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Nutrition Diagnoses According to the International Terminology: Challenges and Effectiveness of the Care Process in Home Enteral Nutrition

Diagnósticos em Nutrição segundo a Terminologia Internacional: Desafios e Efetividade do Processo do Cuidado em Nutrição Enteral Domiciliar

Abstract

Objective: To identify the nutritional diagnoses (DN) of people using home enteral nutrition (NED), through the application of the second step of the Nutrition Care Process (PCN), using the Standardized Nutrition Care Process Terminology (TPCN). *Methods:* Observational, cross-sectional and descriptive study with people using NED assisted by the Program of Nutritional Care for People with Special Feeding Needs (PAN) of a municipality in the Southern region of Brazil. Data collection occurred between June 2016 and February 2018, including socioeconomic, demographic, food security, medical history, nutritional status, and food consumption data, and were obtained from people using NED and their caregivers. The DN were identified according to the TPCN of the Academy of Nutrition and Dietetics (AND), organized into three domains: Intake (IN), Clinical Nutrition (NC), and Nutritional Behavior/Environment (CN). *Results:* 123 people participated, with a mean age of 63.7 ± 21.1 years and a per capita income of 2.6 minimum wages; 41 DN were identified, the most prevalent being: suboptimal fiber and vitamin D intake (100%), swallowing with difficulty (100%), physical inactivity (79.7%), suboptimal self-care management (79.7%), self-feeding with difficulty (79.7%), suboptimal magnesium (68.3%) and folate (67.5%) intake, unintentional weight loss (56.9%), food insecurity (51.2%), and suboptimal protein intake (50.4%). *Conclusion:* The most frequent DN are related to the intake of essential nutrients, difficulties with swallowing and self-feeding, self-care, and physical activity practice. The standardized diagnosis can guide prioritization and increase the effectiveness of home nutritional intervention.

Keywords: Diagnosis. Enteral Nutrition. Nutritional Therapy. Nutritional Assessment. Nutrition Surveys. Home Care.

Resumo

Objetivo: Identificar os diagnósticos nutricionais (DN) de pessoas em uso de nutrição enteral domiciliar (NED), por meio da aplicação do segundo passo do Processo do Cuidado em Nutrição (PCN), utilizando a Terminologia

Padronizada do Processo do Cuidado em Nutrição (TPCN). ***Métodos***: Estudo observacional, transversal e descritivo com pessoas em uso de NED atendidas pelo Programa de Atenção Nutricional às Pessoas com Necessidades Especiais de Alimentação (PAN) de um município da Região Sul do Brasil. A coleta de dados ocorreu entre junho de 2016 e fevereiro de 2018, incluindo dados socioeconômicos, demográficos, segurança alimentar, histórico médico, estado nutricional e consumo alimentar, e foram obtidos das pessoas em NED e seus cuidadores. Os DN foram identificados conforme a TPCN da Academy of Nutrition and Dietetics (AND), organizados em três domínios: Ingestão (IN), Nutrição Clínica (NC) e Comportamento/Ambiente Nutricional (CN). ***Resultados***: Participaram 123 pessoas, com idade média de 63,7 ± 21,1 anos e renda *per capita* de 2,6 salários mínimos. Foram identificados 41 DN, sendo os mais prevalentes: ingestão de fibra e vitamina D subótima (100%), deglutição com dificuldade (100%), inatividade física (79,7%), gerenciamento de autocuidado subótimo (79,7%), autoalimentação com dificuldade (79,7%), ingestão de magnésio (68,3%) e folato (67,5%) subótima, perda de peso não intencional (56,9%), insegurança alimentar (51,2%) e ingestão de proteína subótima (50,4%). ***Conclusão***: Os DN mais frequentes estão relacionados à ingestão de nutrientes essenciais, dificuldades de deglutição e autoalimentação, autocuidado e prática de atividade física. O diagnóstico padronizado pode orientar a priorização e aumentar a efetividade da intervenção nutricional domiciliar.

Palavras-chave: Diagnóstico. Nutrição Enteral. Terapia Nutricional. Avaliação Nutricional. Inquéritos Nutricionais. Assistência Domiciliar.

INTRODUCTION

The use of enteral nutrition (NE) has increased in recent decades, in part due to the growth in the prevalence of noncommunicable diseases and conditions (DANTs), which may cause disabilities that make oral feeding difficult.[1] Frequently, NE is required for prolonged periods, which may not justify hospitalization.[2] In this context, Home Enteral Nutrition (NED) is recommended by international guidelines as a reliable and effective nutritional strategy, capable of ensuring the maintenance and recovery of nutritional status, reducing the risks of hospital infections, complications and associated costs, in addition to promoting greater autonomy for the person using NED, better quality of life and greater proximity to family members.[3]

However, despite the benefits, NE, whether in the hospital or home environment, may be associated with gastrointestinal, mechanical and metabolic complications that may impact safety and adherence to care, requiring continuous monitoring.[2,4] Home enteral nutrition programs have demonstrated a reduction in complications and costs; however, results may vary according to the organization model and available support. In the United States, in 2013, the prevalence of NED use was estimated at 1,395 per million inhabitants;[5] in Spain, in 2019, at 98.51 per million;[6] and in Brazil, a cohort study carried out in the municipality of Curitiba showed a 425% increase in the frequency of NED over the years from 2006 to 2015.[7]

In Brazil, although NED is provided for as a Human Right to Adequate Food (DHAA) for people with special feeding needs and is described in the guidelines of the National Food and Nutrition Policy (PNAN),[8] it still represents a challenge for both the Unified Health System (SUS) and the Food and Nutrition Security System (SISAN).[9] This occurs because NED requires articulation between health and food and nutrition security, as recommended by the PNAN, but faces difficulties, such as the absence of a specific public budget for this modality of care. In view of this scenario, nutritional care protocols have been formulated and implemented in the SUS[10] with the aim of ensuring comprehensive health care in a safe, efficient and effective manner.

