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Nutritional care for children with cerebral palsy: a systematic review

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ABSTRACT

OBJECTIVE

Review the recommendations on nutritional care for children with Cerebral Palsy (CP) and list the impacts of this pathology.

METHODS

Systematically search and analyse, in the PubMed, LILACS, BVS, Scielo databases, publications that report the nutritional care of children with Cerebral Palsy from the anthropometric assessment, the classification of the nutritional status and the choice of feeding route. The method of inclusion of articles was schematized in its identification, selection, inclusion, and eligibility.

RESULTS

Twelve articles were selected that presented divergences in the anthropometric assessment; others dealt with the nutritional status classification curves, highlighting the occurrence of malnutrition and, finally, there were articles on the main feeding routes of children with CP and the main associated difficulties.

CONCLUSION

More studies with homogeneous samples and with methodological quality are needed to clarify with a high level of evidence the possible relationships between diet and motor impairment, nutritional status and diet, and risks and eating difficulties.

DESCRIPTORS

Cerebral palsy, Nutritional care, Malnutrition, Feeding, Feeding difficulties.

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INTRODUCTION

The first reports of cerebral palsy (CP) were recorded in 1843 by William John Little, an English orthopedist, who analysed 47 children with spasticity and observed the relationship with birth: prematurity, labor complications, pelvic presentation, delay in crying and breathing, seizures and coma in the first hours of life[1].

Cerebral Palsy (CP), also known as Chronic Non-Progressive Encephalopathy (CNE), is among the most frequent causes of motor disability in childhood. It is a permanent lesion in the developing brain and may be related to several conditions that course with central motor dysfunction, affecting posture, movements, and tone; this motor involvement and associated symptoms can be systematized[1,2].

The motor subtypes of CP are related to the affected brain region and its severity (mild, moderate, and severe); this classification based on motor function is called Gross Motor Function Classification System (GMFCS) and is used in children aged 2 to 18 years, stratifying the function into 5 levels of motor independence, being level I (milder symptoms) to level V (more severe)[2-4].

When it comes to the prevalence of the disease, there is a limitation of studies that have investigated the prevalence and incidence of CP in Brazil[1]. Figures in developed countries show a prevalence ranging from 2.1 to 2.9/1,000 live births.

Children with this disease are at higher risk for comorbidities, especially those with greater motor impairment, classified as GMFCS IV and V, which are prone to serious complications leading to hospitalization and even death[2]. Moreover, growth deficit and nutritional problems are frequent, 58% of moderate and severe CP degrees present malnutrition[5].

The reason would be associated with the various difficulties in feeding these children, because they depend on controls of the cerebral cortex, cranial nerves, and trunks. Therefore, many children have difficulties related to mastication, swallowing and self-feeding, because many individuals have weak suction, insufficient lip closure, poor suction-swallowing coordination, and ineffective mastication, and they also need help to feed themselves[3,6].

In clinical practice it is common to observe gastrointestinal disorders in about 80% to 90% of patients with CP, mainly dysphagia, gastroesophageal reflux disease, and constipation; in addition, they have growth deficit and malnutrition in approximately 60% to 90% of the cases[3].

Another point is that many health teams usually use growth curves for children without neurological impairment, which is not appropriate for this population, because it may induce an inaccurate assessment of nutritional deficit with unnecessary interventions or the acceptance that malnutrition is an inherent part of CP[5].

Thus, there is a need to review the recommendations on nutritional care for children with Cerebral Palsy and list the impacts of this pathology, which may reduce intercurrences or gastrointestinal discomforts, as well as the impact on the nutritional status, prevention of malnutrition, and improvement in the quality of life of this population.

METHODS

To prepare this systematic review, scientific literature was searched in the following databases: Virtual Health Library (VHL), US National Library of Medicine - National Institutes of Health (PubMed), Latin American and Caribbean Literature on Health Sciences (LILACS), and Scientific Electronic Library Online (SCIELO). The descriptors and expressions used in the searches were: "cerebral palsy", "cerebral palsy", and "cerebral palsy".

