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Trabajo Original

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Homemade diet *versus* diet industrialized for patients using alternative feeding tube at home - An integrative review

La dieta artesanal versus la dieta industrializada en pacientes con nutrición enteral domiciliaria: una revisión integradora

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Abstract

Background: Enteral nutrition therapy can be provided using commercialized products (chemically defined formulas) or blenderized home-made preparations.

Objective: To perform an integrative review of the literature comparing the use of both type of formulation.

Methods: In this descriptive study papers published in English, Spanish or Portuguese Brazil, in journals indexed in the databases PubMed, EMBASE, Scopus, Web of Science and Bireme without the period 2010 to 2015 were reviewed. The terms "enteral nutrition, foods, formulated, diet, homemade diet industrial and artisanal diet" according to the MeSH were used for the search.

Results: Twelve articles were selected. Most studies showed a level 4 of evidence and were published in journal in the higher Qualis index. Four aspects were evaluated: comparison between groups studying the clinical effects; comparison of the chemical composition of home-made products; physical-chemical and microbiological analysis of the enteral diets comes; articles on epidemiological Data on home enteral nutrition

Conclusion: Industrialized diet is more suitable for patients using alternative feeding supply at home. But it has a higher cost.

Key words:

Integrative review.
Enteral nutrition.
Handmade
enteral nutrition.
Enteral nutrition
industrialized.

Resumen

Introducción: en la terapia nutricional enteral pueden administrarse productos comerciales con fórmulas químicamente definidas o preparados artesanales compuestas por alimentos *naturales* y/o procesados.

Objetivo: realizar una revisión integradora de la literatura sobre el uso de la dieta artesanal *versus* industrializada, en pacientes con nutrición enteral.

Métodos: estudio descriptivo de los artículos originales que comparaban el uso de fórmulas enterales comerciales con preparados caseros. Se consideraron elegibles los artículos publicados en inglés, español o portugués, en revistas indexadas en las bases de datos: PubMed, Scopus, EMBASE, Web of Science y Bireme en el periodo de 2010 a 2015, a partir de los descriptores: "enteral nutrition, food, formulated, industrialized diet, homemade diet, handmade diet". Para el análisis de los estudios fue utilizado un instrumento específico para evaluación de artículos.

Resultados: finalmente se analizaron 12 artículos. La mayoría de los estudios presentó un nivel de evidencia 4 y fueron publicados en revistas de elevado índice Qualis. Los artículos fueron separados en 4 grupos: comparación del uso de las dietas y el efecto en los pacientes que las recibían; evaluación de la composición química de la alimentación enteral artesanal por medio de tablas de composición de alimentos; análisis físico-químico y microbiológico de las dietas enterales artesanales; y artículos que presentaron la situación epidemiológica de la terapia nutricional enteral domiciliaria.

Conclusión: la dieta industrializada es la más indicada para pacientes que nutrición enteral en el domicilio, mientras, que los costos generados pueden volverse grandes obstáculos para quien la elija.

Palabras clave:

Revisión integradora.
Nutrición enteral.
Dieta enteral
artesanal.
Dieta enteral
industrializada.

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INTRODUCTION

Enteral nutrition therapy (ENT) is indicated for patients with functioning gastrointestinal tract whose oral feeding is not possible or does not provide the proper amount of calories and nutrients necessary for their homeostasis (1-4).

For patients requiring enteral nutrition during a short period of time, the nasogastric tube is most commonly used, due to lower costs and easy installation. The indication of percutaneous endoscopic gastrostomy (PEG) or percutaneous endoscopic jejunostomy (JEP) should be considered (4) when the ENT period is longer. According to the Guidelines Project (1), when enteral nutrition is needed for longer than 30 days and also when the passage of a nasogastric tube is not feasible, due to obstruction, other authors suggest the employment of enterostomy for periods longer than three weeks (4), or when the nutritional therapy lasts longer than 6 weeks (5).

Enteral nutrition therapy may occur by infusion of processed products with chemically defined formulas or by handmade formulations composed of fresh food and/or processed (6).