Safety, effectiveness, high quality and cost reduction are also objectives of the Academy of Nutrition and Dietetics (AND) in the proposal of the Nutrition Care Process (PCN).[11] This tool includes four steps: assessment, diagnosis, intervention and monitoring, and can be applied in any area of the nutritionist's practice. The PCN assists in prioritizing diagnoses and identifying interventions that may improve the outcomes of nutritional care, encouraging critical thinking and problem solving.][12,13] In 2014, the PCN was adapted for Brazil with the support of the Brazilian Association of Nutrition (ASBRAN) and a group of specialists, who adapted the terms and guidelines to the reality of professional practice in the country.[13]

The PCN also includes the Nutrition Care Process Terminology (TPCN), which internationally standardizes the terms used in the four steps of the tool. This standardization represents a paradigm shift in nutritional practice, as it favors data comparability, communication between teams and integration between different points of care, standardizes documentation and clearly describes the observed problems, the interventions performed and their results. The second step, the DN, is the description of the nutritional problems identified for the person or group, for which the nutritionist is responsible for intervention.[12,13]

To date, no studies have been found on the use of the PCN in home nutritional care. It is noteworthy that people using NED constitute a complex and heterogeneous group, varying in terms of clinical, nutritional and sociodemographic characteristics. These factors influence clinical evolution and nutritional prognosis, reinforcing the need for tools that allow the systematization and standardization of care. In this sense, the application of the international standardization of nutrition diagnoses, through the TPCN, may be a useful tool for care planning. Therefore, this study aimed to identify the DN of people using NED, through the application of the second step of the PCN, using the TPCN.

METHOD

Study Design and Data Collection

Observational, cross-sectional study with descriptive analysis, with the participation of people using NED included in the Program of Nutritional Care for People with Special Feeding Needs (PAN) of a municipality in the Southern region of Brazil.

The inclusion criteria were exclusive use of NE, being in home care through the PAN, agedover 18 years, and having a caregiver available to participate in data collection. People with incomplete data were excluded.

Data collection was carried out from June 2016 to February 2018, and the information was obtained from both NED users and their caregivers. Data were collected at the participants' homes and covered socioeconomic, demographic, food security, medical history, nutritional status assessment and food consumption. No missing data were identified in the main study variables, so all participants with complete information were included in the analysis. The sample was selected by convenience, including eligible people assisted by the PAN during the data collection period.

Socioeconomic and Demographic Data

The demographic and socioeconomic data collected included sex, age, skin color, marital status, education, monthly family income in minimum wages (considering R$ 937.00, approximately U$ 280.00, the minimum wage during the data collection), receipt of retirement (social security benefit granted to workers who met requirements such as contribution time and minimum age, ensuring a monthly income after leaving the labor market) and/or benefit from a government program (financial or social assistance from a program created by the government, regardless of prior contribution). The presence of a formal caregiver (trained and paid professional) or informal caregiver (family member or friend who assumes responsibility for care without remuneration)[14] was also recorded, as well as the education level of the person using NED and of the caregiver.

Household Food Security

To assess food security aspects, the Brazilian Food Insecurity Scale – EBIA (short version) was used.[15]

Medical History and Nutritional Assessment

Nutritional status assessment was performed by two previously trained nutritionists. The nutritionists responsible for data collection were previously trained to ensure standardization of procedures and minimize measurement bias. Self-reported data were complemented with clinical records whenever possible. When participants were unable to remain upright, weight (kilograms, kg) and height (centimeters, cm) were estimated using the equations proposed by Chumleaet al.,[16,17] based on knee height (AJ) and arm circumference (CB). Although these equations were originally validated for older adults, their use was chosen because they are a widely employed method in Brazilian clinical practice and recommended in technical manuals of the Ministry of Health for estimating weight and height in bedridden individuals.[18] Clinical observation was performed to verify the presence of edema, which could interfere with anthropometric measurements. This assessment was performed in a standardized manner, considering the presence or absence of edema in upper and lower limbs, and was used as complementary information in the interpretation of anthropometry. It was not possible to assess biochemical tests related to nutrition and malnutrition disorders due to the unavailability of information.

Dietary Intake Assessment

Dietary intake was assessed using a single 24-hour recall (24HR), applied to the main caregiver responsible for diet administration, following a standardized protocol. In the case of NE with foods or mixed, all ingredients used were described in detail, as well as their quantities, preparation methods and dilutions. For industrialized NE, brand, presentation and volume used were recorded. The use of only one 24HR was chosen, considering that data collection was carried out in only one home visit, in order to respect the routine of people using NED, caregivers and the time available for collection. However, the adopted strategy made it possible to obtain consistent and applicable data for the proposed analysis, especially in the context of NED, in which there is a high standardization of the diet in use.[19] Macronutrient and micronutrient values from the 24HR were calculated using an Excel spreadsheet structured based on the Table of Reported Measures – POF 2008-2009[20] and calculated according to the Food Composition Table.[21] For each recorded item, the amount consumed was multiplied by the content of each nutrient present in the food according to the table,

obtaining the individual value of energy, macronutrients and micronutrients. These individual values were summed for each meal and subsequently for the daily total, allowing the evaluation of daily intake.