The inclusion criteria adopted were: articles available in English, Portuguese, and Spanish, published between the years 2017 and 2022, full text available, type of study, and that were in accordance with the theme "nutritional care in infant cerebral palsy". Articles without the full text available, in languages other than the three previously selected, studies repeated in the databases, outside the determined timeframe, and publications that did not match the theme were excluded. The searches were conducted between August and November 2022 (Figure 1).

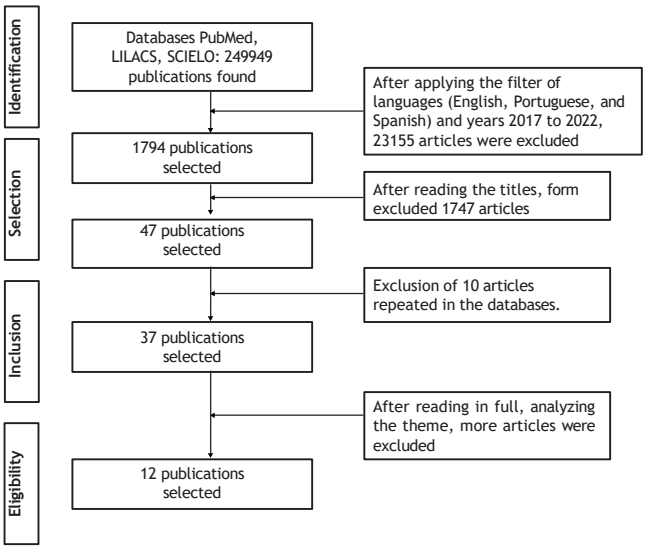

Figure 1. Flowchart of the search: identification, selection, inclusion and eligibility of scientific articles in the systematic review.

RESULTS AND DISCUSSION

It can be observed during the selection of articles that some topics related to the care of this population were highlighted among the publications: some studies presented the divergences in anthropometric assessment; others dealt with the nutritional status classification curves, highlighting the occurrence of malnutrition, and finally, there were articles on the main feeding routes of children with CP and the main associated difficulties.

Therefore, to discuss each of these situations that impact nutritional care, we divided them into three main points - anthropometric assessment, nutritional status, and food intake - to facilitate discussion among authors and guide the care of health professionals.

Anthropometric Evaluation in Infantile Cerebral Palsy

Among the 12 studies found, 5 dealt with the methods of anthropometric evaluation of this population. Children with CP need specific curves to guide nutritional care. It is recommended to associate them with other nutritional parameters, evaluating individually and the follow-up must be continuous, specialized, and focused on the health and quality of life of these patients[7-11].

Table 1. Findings on anthropometric assessment of children with Infantile Cerebral Palsy.

Findings on anthropometric assessment of children with Infantile Cerebral Palsy				
Reference	**Type of study**	**"N" Characteristics**	**Methodology of anthropometric evaluation**	**Findings**
Kim et al, 2022	Transversal	16 children without paralysis (12 boys and 4 girls) and 16 children with Cerebral Palsy (13 boys and 3 girls), ages 4 to 12 years (mean age 8 years).	Anthropometric evaluation by Bioimpedance model Inbody S10 and classification according to the Chart for Korean children and adolescents published by the Korean Ministry of Health and Welfare.	In BMI there was no significant difference between the groups. As for height, there was a significant difference of 20.25% in the group with paralysis and 64.06% in the group without paralysis. Weight was found a difference of 27.13% of those with paralysis versus 54% of those without paralysis.
Furnus; Maseras; Salgado, 2018	Transversal	30 children, mean age 8.5 years; 57% male, 43% female. 47% were fed by nasoenteric tube (mean time of use 3.5 years) and 53% by gastrostomy.	The weight evaluation was done by the differential weight (caregiver's weight - child's weight); the classification by the specific curves for CP - Life Expectancy Project,2011.	Height: 97% had height according to age, there was only 1 case of short stature. Weight: 60% normal weight, 33% underweight, 7% overweight.
Silva et al, 2017	Transversal	68 children between 5 and 16 years old, 33 under 5 and 35 over 5, 47 male and 21 female, 76% are GMFCS 4 or 5, 83.8% are oral.	Weight, estimated height, and body mass index were classified in Z-score by the World Health Organization curves. Brachial circumference, triceps skinfold, and arm muscle circumference were classified according to Frisancho.	Children with Cerebral Palsy have atypical growth and the greater the motor impairment, the greater this deficit. Therefore, specific curves are more recommended.
Caselli et al, 2017	Transversal	54 children, mean age 10.2 years, 34 boys and 20 girls; 5 children used a gastrostomy and 29 used the oral route.	Knee height, estimated height, weight: classification using the specific curves for PC - Life Expectancy Project,2011. Brachial circumference and triceps skinfold classified according to Frisancho.	The frequency of low weight by the reference curve was 22.22%, and height was classified as adequate in the reference curve. And more than half of the patients had the parameters indicating lean mass below the 5th percentile.
Lopes V, 2017	Longitudinal/ descriptive	98 children, between 1 and 19 years old, 61.22% male and 38.78% female; 70% had Cerebral Palsy, the rest had other types of mental impairment among these, epilepsy, Down's Syndrome and encephalopathy.	Comparison of curve classification from WHO, Stevens et al, 1995, NCHS/CDC, Mustacchi,2002, Cronk et al, 1988.	For this population, even with multiple disabilities, the benchmarks that were most appropriate were the developmental benchmarks for people with Cerebral Palsy.

