

Feeding development of children with microcephaly: a descriptive study

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ABSTRACT

Purpose: to describe feeding characteristics of children with microcephaly, encompassing the feeding route, food consistencies, and utensils used to feed them.

Methods: a descriptive study approved by the Research Ethics Committee, including 34 caregivers of children diagnosed with microcephaly. They answered a structured interview on the children's feeding route, breastfeeding, utensils used to feed them, and the food consistencies, besides sociodemographic and overall development data. Descriptive statistical analyses were performed, presenting absolute and percentage frequencies and measures of central tendency and dispersion.

Results: the 34 caregivers in the sample were responsible for 34 children born between 2015 and 2018, diagnosed with microcephaly, due to various causes. Of these, 33 (97.02%) were on oral feeding in their first year of life – 26 (76.44%) on breastfeeding, nine of which (26.46%) exclusively so until 6 months old. The children were served food in baby bottles, cups, spoons, and syringes. Pureed food was the consistency most accepted by the children.

Conclusions: there was a low prevalence of exclusive breastfeeding until they were 6 months old, delayed progress of consistencies, use of utensils inadequate to their age, and necessary adaptations to feed children, orally.

Keywords: Microcephaly; Child Nutrition; Feeding Methods; Breast Feeding; Bottle Feeding



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INTRODUCTION

Nutrition plays an important role in child development, as nutritional status is closely related to survival, growth, and development¹⁻³. Thus, changes in the feeding process must be carefully investigated and treated because an inadequate diet may be related to inadequate growth and unsatisfactory neurodevelopment³.

Swallowing disorders stand out among the many possible changes in the feeding process, as they are highly prevalent in children with neurological problems. Dysphagia prevalence has not been established yet, but it is estimated to affect up to 80% of children with neurological impairments⁴.

Dysphagia can be understood as any interruption in the swallowing process that might compromise feeding safety, effectiveness, and comfort⁵. It may occur without clear clinical manifestations; hence, it is important to follow up on children with risk factors for development⁴. The risk factors for dysphagia in children include prematurity, congenital changes, and neurological changes⁶, such as microcephaly.

Microcephaly is a long-known health condition – a clinical finding that may result from congenital anomalies or postpartum circumstances^{7,8}. Its main characteristic is the head circumference smaller than two standard deviations below the average for the age and sex, which impairs brain development, neuropsychomotor development, sight, hearing, and so forth⁹. Thus, microcephaly poses challenges to these children and their families, as they will have lifelong specific needs⁹.

The integrity of the central nervous system is important to feeding functions. Therefore, children with neurological changes (such as microcephaly) may have oral function difficulties^{4,10}. Moreover, the neurological condition may lead to changes in the oral-motor system, further impacting its function. Various studies report the presence of dysphagia in children with microcephaly^{9,11-14}, affecting their motor development¹², weight, and stature¹⁴.

Since swallowing disorders can impair children's growth, development, and pulmonary health^{2, 10}, it is

essential to address their nutritional care, especially in those more likely to have such difficulties – which is the case of microcephaly.

Some pieces of research have described dysphagia signs and symptoms^{7,15,16} in 0-to-3-year-old children with microcephaly. However, few studies have addressed their food consistency^{2,10,17} and the utensils used to feed them¹⁷.

Therefore, this research aimed to describe the characteristics related to the nutrition of children with microcephaly, considering their feeding route, food consistency, and utensils used.

METHODS

This descriptive study was approved by the Human Research Ethics Committee of the Department of Health Sciences of *Universidade Federal da Paraíba*, Brazil (evaluation report 5.167.511; CAAE 30675620.0.0000.5188).

The inclusion criteria were as follows: being a caregiver of a child diagnosed with microcephaly, born between 2015 and 2018, and residing in the state where the research was conducted. The caregivers of children with microcephaly who had oral cavity malformations such as cleft lip and/or palate were excluded from the research.

Altogether, 34 caregivers participated in this research. Volunteers were recruited through a classic nonprobabilistic sampling method known as snowball¹⁸. The seeds were caregivers who took children to healthcare in reference institutions for children with microcephaly.

Data were collected with a structured interview, developed based on the MMBGR protocol¹⁹. The interviews took place between September 2021 and September 2022, either in person (n = 26; 76.47%) or remotely via video calls (n = 8; 23.52%). In-person interviews were held at the outpatient centers where children received treatment.

The caregivers were asked about the children's feeding habits. The study variables are presented in Chart 1.