In general, industrialized diets are convenient, nutritionally complete and provide greater certainty as for the microbiological control and chemical composition of nutrients, however, they are expensive, especially when administered for long periods, endangering treatment, leading many patients to use homemade formulas, also known as handmade diets (7).

The calculation of handmade diets is limited and does not offer complete safeness, since most of the time it is obtained from the nutritional composition tables of food employed. Moreover, the way that food is employed, the preparation techniques and procedures adopted (cooking time, grinding and sieving) lead to nutrients loss. As in Brazil there is no table of food composition to provide accurate and complete data on the amount of nutrients, the need for supplementation of these elements should be considered, in order to suit the individual daily needs. Besides the low cost, the possibility of individualization of the handmade diet can be considered as one of its advantages in relation to nutrition composition and volume (7,8).

Patients undergoing ENT, receiving hospital discharge and in need for keeping this type of therapy at home, usually end up manipulating the diet, as the cost of the industrialized enteral nutrition is very high (8,9).

The tubes used for ENT provide thin gauge allowing the passage of homogeneous solutions, but it becomes difficult to use thicker solutions when compared to the probes used for ostomy.

Whereas handmade diets are common for ENT, studies are necessary to assess which type of diet should be employed, whether homemade or industrialized.

Evidence-based practice constitutes an encouraging for the development and/or the employment of research results in clinical practice. Integrative review constitutes a research method allowing searching, critical evaluation and synthesis of available evidence about the researched theme, since its final product comprises the current knowledge of the investigated subject, the implementation of effective interventions in health assistance and

cost reduction, as well as the identification of gaps which lead to the development of future researches (10-12).

OBJECTIVES

- To conduct an integrative review of national and international literature on the use of homemade diet *versus* industrialized diet, for patients using alternative feeding supply.
- To describe the advantages and disadvantages of employing homemade enteral diet, whether via nasoenteral or nasogastric, gastrostomy or jejunostomy.
- To describe the advantages and disadvantages of employing industrialized enteral diet, whether via nasoenteral or nasogastric, gastrostomy or jejunostomy.

METHODS

This is a descriptive study, using the Integrative Review method, enabling evidence-based research, including studies from different approaches (quantitative, qualitative, experimental and non-experimental) to generate a concept overview, theory or relevant health problems (13). This methodology comprises several steps (10-12), as follows:

- *First step*: theme identification and hypothesis selection or research question, in order to elaborate the integrative review.
- *Second step*: establishment of inclusion and exclusion criteria of studies/sampling or literature search.
- *Third step*: definition of information to be extracted from selected studies/categorization of studies
- *Fourth step*: evaluation of the studies included in the integrative review.
- *Fifth step*: interpretation of results.
- *Sixth step*: presentation of the review/knowledge synthesis.

REVIEW OF PROBLEM IDENTIFICATION

From the hypothesis that there is difference between homemade enteral nutrition and industrialized enteral nutrition, and each diet, may or may not, produce different outcomes for patients who use them at their homes, the guiding question is: *According to the literature, which diet should be indicated for patients who use alternative nutrition supply at home?*

SAMPLE SELECTION

Articles were selected in English, Spanish or Brazilian Portuguese, published in journals indexed in databases of Medical Literature Analysis and Retrieval System on-line (MEDLINE, PubMed version), Scopus, EMBASE, Web of Science and Bireme, in the period between 2010-2015, from descriptors as "enteral nutrition, Food, Formulated, Industrialized diet, Homemade diet, Handmade diet",

according to the Medical Subject Heading (MeSH) and their equivalents in Portuguese, established by the descriptors in Health Sciences (DeCS). The search was performed concurrently on all databases using the descriptors combined by means of the connector Boolean "AND" and use of synonyms, through the Boolean connector "OR". A total of 3 different combinations or strategies have been to get results on the subject under study. Of the articles found, the titles and abstracts were carefully read and inclusion and exclusion criteria were considered. The selected articles which respected the established inclusion criteria were totally read. Publications as manuals, monographs, dissertation and repeated articles were excluded.