The participants' energy and protein needs were estimated, respectively, by equations that consider kilocalories (kcal) and protein in grams (g) per kilogram of body weight per day (kcal/kg/day and g/kg/day) according to the degree of metabolic stress.[22] Carbohydrate and lipid needs were calculated individually.[23] Fibers, vitamins (A, C, D, E, cobalamin, thiamine, riboflavin, niacin, pyridoxine, folate) and minerals (calcium, iron, magnesium, potassium, phosphorus, sodium, zinc, copper, selenium and manganese) were analyzed considering the daily reference values for sex and age group.[23-27] For the assessment of fluid intake, a recommendation of 30 to 40 milliliters (ml) per kilogram of body weight per day was considered.[28]

Nutrition Diagnoses

Subsequently, the DN were identified according to the TPCN proposed by the AND and adapted by the Brazilian Association of Nutrition (ASBRAN).[13]

The DN were divided into three domains: 1) Intake (IN), which contains five classes: energy balance, oral intake or nutritional support, fluid intake, bioactive substances intake and nutrient intake; 2) Clinical Nutrition (NC) with four classes: functional, biochemical, weight and malnutrition disorders; 3) Behavioral/Environmental Nutrition (CN) with three classes: knowledge and belief, physical activity and functionality, and food security and access.[13]

The DN in the "Intake (IN)" domain were identified using the comparison between dietary intake and the individual recommendations for energy, micro- and macronutrients and fiber. All participants were in exclusive use of NE, with a tube as an alternative feeding route and without full oral intake; therefore, dietary intake was evaluated based on nutritional support, that is, on the administration of food via the enteral route, while fluid intake was analyzed considering the volume of water administered via the enteral tube.

It was not possible to identify the DN referring to the biochemical and malnutrition disorder classes due to the absence of these data.

For the DN in the "Clinical Nutrition (NC)" domain, data referring to clinical history and nutritional status assessment were considered. For the Altered Gastrointestinal Function class, constipation was considered as fewer than three bowel movements per week; diarrhea: three or more liquid bowel movements per day; normal: one to two bowel movements per day.[29] For the Unintentional Weight Loss class, information on recent weight changes was used. Body Mass Index (BMI) was used to classify participants according to the recommended cutoff points.[30]

For the DN in the "Behavioral/Environmental Nutrition (CN)" domain, the Physical Activity and Functionality class was evaluated using the Subjective Global Assessment,[31] verifying autonomy in physical activity, self-care and self-feeding. The Knowledge and Belief class was not evaluated, as most participants were unable to communicate and had their diet managed by caregivers.

Ethical Considerations

The study was conducted in accordance with the guidelines of Resolution 466/2012 of the National Health Council. All procedures involving human beings were approved by the Research Ethics Committee of the Federal University of Paraná (CAAE: 49265615.1.0000.0102). The informed consent form (ICF) was signed by all participants. This study followed the reporting guidelines dictated by the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE).[32]

Statistical Analysis

Data were organized and analyzed using Microsoft Excel software and presented through descriptive statistics, in absolute and relative frequency, mean, standard deviation and median (minimum and maximum values).

RESULTS

A total of 123 people using NED were included, 64.3% older adults (n=79), with a mean age of 63.7 ± 21.1 years, 50.4% (n=62) male, mostly white, more than half single, separated or widowed and with incomplete elementary education or illiterate. The presence of an informal caregiver was predominant, indicating dependence on support for NED management. The mean per capita income was higher than 2.5 minimum wages (approximately 2,436.20 reais / 728 dollars) and half of the participants reported receiving retirement benefits of the person using NED or some government benefit. Regarding food security, more than half of the participants' households presented some degree of Food Insecurity, evidencing social vulnerability (Table 1).

Table 1. Demographic and socioeconomic characteristics. Curitiba-PR, 2018.

Characteristics	(n= 123)
Age group	% (n)
Adult	35,7 (44)
Elderly	64,3 (79)
Age (mean ± SD) (years)	63,7 ± 21,1
Sex	% (n)
Female	49,6 (61)
Male	50,4 (62)
Skin color	% (n)
White	80,5 (99)
Black	17,1 (21)
Asian	2,4 (3)
Marital status	% (n)
Single, separated, or widowed	60,2 (74)
Married or living with a partner	39,8 (49)
Education level	% (n)
Illiterate	19,5 (24)
Incomplete elementary school	34,1 (42)
Completed elementary school	16,3 (20)
Incomplete high school	1,6 (2)
Completed high school	13,8 (17)
Incomplete higher education	3,3 (4)
Completed higher education	6,5 (8)
Not informed	4,9 (6)
Caregiver	% (n)
Formal	9,8 (12)
Informal	90,2 (111)
Per capita income (mean ± SD)	2,6 ± 1,8
Receives retirement pension	49,6 (61)
Receives government benefit	56,9 (70)
Household food insecurity	51,2 (63)

Abbreviations: SD = Standard deviation; PAN = Nutrition Care Program.

The most prevalent medical diagnoses were neurological diseases or conditions and cancer, present in 82.9% (n=102) of the sample. The majority (78%; n=96) made exclusive use of NE as an alternative feeding route for a median time of one year, with more than half using gastrostomy as the access route. The most used enteral formulation category was industrialized and more than half reported purchasing the NE formulation with their own resources. Regarding anthropometric data, participants had a mean weight of 49.1 ± 13.8kg, mean height of 159.2 ± 9.9cm and mean BMI of 19.2 ± 4.4kg/m², with most participants being in the eutrophic state (48.0%, n=59) or underweight (43.9%, n=54), (Table 2).

Table 2. Clinical and nutritional characteristics. Curitiba-PR, 2018.