Chart 1. Research variables

VARIABLES	DESCRIPTION	CATEGORIZATION/UNIT
CAREGIVER'S SOCIODEMOGRAPHIC CHARACTERISTICS	Age	In years
	Sex	Male or female
	Marital status	Single, married/domestic partnership, separated, or widow(er)
	Educational attainment	Illiterate, finished middle school, finished high school or finished Higher education
	Occupation	Identify the caregiver's occupation
	Relationship to the child	Mother, father, grandmother, or aunt
HILD'S SOCIODEMOGRAPHIC CHARACTERISTICS	Cause of microcephaly	Identify the cause
	Age	In months
	Sex	Male or female
	School attendance	Yes or no
CHILD'S DIET IN THE FIRST YEAR OF LIFE	Feeding route in the first year of life	Oral, alternative, or mixed feeding
	Breastfeeding	Yes or no
	Type of breastfeeding	Exclusive or complemented
	Time on exclusive breastfeeding	In days
	Complementary diet	Baby bottle, cup, spoon, or other
CHILD'S OVERALL MOTOR DEVELOPMENT AT THE INTERVIEW	Holds their head up	Yes or no
	Sits up without support	Yes or no
	Walks with support	Yes or no
	Moves independently	Yes or no
CHILD'S CURRENT DATA	Current feeding route	Oral, alternative, or mixed feeding
	Liquid consistency	Yes or no
	Pureed consistency	Yes or no
	Solid consistency	Yes or no
	Current baby bottle use	Yes or no
	Current cup use	Yes or no
	Current spoon use	Yes or no
	Type of baby bottle nipple	Common nipple, orthodontic nipple, baby spoon bottle
	Material of the baby bottle nipple	Latex or silicone nipple
	Hole in the baby bottle nipple	Unchanged/normal nipple hole, changed/enlarged nipple hole
	Type of cup	Cups with straws, cups with lids, sippy cups, common cups
	Other utensils used	Yes or no
	If other utensils are used, identify	Utensil identification
MASTICATION	Lip posture	Closed, parted, or open lips
	Noise	Yes or no
	Food escape	Yes or no
	Mastication mode	Adequate, little, much, not known
	Mastication speed	Like other children, slower, faster, not known
SWALLOWING	Anterior escape	Yes or no
	Residue after swallowing	Yes or no
	Chokes	Yes or no
	Coughs	Yes or no
	Phlegm	Yes or no
	Nasal reflux	Yes or no
	Noise	Yes or no
Pain	Yes or no	

Source: Developed by the authors, 2022

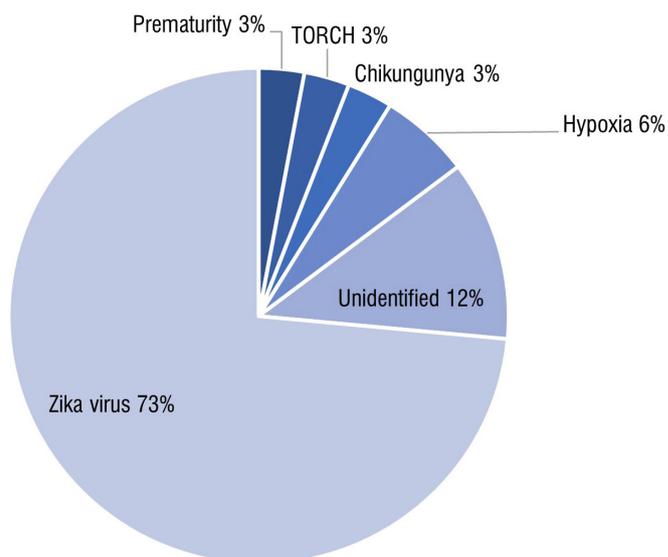
The study performed descriptive statistical analyses. The categorical variables were presented in absolute and percentage frequency distribution, and the quantitative variables, in measures of central tendency and dispersion.

RESULTS

The mean age of the participating caregivers was 35.24 years (minimum: 23, maximum: 63, standard deviation: 8.67), and that of the children for whom they were responsible was 70.18 months (minimum: 46, maximum: 82, standard deviation: 10.76). Only one (2.94%) of the 34 caregivers was male; all others were females.

Of the 34 children, 13 (38.24%) were females, while 21 (61.76%) were males. Figure 1 shows the causes of microcephaly in the children for whom the sample caregivers were responsible.

Even though the children were school-age, only six of them (17.65%) were studying – one of them in homeschooling, with a private teacher. The caregivers whose children did not study and the one whose child was in homeschooling reported they feared sending them to school.