CATEGORIZATION, ANALYSIS AND INTERPRETATION OF THE STUDIES

A specific instrument was used for evaluating the articles to be included in the review studies, validated by Ursi (2005) (13). The instrument summarized the studies containing information related to the authors, their graduation and performance; year, journal and language of publication; country of origin of the study; methodological characteristics (type of research, objective, sample size, statistical processing of data, whether intervention was carried out, or not); main results; conclusion and limitations.

The publications evidence levels were also ranked according to the classification system, into six levels (11):

- Level I - multiple controlled studies meta-analysis;
- Level II - individual experimental studies;
- Level III - quasi-experimental studies, such as nonrandomized clinical trials, single group, pre and post-test, besides time series or case control;
- Level IV - non-experimental studies as descriptive, correlational and comparative research with qualitative approach and case studies;
- Level V – data evaluation from programs systematically obtained;
- Level VI - experts opinions, experience reports, consensus, regulations and laws.

Each journal was classified according to its Qualis index; classification defined by CAPES for stratification of the intellectual production quality of the post-graduation programs, indirectly, because it checks the quality of the articles from the analysis of the quality of the dissemination means (scientific journals). The classification is updated annually and follows a series of criteria, such as the amount of circulating copies, number of databases indexed and amount of institutions which publish in the journal. These means are classified into quality indicative strata, divided into eight levels, by order of quality: A1, the highest; A2; B1; B2; B3; B4; B5; C - weighing zero (15).

RESULTS

The search in the databases found 82 articles which were selected for checking compatibility with the inclusion criteria, and

61 articles were excluded for not being compatible with the subject under study, not answering the guiding question, presented in other languages (German, Japanese, French) and publications prior to 2010. From the remaining 21 articles, 9 of them were repeated on different platforms, so 12 articles were included for this review. The entire selection of the articles for evaluation can be seen in figure 1.

Many times, the descriptors employed in Brazil, are not only translated into English or Spanish, but are presented as idiomatic expressions, related to technical translation and difficult to find, making the research work dependent from library professionals and the topic to be addressed, so that the study result can be more refined. Thus, three search strategies were employed, in order to reduce potential bias and to make a complete research.

The first strategy employed the combination of the terms "enteral nutrition" AND "homemade diet OR handmade diet" AND "home care services", representing the search for enteral homemade diets, and at the end, 6 articles were selected for review, as shown in figure 2.

The second search strategy combined the terms "enteral nutrition" AND "industrialized diet OR food formulated" AND "home care services", representing the search for enteral diets with industrialized formula, produced at home, and the end 15 items were selected for review, as shown in figure 3.

The combination of home homemade enteral diet and industrialized diet, in the same search strategy, showed similar results only in the PubMed database, and no more articles were found on the other platforms. Similarly, other combinations with the same terms were used, but they presented extensive results comprising items different from the objective of this study.

The original countries of the studies on homemade enteral nutrition and industrialized enteral nutrition, were: Brazil (five articles), Spain (four articles), Poland (two articles) and Italy (one article). The predominant language was English (nine articles); nutritionists were authors of eight publications and physicians of 4.