The study done with 68 children with CP, in which 76% of the individuals were classified as GMFCS IV or V, can be observed a growth deficit in this population, thus recommending the use of specific curves 9. This corroborates another article that cites the difficulty in obtaining reliable data for anthropometric measurements of this population, particularly of height due to the impossibility or difficulty in standing, muscle spasms, contractures, and scoliosis, besides the poor collaboration due to cognitive impairment[5].

Nutritional status and malnutrition

The nutritional status of children and adolescents with CP is in great evidence in the 12 articles listed in this research, 6 of which stand out for the quality of anthropometric evaluation. It is already known that the anthropometric evaluation needs to be detailed and that part of the studies used the specific curves to determine the nutritional status of these individuals.

All studies used the specific curves for children with CP from the study by Brooks et al (2011), except the publication by Silva et al (2017) that classified according to the WHO curves (2006 and 2007), but their results showed no significant differences, it is also possible to observe that there are few studies with hospitalized patients, only two studies bring this type of sample, making it difficult to compare individuals at the same level of clinical impairment[9,10].

Observing the nutritional status presented by all the publications presented in the table below, the prevalence of malnutrition ranged from 7.7% to 35.7% of the children analyzed[9,11-15], alarming data, since these studies deal mostly with individuals seen in outpatient clinics with a multidisciplinary team, including nutritional care.

Overweight and obese patients ranged from 3.3% to 7% of the sample in all selected articles. The study with the highest number of obese patients had in its population only hospitalized patients and 46% using enteral tubes or ostomy, which may have influenced the nutritional status[10,12].

When it comes to analysing the patients classified as eutrophic, it can be observed that the population analysed in the hospital setting ranged between 73 and 76% of eutrophic children. While the children in outpatient care had a large variation in the percentage of eutrophic, ranging from 32.7 to 90.8% among the individuals studied.

Table 2. Nutritional status of the study populations with Infantile Cerebral Palsy.