Caption: TORCH = congenital infection caused by toxoplasmosis, rubella, syphilis, cytomegalovirus, or simple herpes
Source: Developed by the authors, 2022

Figure 1. Percentage frequency of the causes of microcephaly (n = 34)

The sociodemographic characteristics of the research subjects are shown in Table 1.

Table 1. Sociodemographic data of the caregivers (n = 34)

Variables	n	%
Marital status		
Single	8	23.53
Married/domestic partnership	23	67.65
Separated	1	2.94
Widow(er)	2	5.88
Educational attainment		
Illiterate	1	2.94
Middle school	6	17.65
High school	22	64.71
Higher education	3	14.71
Occupation		
Caring for the child	31	91.18
Self-employed	1	2.94
Teacher	1	2.94
Nurse	1	2.94
Relationship		
Mother	29	85.29
Father	01	3.03
Grandfather/grandmother	03	9.09
Aunt/uncle	01	3.03

Caption: n = number of observations; % = percentage frequency of observations
Source: Developed by the authors, 2022

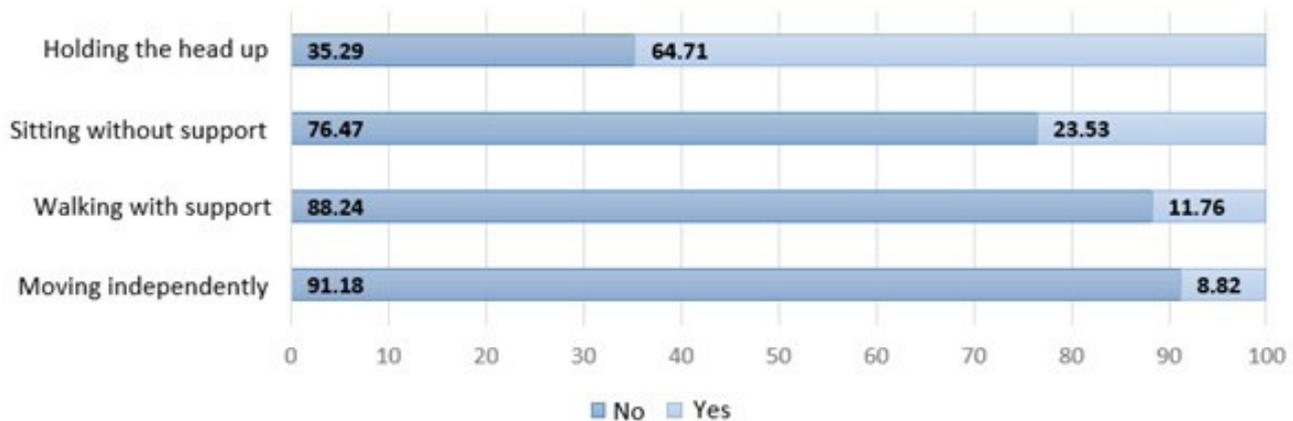
The caregivers were asked about the feeding route in the children's first year of life. Of the total interviewees, 21 (61.76%) reported that the child was on exclusive oral feeding; 12 (35.26%) reported an alternative feeding route for a time, having reestablished oral feeding during the first year of life; and only one (2.94%) informed that the child used an alternative feeding route from their first day of life.

Of the 13 who reported using an alternative feeding route for some time during the first year of life, 10 (76.9%) reported the use of an orogastric tube; one (7.7%), a nasogastric tube; one (7.7%), gastrostomy; and one (7.7%) began using an orogastric tube and then used gastrostomy.

Of the 33 caregivers who reported that the child used oral feeding at some moment in their first year

of life, seven (21.21%) reported that the child was not breastfed. The other 26 were breastfeeding, nine of whom (34.56%) were exclusively so until the sixth month, while 17 (65.28%) were on exclusive breastfeeding for a time but needed an infant formula before they were 6 months old. Hence, exclusive breastfeeding lasted from 3 days to 8 months. The caregivers who gave them formulas ($n = 17$) served them in baby bottles. None of them reported using other utensils, such as cups or spoons, to feed the children in their first year of life.

They were also asked about the children's motor development at the time of the interview, considering its close relationship with the feeding process. This information is presented in Figure 2.