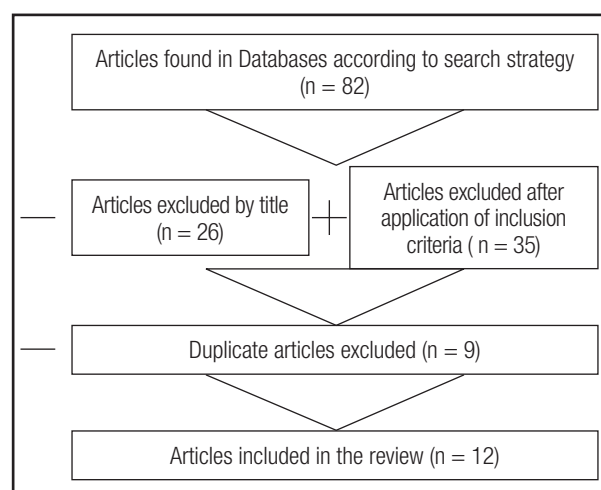
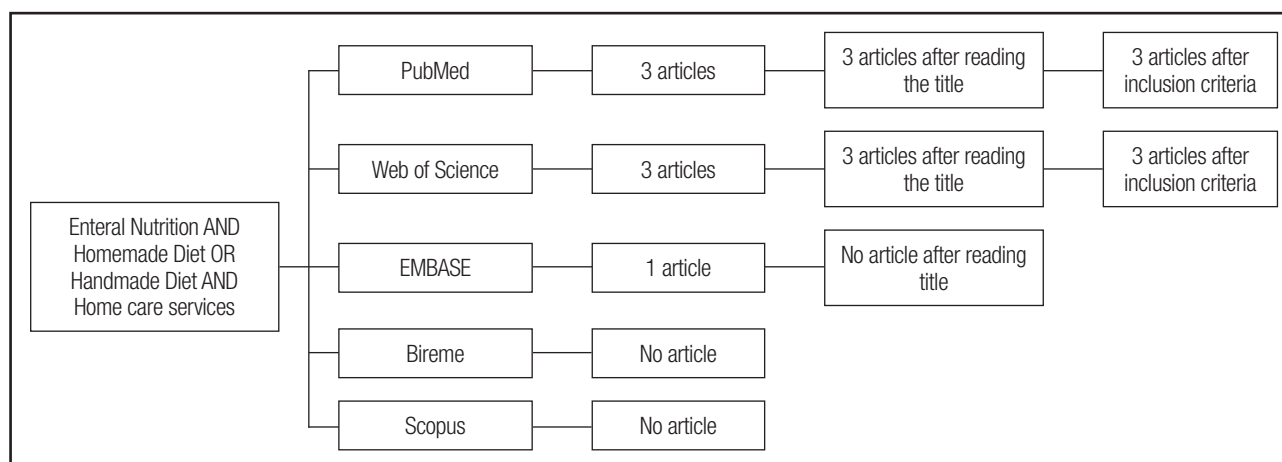
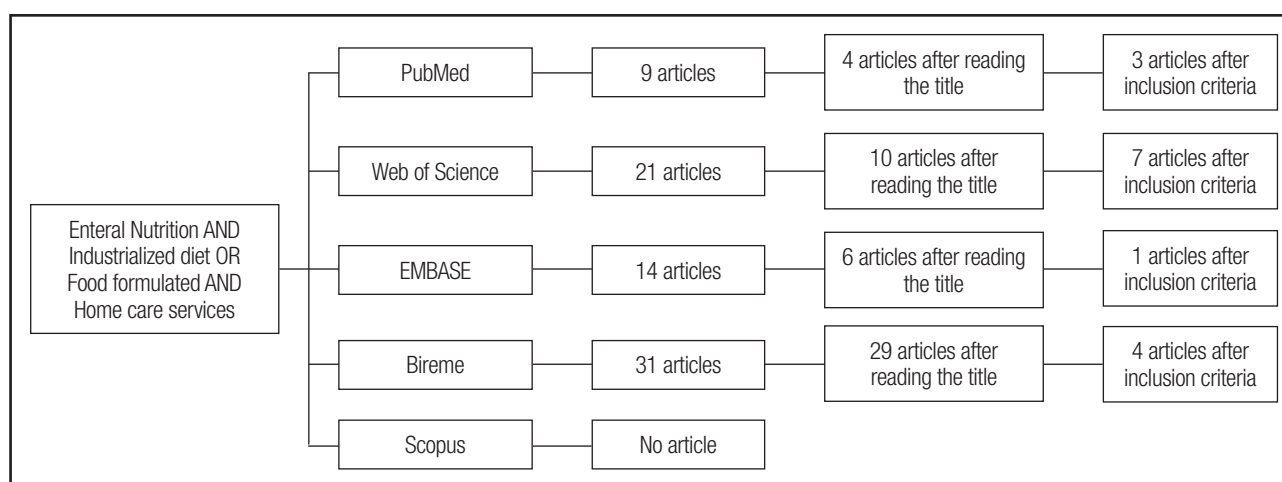


Figure 1.