Nutritional status of study populations with Infantile Cerebral Palsy					
Reference	**Type of study**	**"N" Characteristics**	**Curve used in the classification**	**Nutritional status**	**Scope of care for the study population**
Caselli et al, 2017	Transversal	54 children, mean age 10.2 years, 34 boys and 20 girls; 5 children used a gastrostomy and 29 used the oral route.	Weight and height classified by Brooks et al, 2011.	24.1% were malnourished, 42% fed via gastrostomy and 58% via oral; 76% were eutrophic and 7% overweight.	Hospitalar
Silva et al, 2017	Transversal	68 children between 5 and 16 years old, 33 under 5 and 35 over 5, 47 male and 21 female, 76% are GMFCS 4 or 5, 83.8% are oral.	Weight, estimated height and BMI were classified into Z-score by the WHO curves.	27% underweight and 73% normal weight or overweight.	Outpatient and inpatient
Lopes V, 2017	Transversal	98 children, between 1 and 19 years old, 61.22% male and 38.78% female; 70% had Cerebral Palsy, the rest had other types of mental impairment among these, epilepsy, Down's Syndrome and and encephalopathy.	Comparison of curve classification from WHO, Stevens et al, 1995, NCHS/CDC, Mustacchi, 2002, Cronk et al, 1988.	P/I (Stevens) 90.8% adequate weight; P/E (WHO) 70% adequate; E/I (Stevens) 100% of the boys and 97.8% of the girls were adequate. In BMI (Stevens), 96.66% of the boys and 94.73% of the girls are eutrophic.	Ambulatorial
Barja et al, 2020	Transversal	65 children with a mean age of 10.8 years, 63.1 % male; 81.6 % were GMFCS IV-V; 43.5 % had a gastrostomy.	Weight and height classified by Brooks et al, 2011.	15.4% underweight (< 10th percentile) and 10.8% overweight (>75th percentile).	Ambulatorial
Pérez - Moya, Ochoa - Lares, González - Lugo, 2020	Transversal	180 patients, 42.7% female, 57.3% male; motor function: 5% GMFCS I, 8.3% GMFCS II, 24.4% GMFCS III, 31.1% GMFCS IV, 31.1% GMFCS V.	Weight and height classified by Brooks et al, 2011.	7.7% severely malnourished, 20.0% moderately malnourished, 29.4% mildly malnourished, 32.7% eutrophic, 6.6% overweight, and 3.3% obese.	Ambulatorial
Sánchez, Ojeda, Mesquita, 2019	Prospectivo	42 patients, mean age 5 years, 52.4% female.	Weight and height classified by Brooks et al, 2011.	35.7% malnourished; 11.9% at risk of malnutrition; 46.7% eutrophic and 4.8% overweight.	Ambulatorial

Food intake and eating difficulties

The food intake of children and adolescents with Cerebral Palsy was analyzed in 6 articles; the results were the most varied. The study by Doylet-Rivas YL et al, evidenced that caregivers have a basic knowledge of the frequency and times of children's meals and little knowledge about food groups[16]. While Furnus et al emphasizes that the caregivers do not have the perception of the real nutritional status of the children, do not prioritize the nutritional care and therefore run the risk of becoming undernourished and there is little importance to evaluate the meals offered, contributing to greater feeding difficulties[8].

The authors, Hyo-Jung Kim et al, compared children without CP and children diagnosed with CP, and in both groups, there is food selectivity prioritizing flavor (75% and 56%, respectively); however, 81.3% of the group with CP had a lower calorie diet and better micronutrient intake, while children in the other group accounted for only 25%7. This selectivity is also confirmed in the study by Carvalho et al, where the sample of 27 children with CP, 70.37% consumed sugars; and the diet consistencies were pasty or liquid[17].

The importance of the choice of feeding route was fundamental in all studies. Some authors correlated the oral diet with eating difficulties such as dysphagia, gastrointestinal reflux, and constipation[16,18]. The study by Caselli et al, complements that the individuals studied with oral feeding presented malnutrition, greater depletion of lean and fat mass[12].

Some references show that the dietary route chosen, besides being related to eating difficulties, can influence the nutrients offered[7,8,17,18]. In one study, the GTT group had higher lipid intake, while protein and fiber were higher in the VO group. Comparing diets of the gastrostomy group indicated that the mixed diet (industrialized + homemade) provides higher protein and fiber intake[12].

In another research, it shows that the feeding route, eating difficulties, and food consistency are linked to nutritional status and food choices. Children with dysphagia ingested fewer calories, carbohydrates, and liquids. While those with reflux ingested more liquids. Individuals with constipation ingested less liquids and fiber[18].

Table 3. Feeding routes and feeding difficulties of children with Infantile Cerebral Palsy.

