaluated the influence of industrialized formulas on the nutritional status of patients,[13] and one study discussed the economic aspects of home enteral nutrition,[14] as shown in Table 1. Of the six articles selected for the review, five were conducted in Brazil between 2013 and 2018.

The thematic axes for the Venn diagram are shown in Figure 2. The diagram presents the main aspects discussed in the studies selected for this review.

Table 1. Authors, reference data of the publication, title, objectives, method, results, and conclusion of the selected articles.

AUTHOR, YEAR and JOURNAL	TITLE	OBJECTIVE	METHODOLOGY	RESULTS AND CONCLUSION
dos Santos VFN; Bottoni A; Morais TB [9] Rev. nutr ; 26(2): 205-214, Mar.-Apr. 2013.	Qualidade nutricional e microbiológica de dietas enterais artesanais padronizadas preparadas nas residências de pacientes em terapia nutricional domiciliar	To evaluate the physicochemical, microbiological, and nutritional properties of standardized homemade enteral diets prepared in the homes of patients undergoing home nutritional therapy.	This is a longitudinal observational study carried out in São Paulo-SP. Two experimental formulas (F1 and F2) were developed with different concentrations of maltodextrin, dehydrated albumin, whey protein, salt, soybean oil, and olive oil. 2 "Centrum" tablets, 2 sachets of vitamins and minerals, free of gluten and sucrose, have also been added. Afterward, these formulas were prepared in 33 homes of HENpatients,and samples were collected for analysis.	After the analysis of the preparations carried out at home, F1 had 1.2 Kcal/ml and 4.4g/100g of protein, and F2 had 1.5 Kcal/ml and 6.0g/100g of protein. Microbiological quality was also a concern, since approximately 40% of the samples were outside the standards established by ANVISA, reinforcing the need for a specific instrument of good practices in households for greater control.
de Sousa LRM; Ferreira SMR; Schieferdecker MEM [10] Nutr. hosp ; 29(3): 568-574, 2014	Physicochemical and nutritional characteristics of handmade enteral diets.	To determine the quality of homemade enteral diets.	This is an analytical study carried out in Curitiba-PR. A homemade diet plan consisting of 6 meals was developed. The preparations were calculated using table values and analyzed in the laboratory. The proportion of solids in the diet was 25%. The meal plan was classified as normocaloric and normoproteic with a total volume of 2 liters/day.	The meals had a nutritional discrepancy between the estimated and actual value, where the variations were from 22 to 110%. This variation between the formulas prepared with food is justified by the loss of nutrients in the sieving stage. The authors suggest that homemade preparations recover psychosocial values since they can be made at home with conventional foods. It suggests the prescription of a mixed diet since determining the nutritional composition of the homemade enteral diet is more challenging.

Table 1. Authors, reference data of the publication, title, objectives, method, results, and conclusion of the selected articles. Continues.