Selection trajectory of the articles for integrative review.

**Figure 2.**

Articles selection by search strategy with descriptors for "homemade diet".

**Figure 3.**

Articles selection by search strategy with descriptors for "industrialized diet".

Most of the studies were published in high Qualis journals, according to table I.

The selected articles showed uniform distribution according to the publication year (Figure 4).

As for the methodological characteristics of the studies, most showed evidence level 4, as they were non-experimental descriptive studies, and two studies showed evidence level 3, as they presented quantitative and quasi-experimental approach, being published in high rate Qualis journal.

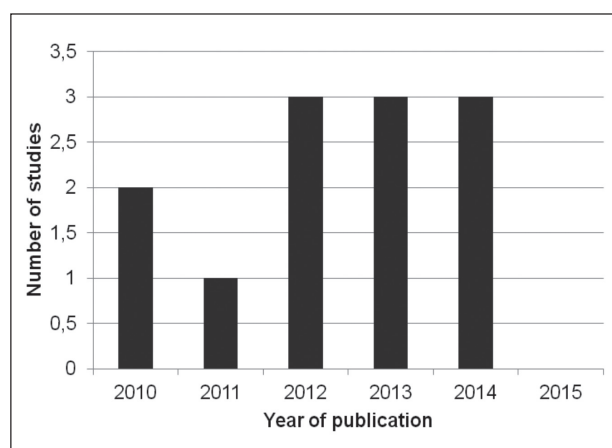
Studies ranged concerning the aspect of the research object, constituting four publication groups about homemade enteral diet and industrialized. Table I presents a summary of this integrative review.

The first group of publications comprised studies comparing the use of the diets and the effects upon the patients who received them (items 1, 2 and 9).

The two higher rating studies for Qualis and Level of Evidence, compared clinical outcomes for patients making use of industrialized enteral diet (or commercial formula) and home enteral diet (or homemade enteral diet), providing initial and periodic home visits, every 2 or 3 months. Over 2 years, they provided instructions on diet and care of the tube, assessed the nutritional status of the sample by means of clinical examination, Nutritional Risk Screening - NRS 2002 and Subjective Global Assessment (SGA), collected laboratory tests and anthropometric measures and triceps skinfold (TSF) and arm circumference (AC). As results, the implementation of homemade enteral nutrition therapy (ENT), employing chemically defined formulas enabled weight gain and stabilized liver function in both groups studied; significantly reduced the incidence of infectious complications, the number and length of hospitalization. Hospitalization annual average costs (\$) were also reduced (15,16).

Table I. Distribution of the selected articles according to the country of origin, language of publication, level of evidence, periodic and Qualis index

	Country of origin	Language	Journal	Qualis	Level of evidence
1	Poland	English	The American Journal of Clinical Nutrition	A1	3
2	Poland	English	Journal of Parenteral and Enteral Nutrition	A2	3
3	Brazil	English	Nutrición Hospitalaria	B2	4
4	Spain	Spanish	Nutrición Hospitalaria	B2	4
5	Spain	Spanish	Nutrición Hospitalaria	B2	4
6	Spain	English	Nutrición Hospitalaria	B2	4
7	Brazil	English	Nutrición Hospitalaria	B2	3
8	Italy	English	European Journal of Clinical Nutrition	A2	4
9	Brazil	English	Journal of Tropical Pediatrics	B2	3
10	Spain	English	Nutrición Hospitalaria	B2	4
11	Brazil	Portuguese	Revista de Nutrição	B2	3
12	Brazil	English	Nutrición Hospitalaria	B2	4

**Figure 4.**

Distribution of the studies according to the year of publication.

Santos and Morais (2010) also observed results on homemade enteral nutrition on growth parameters for children, but did not make comparisons with commercial and homemade formulas. In this population, underweight was reduced, as observed, after using ENT with homemade food, and obesity prevalence decreased from 17% (4/23) to 9% (2/23, $p < 0.001$) but prevalence with children underheight increased, according to age from (30% (9/30) to 53% (16/30) with $p = 0.511$) (23), with no statistical significance. Impairments on child development, characteristic of chronic malnutrition, are suggested by these results.