Characteristics	(n= 123) % (n)
Medical diagnosis	
Neurological diseases/conditions	59.3 (73)
Cancer	23.6 (29)
Other	17.1 (21)
Enteral nutrition	
Exclusive enteral nutrition	78.0 (96)
Oral supplementation	22.0 (27)
Duration in HEN (months) (median, min–max)	12 (0,23-312)
Feeding tube position	
Nasogastric	19.5 (24)
Nasoenteric	13.8 (17)
Gastrostomy	59.3 (73)
Jejunostomy	7.3 (9)
Formula category	
Industrialized	89.4 (110)
Food-based	4.9 (6)
Mixed	5.7 (7)
Formula acquisition	
Purchase	64.2 (79)
PAN	23.9 (29)
Donation	5.7 (7)
Health insurance	1.6 (2)
Others	4.6 (6)
Anthropometry (mean ± SD)	
Weight (kg)	49,1 ± 13,8
Height (cm)	159,2 ± 9,9
BMI (kg/m^2)	19,2 ± 4,4
Underweight	43,9 (54)
Eutrophy	48,0 (59)
Overweight	5,7 (7)
Obesity grade I	1,6 (2)
Obesity grade II	0,8 (1)

Abbreviations: cm = centimeters; kg = kilograms; SD = Standard deviation; BMI = Body Mass Index; HEN = Home Enteral Nutrition; PAN = Nutrition Care Program.

A total of 41 DN were identified, with 70.7% (n=29) in the "Intake" domain. The DN Suboptimal fiber intake, Suboptimal vitamin D intake and Swallowing with difficulty were observed for all people using NED evaluated, showing common challenges in nutritional adequacy in NED. For approximately 80% (n=98), the DN Physical inactivity, Suboptimal self-care management and Difficulty with self-feeding were identified,

reflecting the complexity of nutritional care. The DN Suboptimal magnesium intake, Suboptimal folate intake, Unintentional weight loss, Food insecurity and Suboptimal protein intake were observed for more than half of the participants (Table 3), reinforcing the importance of systematic DN assessment.

Table 3. Nutrition diagnoses of participants. Curitiba-PR, 2018.

Nutrition Diagnoses	(n= 123)
Domain: Intake (IN)	% (n)
Energy balance	
Suboptimal energy intake	38,2 (47)
Excessive energy intake	35,8 (44)
Oral intake or nutrition support	
Suboptimal enteral nutrition infusion	38,2 (47)
Excessive enteral nutrition infusion	35,8 (44)
Fluid intake	
Suboptimal fluid intake	38,2 (47)
Nutrient intake	
Excessive fat intake	8,9 (11)
Suboptimal protein intake	50,4 (62)
Excessive protein intake	26,8 (33)
Suboptimal carbohydrate intake	8,1 (10)
Excessive carbohydrate intake	0,8 (1)
Suboptimal fiber intake	100 (123)
Suboptimal vitamin intake	
Vitamin A	14,6 (18)
Vitamin C	17,1 (21)
Vitamin D	100 (123)
Vitamin E	19,5 (24)
Thiamine	8,1 (10)
Riboflavin	3,3 (4)
Niacin	4,1 (5)
Folate	67,5 (83)
Vitamin B6	8,9 (11)
Vitamin B12	7,3 (9)
Suboptimal mineral intake	
Calcium	25,2 (31)
Iron	5,7 (7)
Magnesium	68,3 (84)
Phosphorus	4,9 (6)
Zinc	22,8 (28)
Copper	16,3 (20)
Selenium	14,6 (18)
Manganese	13,0 (16)
Domain: Clinical (NC)	% (n)
Functional	
Swallowing difficulty	100,0 (123)
Altered gastrointestinal function	
Constipation	38,2 (47)
Diarrhea	32,0 (39)
Weight status	
Underweight	47,2 (58)
Unintentional weight loss	56,9 (70)
Overweight/obesity	5,7 (7)
Obesity class I	1,6 (2)
Obesity class II	0,8 (1)
Domain: Behavioral/Environmental (CN)	% (n)
Physical activity and functionality	
Physical inactivity	79,7 (98)
Suboptimal self-care management	79,7 (98)
Difficulty with self-feeding	79,7 (98)
Food security and access	
Food insecurity	51,2 (63)

Abbreviations: IN = Intake; NC = Clinical; CN = Behavioral/Environmental.

DISCUSSION

Most participants in this study were older adults with a medical diagnosis of neurological diseases/conditions or cancer. The number of older adults in NED is often higher than that of adults. A study with this population showed a prevalence of older adults (68% with a mean age of 66.7 ± 17.6 years) with neurological diseases (46.4%), followed by cancer (33.6%).[7] The main indications for NED are related to dysphagia resulting from neurological impairment and cancer.[2]

In the retrospective study conducted by the Spanish Home Artificial Nutrition Group – NADYA, neurological diseases and neoplasms represented approximately 83% of NED cases in the years 2018 and 2019,[2] while in the United States this number reached almost 69%.[1] The predominance of older adults reflects the association between aging, higher incidence of neurological diseases and cancer, in addition to functional decline and the presence of dysphagia, conditions that frequently require the use of an alternative feeding route and reinforce the vulnerable profile of the older population.[1,6,7]

In addition to the similarity in the clinical profile of participants, it is noteworthy that, both in Spain and in the United States, the use of industrialized enteral formulas is predominant,[1,2] practice that was also observed among the participants of this study. There are differences between the contexts of each country: in Spain, NED is provided and organized by the public health system[6]; in the United States, coverage occurs through public or private insurance, conditioned to specific clinical criteria;[5,33] in Brazil, supply remains heterogeneous among municipalities, with variable participation of the public sector and, in some cases, the need for direct purchase by families.[34,35]

The use of industrialized enteral formulas had high prevalence among the participants. This information is particularly relevant considering that the main form of acquisition is purchase and that a considerable portion of participants present Food Insecurity at home. The PAN provides industrialized enteral formulas only for children up to 10 years of age, while for adults and older adults the preparation of enteral nutrition with foods is recommended through tested and analyzed prescriptions.[10] Despite follow-up of dietary prescriptions, families still choose to acquire industrialized enteral formulas.