Feeding routes and feeding difficulties of children with Infantile Cerebral Palsy				
Reference	**Type of study**	**"N" Characteristics**	**Feeding Routes**	**Eating Difficulties**
Kim et al, 2022	Transversal	16 children without paralysis (12 boys and 4 girls) and 16 children with Cerebral Palsy (13 boys and 3 girls), ages 4 to 12 years (mean age 8 years).	oral route	43.8% of the group with Cerebral Palsy did not eat without help; 18.8% refused food; The priority in choosing food was taste (56%) and nutrients (31.3%) in the group with Cerebral Palsy; and the group without Cerebral Palsy was taste (75%) and color (18.8%); 81.3% of the group with Cerebral Palsy had a healthy diet, in the other group it was only 25%.
Carvalho et al, 2020	Transversal	27 children with Cerebral Palsy with a mean age of 8.5 years; 67% male and 33% female.	oral route and gastrostomy	48% receive a soft diet, 33% soft + fibrous, 18.5% liquid, and these 18.5% are gastrostomized. 70.37% of the sample consumes sugars.
Doylet-Rivas et al, 2020	Transversal	10 children, 6 boys and 4 girls between the ages of 1 and 10.	oral route	30% of children have dysphagia; 20% have GI reflux, 20% constipation, and 30% no symptoms.
Caramico-Favero et al, 2018	Transversal	40 children with Cerebral Palsy, aged 0 to 4 years, 57% male and 42.5% female. 82.5% oral, 12.5% gastrostomy, and 5% both.	oral route and gastrostomy	82.5% had dysphagia, 40% reflux, 60% constipation. Dysphagics had lower calorie, carbohydrate, and fluid intake. Those with reflux ingested more liquids. Those with constipation ingested fewer liquids and fiber.
Furnus et al., 2018	Transversal	30 children, mean age 8.5 years; 57% male, 43% female; 47% fed by nasoenteral tube (mean time of use 3.5 years) and 53% by gastrostomy.	enteral route	70% formula, 3% home-cooked diet, and 27% mixed; average caloric intake of 11.1 kcal/cm; 90% protein adequacy, 80% iron, 73% water intake, 70% calcium, and 3% fiber.
Caselli et al, 2017	Transversal	54 children, aged 2 to 19 years, divided into 2 groups: gastrostomy (> 6 months) or total oral route.	via oral e gastrostomia oral route and gastrostomy	24.14% of the oral group were malnourished, with greater depletion of lean and fat mass. The highest intake of lipids was in the gastrostomy group, while protein and fiber intake was higher in the oral group. Comparing diets of the gastrostomy group indicated that the mixed diet (industrialized + homemade) provides higher protein and fiber intake.

The importance of continuous nutritional guidance for parents/caregivers, individualized and specialized care, and the choice of an appropriate feeding route was clearly evidenced, to contribute to the improvement of nutritional status and food intake[7,8,12,16,17,18].

Limitations of the study

During the eligibility evaluation of the publications, there was a potential risk of bias due to the heterogeneity of the samples, the unequal scope of care (outpatient or inpatient), the varying degrees of CP, and the different food routes. Also, there is a variation of nutritional status evaluation curves, not all authors used specific curves for children with CP, which makes the analysis of the nutritional status of the population studied difficult, as well as the choices of foodways were not homogeneous in each study, making a more appropriate comparison difficult. It must also be considered that the concept of eating difficulties is very broad in each publication and may have a greater or lesser range. It is also necessary to consider that the methodologies found in all studies had a considerable variation, whether with the use of questionnaires, measurement of anthropometric measures or questioning the perception of nutritional status, analysing, or asking about eating difficulties, and the variation of the time of use of each foodway.

CONCLUSION

Nutritional care of children and adolescents with Cerebral Palsy require specific nutritional status classification curves because studies show that children with CP have slower growth and development than healthy children.

Malnutrition affects a large part of this population, and it is up to the professional to pay attention to some situations that have greater potential to aggravate this situation, such as motor development, the need for a caregiver at mealtimes, the consistency of the diet, the nutrients offered, and the feeding routes.

The feeding routes of children with CP may be related to motor function, children with an oral diet were more prone to malnutrition and eating difficulties such as dysphagia, gastroesophageal reflux, and constipation.

More studies with homogeneous samples and with methodological quality are needed to clarify with a high level of evidence the possible relationships between feeding and motor impairment, nutritional status and feeding route, and risks and eating difficulties.

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