Source: Developed by the authors, 2022

Figure 2. Percentage frequency of child motor development milestones ($n = 34$)

The caregivers were asked about the children's feeding route at the time of the interview to identify their current feeding status. Of the 34 children assisted by the participating caregivers, 29 (85.29%) were on oral feeding, while five (14.71%) used an alternative feeding route – more specifically, gastrostomy.

The caregivers were further asked about the current food consistency, the utensils used to give them food, and their mastication and swallowing characteristics. Since five children were exclusively on an alternative feeding route at the time of the interview, the questions on oral feeding were answered by 29 caregivers.

The information on the consistencies the children accepted is shown in Figure 3.



Source: Developed by the authors, 2022

Figure 3. Percentage frequency of consistency acceptability at the time of the interview (n = 29)

As for utensils, they served food to the children in baby bottles (n = 19; 65.36%), cups (n = 17; 58.48%), and syringes (n = 3; 10.32%).

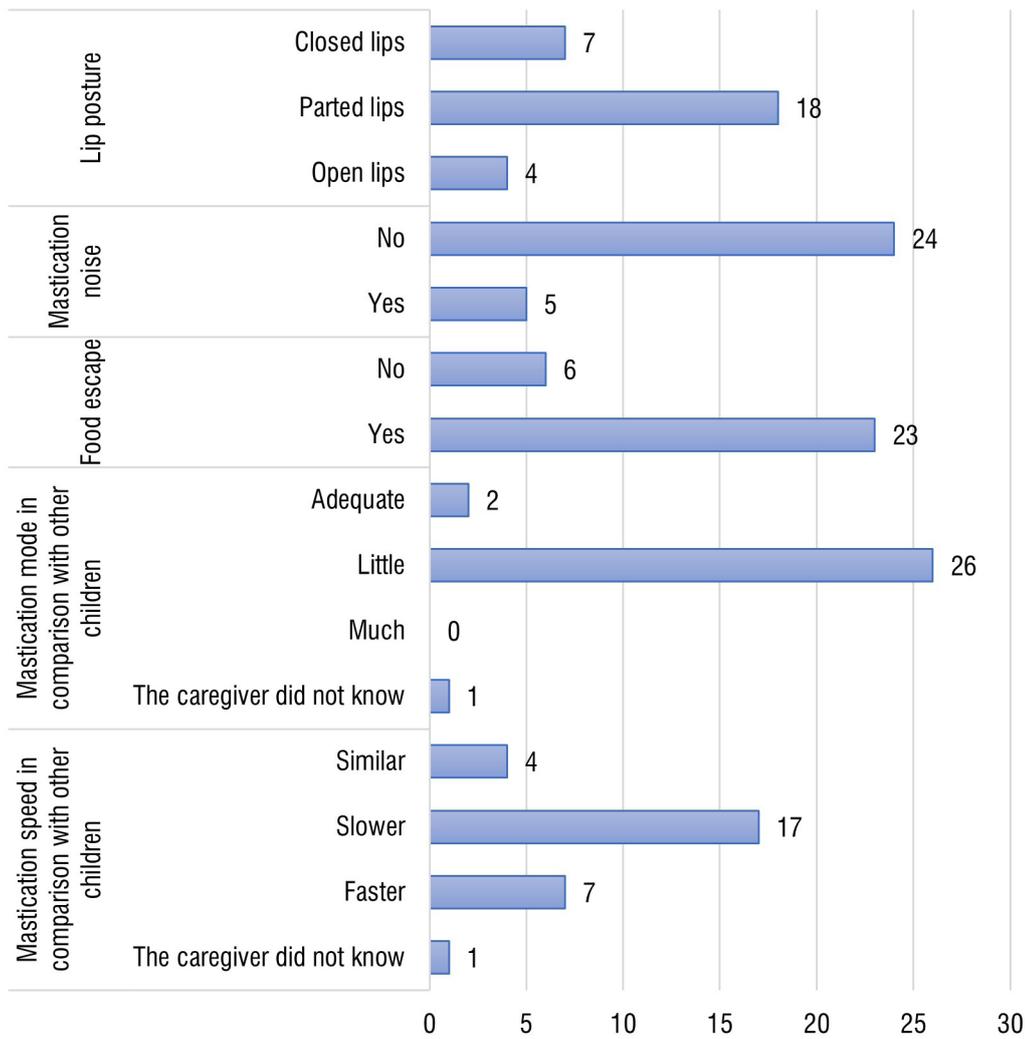
The 19 caregivers who reported using a baby bottle were asked about the type of nipple – 12 (63.14%) reported using a common nipple, six (31.58%) used an orthodontic nipple, and one (5.28%) used a baby spoon bottle. The nipples of all children who used such baby bottles were made of silicone. Those who used common and orthodontic nipples (n = 18) were asked about their holes. Only two (11%) said they did not

change the holes; all other ones (89%) said they need to enlarge the hole to feed the children.