Industrialized enteral formulas represent an important expense for families and become unsustainable with prolonged use. NE with foods and/or mixed may be a more economical and safe alternative from a food and nutrition standpoint.[36] However, studies are needed to investigate the effectiveness of the different enteral formulas used at home to support decision-making.[10] This need becomes even more relevant when considering the prolonged time in NED observed in this study, in which many participants remained on home therapy for more than one year, requiring sustainable long-term decisions regarding the type of formula used.

Participants in this study remained in NED for a period similar to that observed in a Polish study, where the median length of stay was 354 days.[37] Unlike Brazil, where NED programs are incipient and have limited budgets, compromising the effectiveness of care,[38] in Poland this modality of care is fully funded by the Health System, with support from a multidisciplinary team and provision of industrialized enteral formulas and supplies.[37] In this context, the role of the nutritionist as part of the multiprofessional team and the adoption of the PCN, based on standardized nutrition diagnoses, are fundamental to qualify nutritional care in NED, especially in realities with structural limitations, such as the Brazilian one.

The identified DN reveal controversial results, such as a high prevalence of unintentional weight loss and underweight concomitant with adequate or excessive energy intake. This can be explained by the limitations of methods for assessing nutritional and metabolic status of bedridden people and those in NED, as well as by the limitation of estimating energy requirements using equations. In practice, this may mean

that people with adequate energy intake according to predictive equations may still maintain low weight or weight loss due to protein deficits, micronutrients or absorption problems, highlighting the need for careful monitoring of nutritional status.

The choice of tools, such as the 24HR, may influence the possible diagnoses. Although it is a practical, low-cost tool widely used in clinical practice, the method reflects current intake and cannot be related to body weight conditions or capture consolidated dietary patterns.[39] However, in the context of NED, this limitation tends to be minimized, since the administered diet shows little variation between days, due to standardization of enteral prescription.[19,37] Thus, the application of a single 24HR proved adequate to estimate intake, especially when associated with detailed composition of formulas and administered volumes.

Likewise, the assessment of nutritional status of bedridden individuals also presents limitations, requiring estimation of anthropometric measurements, since people with neurological diseases often present muscle atrophy and weight loss.[40,41] These limitations may cause underestimation or overestimation of nutritional status, compromising the identification of real needs and increasing the risk of imprecise diagnoses. In addition, predictive equations for energy expenditure have limited accuracy, reaching at most 70% accuracy, resulting in considerable errors.[42] These variabilities have a direct impact on nutritional adequacy, potentially favoring energy deficits or excesses that influence clinical status, body composition and the effectiveness of NED care.

Indirect calorimetry is the most reliable method, but its use is restricted to specialized outpatient and hospital care due to operational limitations.[42] Correct estimation of energy requirements is essential to guide individualized dietary prescription and the choice of formula type used at home, which may be prepared with foods, mixed formulas or industrialized formulas.

During the preparation of manipulated NE at home (with foods, mixed or industrialized powder), variables such as the type of food, cooking and processing methods may influence nutritional composition.[43] Residues retained in the sieving process, as well as the addition of extra liquids to ensure formula fluidity, may alter the energy density of preparations, resulting in hypocaloric diets.[43] In addition, the database used for nutritional analysis has limitations, as it does not include preparations as consumed at home. Foods are analyzed in cooked form without salt and oil, which may lead to underestimation of lipid and sodium contents.[21]

In addition to changes in formula density, dietary monotony resulting from prolonged maintenance of formulations with low levels of micronutrients[19,37] may reflect the prevalence of insufficient intake of vitamin D, folate and magnesium observed in the present study. Nutritional adequacy of the diet, therefore, should be evaluated by a nutritionist. Analyses of the physical-chemical composition of enteral formulas, whether manipulated or not at home, are necessary to assess dietary intake in this population,[10] as nutrient inadequacy may cause complications such as diarrhea and intestinal constipation.

The diagnosis of suboptimal fiber intake combined with physical inactivity may cause problems such as constipation, present in a considerable portion of participants with the diagnosis of altered gastrointestinal function. Constipation is frequent in people receiving prolonged NE and may be exacerbated by gut microbiota dysbiosis,[44] dehydration and/or opioid use.[45] However, it can be prevented with adequate intake of fiber and water.[46] It is noteworthy that all participants in this study presented deficiency in fiber intake.

In addition, physical activity is also recognized as an important factor in preventing intestinal constipation.[47] However, in the context of NED, most patients are bedridden, which contributes to the high frequency of physical inactivity observed in this study.

The high prevalence of DN in the "Behavioral/Environmental Nutrition (CN)" domain such as physical inactivity, suboptimal self-care management and difficulty with self-feeding, in addition to swallowing with difficulty, included in the "Clinical (NC)" domain, were expected in this population. In this sense, the medical diagnoses presented by most participants in the present study may be related to neurological diseases or sequelae frequently associated with disorders of swallowing, cognition and locomotion, in addition to dependence on general care.[48]

Physical inactivity, prevalent in people using NED, may be mitigated with the implementation of more home rehabilitation programs. Physical activity and physiotherapy sessions for older adults in the context of disabling diseases contribute positively. Among the benefits, improvements in body composition, dietary intake, function and muscle strength, as well as quality of life, stand out.[49,50]

In this sense, nutritional care for people using NED is complex, as multiple DN were identified for each patient. Although each patient may present multiple DN, it is recommended that, in clinical practice, the nutritionist prioritize up to three DN per visit, to enable more targeted and effective interventions, without losing sight of the global analysis of nutritional status. In addition, the priority DN should preferably be in the "Intake" domain, since it involves specific skills of the nutritionist.[11]

Finally, it is highlighted that the choice of methodologies and data collection instruments directly influences the possible diagnoses to be established. The adoption of new approaches may reveal other relevant aspects of the nutritional status and dietary intake of people using NED, contributing to the qualification of care. Future studies should consider not only the standardization of diagnoses, but also methodological diversity that enriches the understanding of the food and nutrition reality of this population.