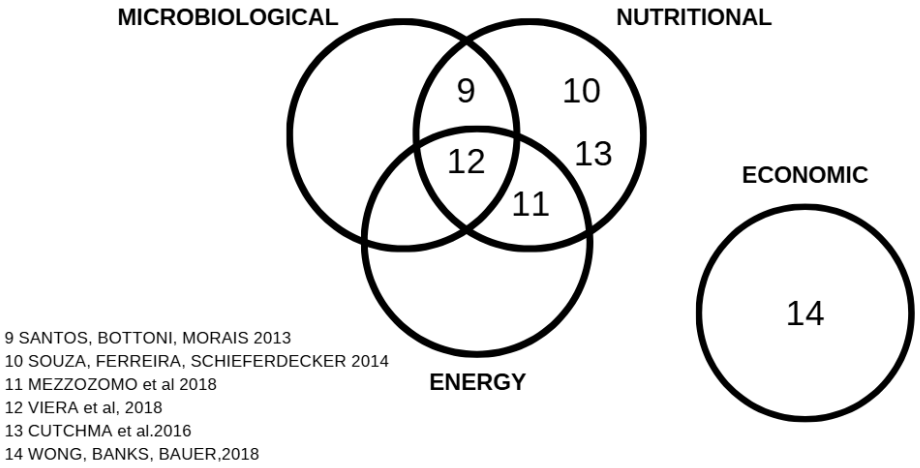
AUTHOR, YEAR and JOURNAL	TITLE	OBJECTIVE	METHODOLOGY	RESULTS AND CONCLUSION
Cutchma G. et al.[13] Nutr. clín. diet. hosp ; 36(2): 45-54, 2016.	Fórmulas alimentares: influência no estado nutricional, condição clínica e complicações na terapia nutricional domiciliar	To analyze the influence of the enteral nutrition category on the nutritional status, complications related to home enteral nutrition, and the need for hospitalization.	This is an analytical observational cross-sectional clinical study. Patients over 18 years of age living in the city of Curitiba-PR were included. Anthropometric, dietary, and HEN access route data were collected in a single visit between December 2012 and May 2013. Nutritional status was classified using BMI value. Dietary data to classify the food formulas used were collected from a 24-hour food recall made by the patient or caregiver.	The characteristics of the diet did not influence the nutritional status of the patients evaluated. Those who used a homemade diet had more tube obstructions due to inadequate homogenization, incorrect administration route of medications, and lack of water irrigation. Complications were reported in 38% of patients, the main ones being nausea and constipation. Hospital readmission was not related to the category of formula used.
Vieira MMC et al. [12] Clin Nutr; 37(1):177-181, 2018 02.	Nutritional and microbiological quality of commercial and homemade blenderized whole-food enteral diets for home-based enteral nutritional therapy in adults.	To evaluate the microbiological and nutritional quality of commercial and homemade diets for adults in HENT.	This was a cross-sectional study. It was made with 66 diets: 33 commercial (powder and liquid) and 33 non-commercial. Nutrition samples were collected at the homes of HENpatients in the urban area of São Paulo and analyzed in the laboratory. Anthropometric data from the patients were collected.	All patients had neurological disease, with a mean age of 73 years. In general, artisanal/homemade enteral preparations were low in energy and macronutrient values. The study suggests that the greater the manipulation, the greater the chances of microbiological contamination. Patients who used non-commercial diets had 64% and 45% of malnutrition according to the MUAC and TST indicators. Those who used commercial diets had 48% and 24% of malnutrition according to the MUAC and TST indicators. The impossibility of access to socioeconomic and demographic data were pointed out as studylimitations.

Table 1. Authors, reference data of the publication, title, objectives, method, results, and conclusion of the selected articles. Continues.

AUTHOR, YEAR and JOURNAL	TITLE	OBJECTIVE	METHODOLOGY	RESULTS AND CONCLUSION
Alvin Wong; Merrilyn D. Banks; Judith D. Bauer [14] Nutrients 2018, 10(2), 214	A Survey of Home Enteral Nutrition Practices and Reimbursement in the Asia Pacific Region.	To determine the availability of reimbursement in enteral nutrition, the type of feeding and enteral access used, national reimbursement policies, the presence of nutrition support teams, and clinical nutrition education.	This was a cross-sectional study that used a specific questionnaire, approved by the Parenteral and Enteral Nutrition Societies (PEN) of 13 of the 20 countries in the Asia-Pacific region where the questionnaire was applied. The questions involved: demographic data, reimbursement for enteral nutrition, current nutritional practice, training and clinical education in the country.The questionnaire was sent electronically.	Financial support for HEN was available in 40% of the countries studied. Homemade diet is used in Southeast Asia due to a lack of funding for commercial formula. Countries with higher incomes obtained a higher percentage of industrialized dietsuse.
Mezzomo TR, et al.[11] Nutr. clín. diet. hosp ; 38(3): 168-173, 2018.	Índice glicêmico e carga glicêmica de dietas enterais artesanais padrão para uso domiciliar	To determine the glycemic index and glycemic load of homemade enteral diets prescribed for home use.	This is a cross-sectional analytical observational study. A total of 22 recipes for homemade enteral diets prescribed at the time of patient discharge from hospitals and the Food and Nutrition Program of the Municipal Health Department of the city of Curitiba-PR/Brazil were analyzed. Homemade enteral diets prescribed in relation to the total daily glycemic index and glycemic load per daily meal were analyzed according to Lemos, Patek, and Mezzomo. The food used as a standard was glucose GI=100.	The GL of the diets varied between adequate and inadequate, and 68.1% (n=15) were adequate (low glycemic load). The others (high glycemic load) are related to the type of carbohydrate used in the preparation. GI was adequate in all homemade preparations, with an average of 28.6±7.6%. The study suggests that the calculation of these factors can help in the glycemic control of patients regardless of the type of diet.