Cups were used by 17 caregivers – 12 of them (70.60%) used common cups, three (17,64%) used sippy cups, one (5.88%) used cups with lids, and one (5.88%) used cups with straws.

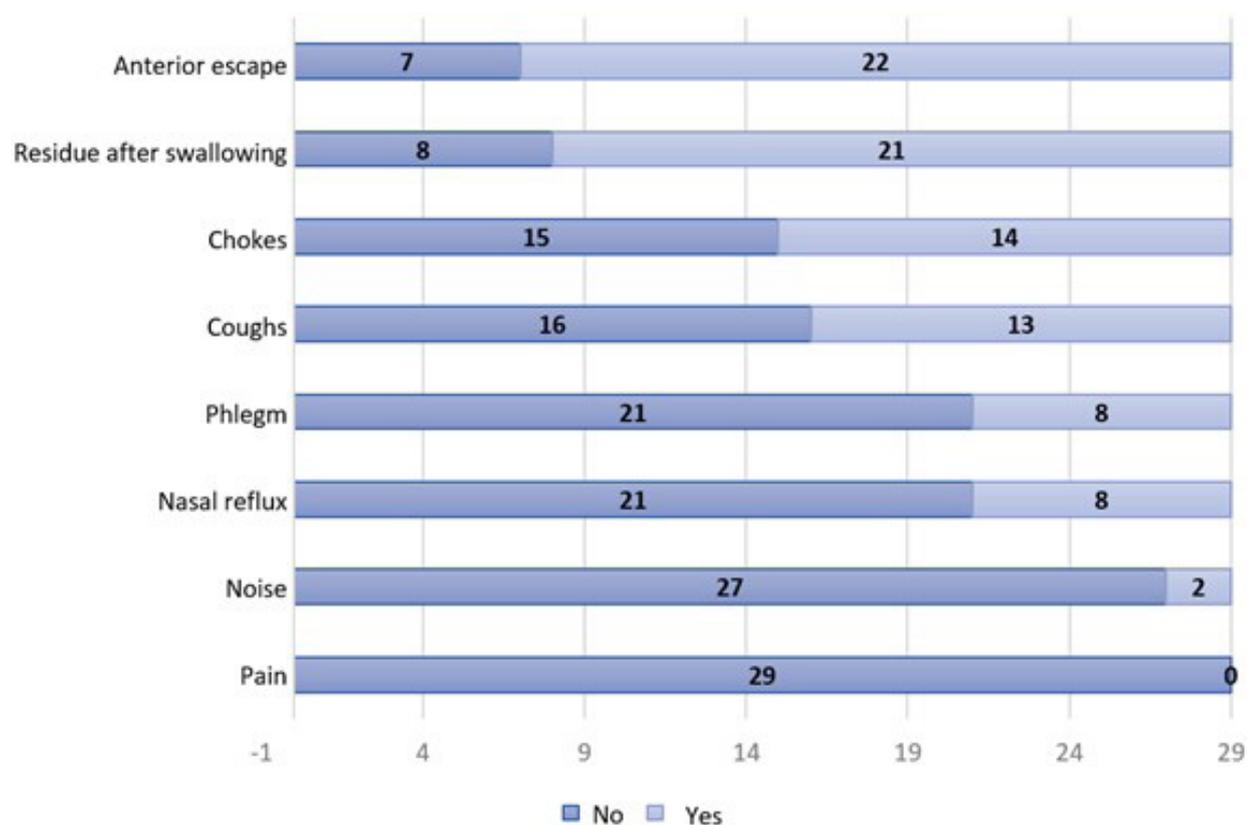
None of the children could eat independently, though four caregivers said the children used the cup independently.

The children's mastication and swallowing are respectively indicated in Figures 4 and 5, according to their caregivers' observations.



Source: Developed by the authors, 2022

Figure 4. Absolute frequency of mastication aspects observed by caregivers (n = 29)



Source: Developed by the authors, 2022

Figure 5. Absolute frequency of the presence (yes) or absence (no) of swallowing aspects (n = 29)

DISCUSSION

In general, the literature points to overloaded emotions and work in the families of children with neurodevelopmental delay⁹. Their routines are transformed by the daily care activities and the time taken in the child's treatment¹⁷. Likewise, most caregivers in this sample (91.18%) dedicated their time to caring for the children, preventing them from having a job.