This study has some limitations. The cross-sectional design does not allow causal relationships to be established. The application of a single 24HR, although justified by the stability of feeding in NED, may reduce sensitivity to identify subtle variations in intake. The absence of biochemical data made it impossible to identify diagnoses in the biochemical and malnutrition disorder domains, restricting the scope of nutritional assessment. The need to estimate anthropometric measurements based on equations, especially among young adults, may have influenced the accuracy of nutritional status. As strengths, the application of the TPCN, still little explored in national studies, the expressive number of participants assisted in a public service and the inclusion of clinical, nutritional and socioeconomic variables stand out, offering an integrated view of the complexity of care. Despite methodological limitations, the study demonstrated the feasibility of using a still incipient tool, but with potential to contribute to home care. Future research should deepen the longitudinal analysis of the impact of DN on clinical evolution and prognosis of people using NED, as well as evaluate the effectiveness of different formulas used at home and the applicability of the PCN in different regional contexts.

CONCLUSION

This study identified the DN of people using NED through the application of the second step of the PCN, using the TPCN. Multiple DN related to nutrient intake, functional limitations and food insecurity conditions were identified, evidencing the complexity of home nutrition care. Standardization of DN proved applicable and useful to systematize priority needs, allowing the planning of more targeted and effective nutritional interventions. In addition to qualifying clinical practice, the use of the TPCN may contribute to the development of care protocols and support public policies aimed at home care, strengthening the organization of nutritional care.

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REFERENCES

1. et al. Home enteral nutrition: A descriptivestudy. Journalof Parenteraland Enteral Nutrition. 12 de maio de 2023;47(4):550–62. https://doi.org/10.1002/jpen.2498

2. Wanden-Berghe C, Patino-Alonso MC, Galindo-Villardón P, Sanz-Valero J. Complications Associated with Enteral Nutrition: CAFANE Study. Nutrients. 1º de setembro de 2019;11(9):2041. https://doi.org/10.3390/nu11092041

3. Bischoff SC, Austin P, Boeykens K, Chourdakis M, Cuerda C, Jonkers-Schuitema C, et al. ESPEN guideline on home enteral nutrition. Clinical Nutrition. janeiro de 2020;39(1):5-22. https://doi.org/10.1016/j.clnu.2019.04.022

4. Byrnes C, Mockler D, Lyons L, Loane D, Russell E, Bennett AE. A scoping review of best practices in home enteral tube feeding. Prim Health Care Res Dev. 4 de agosto de 2022;23:e43.n https://doi.org/10.1017/S1463423622000366

5. Mundi MS, Pattinson A, McMahon MT, Davidson J, Hurt RT. Prevalence of Home Parenteral and Enteral Nutrition in the United States. Nutrition in Clinical Practice. 17 de dezembro de 2017;32(6):799–805. https://doi.org/10.1177/0884533617718472

6. Wanden-Berghe C, Campos Martín C, Álvarez Hernández J, Burgos Peláez R, Matía Martín P, CuerdaCompés C, et al. The NADYA-SENPE Home Enteral Nutrition Registry in Spain: years 2018 and 2019. Nutr Hosp. 2021. https://doi.org/10.20960/nh.03663

7. Mazur CE, Chavoni Zago RC, Schieferdecker MEM, Cesário Pereira Maluf EM. Home enteral nutrition: clinical-nutritional analysis and outcomes of 10 years of public policy. Nutr Hosp. 2019. https:https://dx.doi.org/10.20960/nh.02606.

8. Brasil. Ministério da Saúde. Secretaria de Atenção à Saúde. Departamento de Atenção Básica. Política Nacional de Alimentação e Nutrição. Ministério da Saúde. Brasília: Ministério da Saúde; 2013. [Acesso em 30 de setembro de 2025]. Disponível em: https://www.gov.br/saude/pt-br/composicao/saps/pnan

9. Brasil. Lei nº 11.346, de 15 de setembro de 2006. Cria o Sistema Nacional de Segurança Alimentar e Nutricional – SISAN com vistas em assegurar o direito humano à alimentação adequada e dá outras providências. Diário Oficial da União. Brasília: Diário Oficial da União; 2006. p. 1. [Acesso em 30 de setembro de 2025]. Disponível em: https://www.planalto.gov.br/ccivil_03/_ato2004-2006/2006/lei/l11346.htm

10. Santos DC dos, Ataide CDG, Mota da Costa N, Oliveira Junior VP de, Egea MB. Blenderized formulations in home enteral nutrition: A narrative review about challenges in nutritional security and food safety. Nutr Rev. 2022;80(6):1580–98. https://doi.org/10.1093/nutrit/nuab121

11. Skipper A. Applying the nutrition care process: nutrition diagnosis and intervention. SupportLine. 2007;29(6):12–23. [Acesso em 30 de setembro de 2025]. Disponível em: https://www.andeal.org/files/file/Skipper_Article%20%282%29.pdf

12. Martins C. Diagnósticos em nutrição: fundamentos e implementação da padronização internacional. Artmed Editora; 2016.