The second grouping (articles 3, 7 and 12) conducted evaluation of the chemical composition of homemade enteral nutrition through food composition tables, considering that studies 7 and 12 compared the values obtained by laboratory analyses with the calculated values with the aid of composition tables.

Borghi, Araújo, Vieira Souza and Waitzberg (2013) (17) reported that the macronutrients content of the homemade liquefied enteral diets, was highly variable, often conflicting with the daily recommendations accepted, and homemade liquefied enteral diets nominal cost was lower when compared to industrialized formulas. Nonetheless, indirect work expenses were not computed, which probably makes the final value more expensive than the industrialized alternative.

When actual values and those counted by the composition table were compared, it was observed that laboratory obtained data did not match with those available in the chemical composition tables of the foods and the daily energy intake of the diets was below the standard recommendations, also presenting a different percentage distribution than the estimated for patients receiving ENT, which affected the nutritional quality of the enteral diet, but did not make the physicochemical aspects inappropriate (21,26).

Articles 7, 9, 11 and 12 comprised the third publications group, responsible for the physicochemical and microbiological analyses of the homemade enteral nutrition, proposing new recipes, or not.

Studies developed by Felicio, Pinto, Pinto and Silva (2012) (21) and by Sousa, Ferreira and Schieferdecker (2014) (26) showed statistically significant differences for total energy intake and macronutrients distribution, among data computed from composition tables and the ones obtained in laboratory.

Likewise, Santos and Morais (2010) (23) found that the measured values for macronutrients and energy accounted for about 70% of the amounts predicted on a homemade enteral milk-based feeding for children, and when the base of the enteral diet was changed to soup, the measured values were below 50% of the prescribed, except for carbohydrates.

By developing two distinct homemade enteral feedings (formulation 1 and 2), without using *fresh food*, Santos, Bottoni and Morais (2014) (25) made interventions only in laboratory and achieved variations lower than 20% in percentage adjustments to macronutrients, energy and osmolality contents of household

samples, either in the first, as for the last sampling. Regarding microbiological quality, the proportions of samples not in accordance with the legal standards were significantly lower in the final samples, 24% and 36% for mesophilic bacteria and coliforms, respectively.

The fourth group of articles (4, 5, 6, 8 and 10) presented the epidemiological situation of patients in Spain and Italy, in terms of ENT, using exclusively industrialized formulas.

In Spain, articles 4, 5 and 6 (18-20) organized by the NADYA Group-SENPE (Homecare Artificial Nutrition Group and Ambulatory of the Spanish Society of Parenteral and Enteral Nutrition) described the situation of the homemade nutritional therapy in different years, but with similar characteristics, in which half the patients using ENT were men, with mean age of 70 years and the most frequent diseases were neurological and neoplastic, especially head and neck cancer. The most used alternative via for feeding was the nasogastric/nasoduodenal tube, followed by gastrostomy. The average period for using ENT was 10 months (18), reaching 2 years (19) and the most common reasons for discontinuation of treatment were: death of the patient and transition to oral treatment. The provision of enteral feeding formula was mainly conducted in the hospital and by retail pharmacies, and consumption goods was carried out in hospitals and primary care.

Articles 8 and 10 regarded exclusively the pediatric population attended by referral centers for homemade enteral nutrition.

Pedró-Giner C. et al. (2012) (24) analyzed the profile of 304 Spanish pediatric patients, 157 boys. At the beginning of treatment the mean age was 4 years, 28% of all patients were younger than 1 year and the average treatment took 306 days. The main indications comprised oncologic and digestive tract diseases. There were significant differences depending on the clinical diagnosis concerning the age of onset, type of access, and infusion regimen and prescribed formula. Most used administration. The nasogastric tube was most used administration via (71.7%), and the nocturnal enteral nutrition was the preferred infusion for 51% of patients. Polymer formulas were the most prescribed (62.5%).