*Note: HEN: Home Enteral Nutrition; MUAC: Mid-Upper Arm Circumference; TST: Triceps Skinfold Thickness; BMI: Body Mass Index; HENT: Home Enteral Nutritional Therapy; GI: Glycemic Index; GL: Glycemic Load.

Figure 2. Venn diagram on the main aspectspresented in the selected studies.



Energy and Nutritional aspects

Macronutrient values vary according to the characteristics of the nutrition prescribed, in which the preparation with food has lower values compared to the industrialized formula.[12] However, according to the study on glycemic index and load,[11] food preparations can be adapted to specific situations, such as for diabetics, and have a sufficient glycemic index, energy and macronutrients, resulting in adequate nutritional intake. The characteristics of the formula or preparation do not influence nutritional status, but patients who use the food preparation are more likely to have tube obstruction.[13] On the other hand, the 2014 study[10] discusses the importance of remembering that nutritional values depend on the foods used and their preparation, and may vary between preparations.

Microbiological aspect

The microbiological issue is a determining factor[9] in the adaptation process of HEN. Its influence on the nutritional status of the patient and its handling do not have a standardization aimed at reducing the risk of gastrointestinal symptoms due to inadequate handling of ingredients in the preparation. However, both food preparation and industrialized formulas pose microbiological risks to the patient[12] during the preparation stages.

Socioeconomic aspect

The availability of access to industrialized formulas is related to purchasing power and health protocols. Some Southeast Asian countries do not have funding for HEN, that is, the cost is under the full responsibility of the patient and their family. In general, countries with upper-middle income have a higher prevalence of the use of supplements and industrialized formulas, while in countries with lower income, people opt for preparations with foodor mixed.[14] In addition to the economic issue, food preparations help in the social integration process, as they rescue the psychosocial values that the patient loses during the exclusive use of industrialized formulas.[10]

DISCUSSION

Three aspects were identified: nutritional and energetic, microbiological, and socioeconomic. Most studies analyzed address industrialized nutrition, food preparations, and mixed ones. The vast majority of the selected studies were developed in Brazil. The nutritional characteristics of the preparation generate divergences, emphasizing that, if well adjusted, the preparation with food can achieve adequate nutrient values. Regarding the microbiological aspect, food preparations presented a higher risk of microbiological contamination, but industrialized formulas also have such a risk. Regarding the economic aspects of access and availability, food preparation was more acceptable and provided greater social integration.

Energy and Nutritional aspects

Foods have different nutritional values.When HEN is applied, these foods' quantity and nutritional quality must be known. Food preparations are a challenge for nutritionists as it is necessary to consider a series of factors that can both benefit and hinder their handling, such as the composition of macro and micronutrients and the preparations' consistency. The prescriptions of food preparations can reach 110% of the nutritional needs, as evaluated in the study that compared the estimated and analyzed preparations.[10]

This may be related to the nutritionist's concern with compensating for the losses that may occur in the preparation process. When correctly calculated and elaborated, these preparations can achieve adequate nutritional values.[9] In addition, it is important to establish criteria for training handlers, so that preparations are carried out as planned and prescribed.

In the study that compiled participants' anthropometry, dietary data, and food access data, the authors found that the characteristics of the EN used (with food or industrialized) did not influence the nutritional status of the patients. However, those who used the preparations with food had more cases of tube obstruction due to poor homogenization of the preparation.[13] A study conducted in two public hospitals in Iran evaluated the quality of enteral feeding and suggested that complications of tube obstruction can be reduced with the aid of a manual of good practices for preparations.[15]

The energy values of food-based preparations can vary depending on how they are prepared, such as the ingredients used, homogenization processes, sieving, and cooking factor.[10,16] However, these preparations are sufficient to meet patients' energy and nutritional needs, including those with specific conditions such as diabetes.[11] Thus, when considering different EN options, whether based on food preparations, industrialized formulas, or a combination of both, it is possible to increase the autonomy of patients and their families.

Microbiological aspect

Food preparations involve food handling, and this is a factor that influences the safety of EN. According to the cross-sectional study carried out in 2016, which analyzed 33 industrialized formulas and 33 food preparations,[12] it was observed that, concerning the microbiological standards established by the technical regulation for EN therapy for total coliforms, industrialized formulas comply with 63.64% of the adequacy, while the others (food and mixed preparations) comply with only 6% of these standards. These results confirm that the characteristics of EN do not ensure microbiological quality, and show the need to explore

the origin and hygiene of the prescribed nutrition. EN prepared with food, mixed or industrialized formulas have the risk of contamination during preparation.[17] Studies suggest that corrections should be made in the stages of handling and hygienic quality, from the acquisition of supplies for preparation to the administration of nutrition in the tube.[17,18] This adjustment can be made through training, qualifications, educational material, and manuals of good practices for food handlers, which is essential to reduce and avoid the risks of contamination.