13. Fidelix MSP. Manual orientativo: Sistematização do cuidado de nutrição. São Paulo: Associação Brasileira de Nutrição. 2014;66.[Acesso em 30 de setembro de 2025]. Disponível em: https://www.asbran.org.br/storage/arquivos/PRONUTRI-SICNUT-VD.pdf

14. Diniz MAA, Melo BR de S, Neri KH, Casemiro FG, Figueiredo LC, Gaioli CCL de O, et al. Estudo comparativo entre cuidadores formais e informais de idosos. Cien Saude Colet. novembro de 2018;23(11):3789–98. https://doi.org/10.1590/1413-812320182311.16932016

15. Santos LP dos, Lindemann IL, Motta JV dos S, Mintem G, Bender E, Gigante DP. Proposta de versão curta da Escala Brasileira de Insegurança Alimentar. Rev Saude Publica. 2014;48:783-9. https://doi.org/10.1590/S0034-8910.2014048005195

16. Chumlea WC, Roche AF, Steinbaugh ML. Estimating stature from knee height for persons 60 to 90 years of age. J Am Geriatr Soc. 1985;33(2):116-20. https://doi.org/10.1111/j.1532-5415.1985.tb02276.x

17. Chumlea WC, Guo S, Roche AF, Steinbaugh ML. Prediction of body weight for the nonambulatory elderly from anthropometry. J Am Diet Assoc. 1988;88(5):564–8. https://doi.org/10.1177/088453368800300513

18. Brasil. Ministério da Saúde. Secretaria de Atenção à Saúde. Departamento de Atenção Básica. Brasília: Cuidados em terapia nutricional; 2015. [Acesso em 30 de setembro de 2025]. Disponível em: https://bvsms.saude.gov.br/bvs/publicacoes/cuidados_terapia_domiciliar_v3.pdf

19. Yang H, Hou L, Sun HM, Ye SH. Comparison of micronutrients in adult enteral formulas widely used in clinical practice. Food Sci Nutr. 2023;11(10):6096–105. https://doi.org/10.1002/fsn3.3545

20. Brasil. Ministério da Saúde. Pesquisa de orçamentos familiares 2008-2009: tabela de medidas referidas para os alimentos consumidos no Brasil. Publication. Rio de Janeiro: IBGE; 2011. [Acesso em 30 de setembro de 2025]. Disponível em: https://biblioteca.ibge.gov.br/visualizacao/livros/liv50000.pdf

21. Universidade Estadual de Campinas (UNICAMP). Tabela Brasileira de Composição de Alimentos (TACO). 4º ed. Vol. 1. Campinas: UNICAMP; 2011. [Citado 30 de setembro de 2025]. Disponível em: https://www.nepa.unicamp.br/tabela-brasileira-de-composicao-de-alimentos-4a-edicao

22. Compounding PN. Safe practices for parenteral nutrition. JPEN J Parenter Enteral Nutr. 2004;28:S39. https://doi.org/10.1002/ncp.11064

23. Trumbo P, et al. Dietary reference intakes for energy, carbohydrate, fiber, fat, fatty acids, cholesterol, protein, and amino acids. National Academies Press; 2005. https://doi.org/ 10.1016/s0002-8223(02)90346-9

24. National Academies (US). Dietary reference intakes for water, potassium, sodium, chloride, and sulfate. National Academies Press; 2005. https://doi.org/10.17226/10925

25. National Academies (US). . Dietary reference intakes for calcium, phosphorus, magnesium, vitamin D, and fluoride. 1999. https://doi.org/10.17226/5776

26. National Academies (US).Dietary reference intakes for thiamin, riboflavin, niacin, vitamin B6, folate, vitamin B12, pantothenic acid, biotin, and choline.Washington (DC): National Academies Press (US); 1998. PMID: 23193625. 2000. https://doi.org/10.17226/6015

27. National Academies (US). Dietary reference intakes for vitamin A, vitamin K, arsenic, boron, chromium, copper, iodine, iron, manganese, molybdenum, nickel, silicon, vanadium, and zinc. National Academies Press; 2002. https://doi.org/ 10.17226/10026

28. August D. Guidelines for the use of parenteral and enteral nutrition in adult and paediatric patients. J Parenter Enteral Nutri (JPEN). 2002;26. https://doi.org/10.1177/0148607102026001011

29. Bittencourt AF, Martins JR, Logullo L, Shiroma G, Horie L, Ortolani MC, et al. Constipation is more frequent than diarrhea in patients fed exclusively by enteral nutrition: results of an observational study. Nutrition in clinical practice. 2012;27(4):533–9. https://doi.org/ 10.1177/0884533612449488

30. Organization WH. Obesity: preventing and managing the global epidemic: report of a WHO consultation. 2000. [Acesso em 30 de setembro de 2025]. Disponível em: https://apps.who.int/iris/bitstream/10665/42330/1/WHO_TRS_894.pdf

31. Detsky AS, McLaughlin JR, Baker JP, Johnston N, Whittaker S, Mendelson RA, et al. What is subjective global assessment of nutritional status? Journal of parenteral and enteral nutrition. 1987;11(1):8–13. https://doi.org/10.1177/014860718701100108

32. Von Elm E, Altman DG, Egger M, Pocock SJ, Gøtzsche PC, Vandenbroucke JP. The Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) statement: guidelines for reporting observational studies. The lancet. 2007;370(9596):1453-7. https://doi.org/10.1016/j.jclinepi.2007.11.008

33. United States. Medicare. Medicare. 2024 [citado 30 de setembro de 2025]. Enteral and parenteral nutrition: nutrients, suppliesandequipment. [Acesso em 30 de setembro de 2025]. Disponível em: https://www.medicare.gov/coverage/enteral-parenteral-nutrition-nutrients-supplies-equipment