In Italy, Diamanti et al. (2013) (22) evaluated 757 recorded ENT cases in two-year-old average age children at the beginning of therapy, mean duration of 8 months and found that 14.8% of the complications observed, were related to base disease, to feeding formula choice and via of access.

Selection of number of participants (n) occurred by convenience for all publications, and four studies did not perform statistical data processing.

DISCUSSION

The integrative review method, gathering studies of different methodologies, elaborates results which contribute to practical actions and possible beneficial impact on the quality of care provided to the patient (27). For this purpose, the search for publications includes the employment of descriptors suitable to the study. Finding the correct terms in this review involved the assistance of a librarian to find synonyms with meaning and significance in

the subject area, which is guided by Brandau, Monteiro and Braille (2005) in this special article (28).

Although the correct use of descriptors has conducted to articles on the subject, the number of studies related to Enteral Nutrition Therapy Homecare (TNED) with handmade enteral diet use is scarce, as remarked by Klek et al. (2011) (16) and Pedró-Giner C. et al. (2012) (24). The studies origin may interfere in this issue, since the works with such type of diets are mainly from developing countries (15-17,21-23,25,26) that opt for using homemade diets, with fresh food, due to costs generated by industrialized diets.

Thus, food selection to be conducted and offered to the patient using ENT can be performed based on the results of studies on the benefit of chemically defined diets, but it is also guided by the current health system in the country, because the works from developed countries present exclusive use of diet formulas, supplied by hospitals, health insurance and primary care (18-20,22,24).

Given the variability of the research scenarios, publications have different types of study, with different methodological approaches, evidence levels and therefore Qualis index, but promote reflections on ENT when highlighting positive and negative aspects for each diet modality.

The advantages of using homemade enteral feeding comprise flexibility, with choice of suitable foods from the nutritional point of view; maintenance of the physical and chemical characteristics and fiber content; psychosocial recovery values for the feeding process, since meals can be prepared by the family using conventional foods (17,21,23,25,26). However, the disadvantages can be harmful to those receiving it, as studies show lower nutritional values in relation to the nutritional needs of the patients, due to seasonality, geographic origin, storage and food processing, leading to reduced caloric density, inadequate levels of macronutrients, vitamins and minerals, increased osmolality and a condition which promotes bacterial growth (17,21,23,25,26).

The advantages of using homemade enteral feeding encompasses knowledge about the contained nutrients; stability of nutrients and physicochemical characteristics; easier management after expert guidance (15-17,26). In his two surveys, Klek et al. (15,16) found that patients who received industrialized enteral feeding by a multidisciplinary team monitoring, the number of complications decreased, and when hospital treatment was necessary, patients remained interned shorter period, therefore health care costs were reduced. The main disadvantage of the chemically defined formulas are thus concerning costs, particularly when suggested in poor regions or in developing countries (26).

Given the heterogeneity of the studies, each identified group exposed limitations in their publications, as: nature of the study, for example, being a randomized controlled study the ideal (15,16,22); the use of a convenience sample; the presence of registration errors in databases construction, in case of retrospective research; data simplification for more accessibility to registration (18-20). Implicit limitations were also noted, such as conflict of interest, when research fostered by homecare companies or by laboratories producing industrialized formulas; small number (n) of participants; without using validated protocols; failure on using statistical tools for processing and analysis of results obtained.

CONCLUSION

This integrative review provided confirmation of its own hypothesis, which asserts the existence of differences between home enteral diets and industrialized diets. Each modality may be characterized by pointing the benefits, but also pointing unsuitable properties which may be harmful to patients.

This study highlights findings of the studies published by the Polish medical group (15,16), that managed to compare the use of homemade and industrialized diets, and their impact on patients.

Thus, the amount of results from various articles concludes that the industrialized diet is most suitable for patients using alternative feeding supply at home. However, the costs may become great obstacles for their selection, and loss of the social aspect, of family integration and expression of affection which are factors related to the act of eating, but not to the use of chemically defined formulas.

Controlled and randomized trials which can evaluate the most appropriate enteral nutrition for patients at home environment are necessary to guide prescribers for choosing the diet, thus ensuring food safety to patients and quality of life for patients and caregivers.

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