The microorganisms found in the preparations are not necessarily potential health risks, but rather indicators of poor hygiene. Most of the modifications proposed to improve microbiological conditions are feasible. When indicators show inadequate hygiene, the solution involves modifications to improve microbiological conditions. Therefore, it is up to the responsible health team to develop health education activities to ensure the improvement of patients' quality of life[19] and, consequently, greater safety when consuming enteral preparations.

This aspect can be observed in the study that analyzed incidents related to enteral tubes and showed that the training and qualification of handlers directly influence the microbiological quality of the preparation, because, in most cases, the person who takes this responsibility is a family member[20] who does not have experience as to the correct way to prepare the food[17] to be administered via tube. An alert is needed concerning EN care, as it should be very well instructed at the time of hospital discharge prescription, in order to facilitate the patient's nutrition care process.[19]

Nutrition education and counseling are important at HEN.[15] From the moment that those responsible for the preparation of EN receive information about the appropriate way to handle the food, the microbiological risks – related to mesophilic bacteria and total coliforms – decrease.[9] In other words, the risks of patient contamination are reduced. What is not yet known is the influence of HEN contamination on the development of gastrointestinal problems such as flatulence, diarrhea, and vomiting.

Socioeconomic aspects

In developed countries, such as the United States, the use of industrialized formulas is common, especially in surgical patients, as it aims to minimize complications and improve healing in patients with gastrointestinal diseases[21] after hospital discharge. These formulas are practical, have a defined nutritional composition, and have greater microbiological control. However, in developing or underdeveloped countries, they are not affordable due to cost or logistics, which generates difficulty of access for the population that needs EN.[14,22] In this context, food preparations play an important role in maintaining the nutritional status of patients in HEN in which the underlying diseases do not require specialized EN, thus being able to adapt to the economic reality using the same foods consumed by the family.[23]

Another advantage of food preparations is the increase in the patient's proximity to the environment where they live.[10] In other words, these preparations enable the patient to create a bond with "real food",[24] they can be prepared according to seasonality – which varies the patient's eating plan – and help to maintain life, bringing the individual closer to the reality in which he or she is inserted. Industrialized formulas, on the other hand, reinforce the nutraceutical role of special situations such as pre and post-surgery, gastrointestinal diseases, and cancer treatment, among others, in which patients will benefit from the use of these products.[25]

However, in most developing countries, such as Brazil, the use of these formulas in the HEN generates increased costs, which is often unfeasible. In addition, many HEN patients have dysphagia, caused by

neurological diseases or cancer, with no prospect of cure. Because of this, food preparations are frequently used, but there is a need for studies that explore this theme.

Despite this, it is possible to observe that the preparation with food still generates uncertainties regarding its microbiological and nutritional quality. However, with the data observed in the studies, these preparations can be indicated as a possibility for patients who have a stable condition, in which nutrition aims to preserve life, in addition to establishing greater social bonding. There is also a need for training for caregivers, especially concerning preparation and hygiene.

This study has limitations in terms of deepening the aspects that influence the recommendation of food preparations, as it is a literature review. However, it is a tool to support professionals in prescribing EN, especially in primary care, for the use of HEN with food.

CONCLUSION

Nutritional and microbiological quality and economic aspects are points that influence the prescription and use of food preparation in the HEN. Regarding nutritional aspects, the preparation with food proved to be satisfactory, as it meets the recommended macronutrient values when prepared correctly. As for microbiological quality, there are still controversies, since regardless of whether EN is industrialized or with food, there is a risk of contamination, however, the number of studies that relate socioeconomic conditions and the lack of a manual of good practices to this theme is still scarce.

The economic aspect showed that industrialized formulas have a high direct cost and are not available in an affordable way to all individuals in HEN. Food preparations, in addition to lower direct costs, bring the patient closer to the dietary pattern of consumption in their family environment.

The need for further studies exploring the nutritional and microbiological implications of food preparations in HEN is highlighted.

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Contributors

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