34. de Sousa LRM, Will KL. Fortalecendo a rede de atenção às necessidades alimentares especiais: uma experiência com fórmulas enterais semiartesanais, em Piraquara-PR. DEMETRA: Alimentação, Nutrição & Saúde. 2017;12(3):767–79. https://doi.org/10.12957/demetra.2017.30161

35. Thieme RD, Schieferdecker MEM, Ditterich RG. Idosos em terapia nutricional enteral no domicílio: integração das políticas públicas nacionais e programas municipais. Revista Brasileira de Geriatria e Gerontologia. 2020;23:e200157. https://doi.org/10.1590/1981-22562020023.200157

36. Mezzomo TR, Fiori LS, de Oliveira Reis L, Schieferdecker MEM. Nutritional composition and cost of home-prepared enteral tube feeding. Clin Nutr ESPEN. 2021;42:393–9. https://doi.org/ 10.1016/j.clnesp.2020.12.016

37. Folwarski M, Kłęk S, Zoubek-Wójcik A, Szafrański W, Bartoszewska L, Figuła K, et al. Home enteral nutrition in adults—nationwide multicenter survey. Nutrients. 2020;12(7):2087. https://doi.org/ 10.3390/nu12072087

38. Vieira MMC, Santos VFN, Bottoni A, Morais TB. Nutritional and microbiological quality of commercial and homemade blenderized whole food enteral diets for home-based enteral nutritional therapy in adults. Clinical Nutrition. 2018;37(1):177–81. https://doi.org/ 10.1016/j.clnu.2016.11.020

39. Gazan R, Vieux F, Mora S, Havard S, Dubuisson C. Potential of existing online 24-h dietary recall tools for national dietary surveys. Public Health Nutr. 2021;24(16):5361–86. https://doi.org/ 10.1017/S1368980021003517

40. Tang H, Yang M. Nutritional assessment in patients with chronic diseases: Tools, challenges, and future directions. Vol. 15, Nutrients. MDPI; 2023. p. 4794. https://doi.org/ 10.3390/nu15224794

41. Azzollini V, Dalise S, Chisari C. How does stroke affect skeletal muscle? State of the art and rehabilitation perspective. Front Neurol. 2021;12:797559. https://doi.org/ 10.3389/fneur.2021.797559

42. Bendavid I, Lobo DN, Barazzoni R, Cederholm T, Coëffier M, de van der Schueren M, et al. The centenary of the Harris–Benedict equations: How to assess energy requirements best? Recommendations from the ESPEN expert group. Clinical nutrition. 2021;40(3):690–701. https://doi.org/ 10.1016/j.clnu.2020.11.012

43. de Melo VX, Mezzomo TR, Dall'igna ALA, Dengo V de AM, Stangarlin-Fiori L, Schieferdecker MEM, et al. Does the nutritional composition and category of administered enteral nutrition affect the nutritional status of patients receiving home nutritional therapy? Clin Nutr ESPEN. 2022;49:270–7. https://doi.org/10.1016/j.clnesp.2022.03.042

44. D'Onofrio V, Del Chierico F, Belci P, Vernocchi P, Quagliariello A, Reddel S, et al. Effects of a symbiotic formula on functional bowel disorders and gut microbiota profile during long-term home enteral nutrition (LTHEN): a pilot study. Nutrients. 2020;13(1):87. https://doi.org/10.3390/nu13010087

45. Serra J, Alcedo J, Barber C, de Los Ríos CC, Jordi S, Javier A, et al. Review document of the Spanish Association of Neurogastroenterology and Motility on the management of opioid-induced constipation. Revista Española de EnfermedadesDigestivas. 2024;116(10):546–53. https://doi.org/ 10.3390/nu13010087

46. Van Der Schoot A, Drysdale C, Whelan K, Dimidi E. The effect of fiber supplementation on chronic constipation in adults: an updated systematic review and meta-analysis of randomized controlled trials. Am J Clin Nutr. 2022;116(4):953–69. https://doi.org/ 10.1093/ajcn/nqac184

47. Cui J, Xie F, Yue H, Xie C, Ma J, Han H, et al. Physical activity and constipation: A systematic review of cohort studies. J Glob Health. 2024;14:04197. https://doi.org/ 10.7189/jogh.14.04197

48. Gramlich L, Hurt RT, Jin J, Mundi MS. Home enteral nutrition: towards a standard of care. Nutrients. 2018;10(8):1020. https://doi.org/ 10.3390/nu10081020

49. Lim SER, Cox NJ, Tan QY, Ibrahim K, Roberts HC. Volunteer-led physical activity interventions to improve health outcomes for community-dwelling older people: a systematic review. Aging Clin Exp Res. 2021;33:843–53. https://doi.org/ 10.1007/s40520-020-01556-6

50. Neil-Sztramko SE, Teggart K, Moore C, Sherifali D, Fitzpatrick-Lewis D, Coletta G, et al. Community-based group physical activity and/or nutrition interventions to promote mobility in older adults: an umbrella review. BMC Geriatr. 2022;22(1):539. https://doi.org/10.1186/s12877-022-03170-9

Contributors

Wrobel GM participated in the conception of the study design, data analysis and interpretation, drafting of the study and final review and approval of the manuscript for submission; Crispim SP participated in the final review and approval of the manuscript for submission; Rabito EI participated in the final review and approval of the manuscript for submission; Thieme RD participated in the conception of the study design, drafting of the study and final review and approval of the manuscript for submission. Schieferdecker MEM participated in the conception of the study design, drafting of the study and final review and approval of the manuscript for submission.

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