The caregivers were contacted either at the institutions or via phone calls when indicated by a caregiver who had already been interviewed. The main caregivers were asked to answer the questions, and all of them were from the children's families – mostly their mothers (85.29%). Culturally, women are given the responsibility for household chores and maternal care, especially for children who need greater attention¹⁷.

The research findings indicate feeding difficulties, sometimes requiring alternative feeding routes or adaptations to enable oral feeding.

Parents are always concerned with their children's diet, particularly when the children have changes that might impact such a process. Research shows that parents are unsure of the best way to feed their

children, especially due to swallowing difficulties²⁰. Thus, they refrain from trusting their children to others, for fear that they will not know what to do if they choke, for instance. Therefore, most children in the sample did not go to school. The sample caregivers reported they would not send the children to school because they were afraid that they would not receive due care, especially regarding their nutrition.

Feeding children with microcephaly is known to be potentially difficult from birth. In cases of microcephaly caused by congenital Zika virus infection, such changes seem to be particularly intensified after 3 months old, sometimes requiring an alternative feeding route or adaptations that enable oral feeding^{10,13,14,17,20}.

Alternative feeding routes are indicated to meet nutritional needs when it is not safe to provide food and other elements orally²¹, due to either nutritional or pulmonary risk. The caregivers reported that 13 children (38.20%) needed such feeding routes as early as the first year of life to ensure their nutrition and hydration. Of these, 12 (92.4%) progressed to oral feeding in the first months of life, whereas only one remained with

alternative feeding – gastrostomy – throughout their first year of life.

The first option for babies who can feed orally should be breastfeeding due to its many benefits to the baby, mother, and family^{1,9}. Cases of microcephaly follow the same instruction, as long as the baby is clinically capable of breastfeeding^{3,22}.

Considering the 33 children who were on oral feeding during the first year of life, breastfeeding frequency at birth was of 78.78%. However, the time of exclusive breastfeeding ranged from 3 days to 8 months, and only 26.46% were on exclusive breastfeeding by 6 months old.

The prevalence of exclusive breastfeeding in Brazil is 41%, with significant differences between the five regions of the country. The state where this research was conducted is in the Northeast, whose prevalence of exclusive breastfeeding is below the national average²³.

The sample's breastfeeding frequency was likewise below the national average. Nonetheless, some specific conditions must be considered regarding babies with microcephaly, as they can interfere with their oral feeding performance. For instance, they may have abnormal lip tone, dystonic tongue movements, abnormal pharyngeal sensitivity, increased risk of bronchoaspiration, and severe dysphagia^{3,10,16,17}. Studies also point out that dysphagia can manifest and/or intensify after 3 months old, further justifying their early weaning^{2,16}.

After 6 months old, breast milk alone is not enough to meet the baby's nutritional needs. Hence, food is gradually introduced into the diet as the baby continues breastfeeding¹. This period coincides with functional-anatomical and behavioral changes that enable the development of oral skills²⁴. Motor milestones in this period – e.g., holding their head up, sitting up, taking the hand to the mouth, and so on – are important to the development of the feeding process^{1,25}. When these milestones are not reached, the feeding process may be impaired.

The child's posture is an important aspect to observe as they feed, as an adequate posture is essential to the good functioning of the oral structures. Hence, since overall motor development influences oral motor control²¹, it can be said that the greater the overall motor dysfunction, the greater the oral motor dysfunction, which impairs oral functions^{26,27}.

The data in this research point to changes in overall motor development. Holding the head up was the most observed skill (64.71%), although all caregivers who

reported that the children could hold their up also said they did not do so systematically.

The study also found an increase in the use of alternative feeding as the sample children grew up. Only one child (2.94%) used an alternative feeding route by 1 year old, whereas five (14.71%) used gastrostomy at the time of the interview. Such an increase may be due to neurological damage. The literature indicates that in children with microcephaly due to the Zika virus, oropharyngeal dysphagia intensifies after 3 months old because of neurological cortical and extrapyramidal damage, which impairs organization in the voluntary phase of swallowing^{7,12,18}.

As children grow up and develop, they are expected to receive increasingly consistent food. Thus, babies who were on exclusive liquid diets are gradually introduced to other consistencies (usually pureed³ or mashed) in their complementary diet, progressing to minced foods and then the same consistency of the whole family². However, pureed food predominated in this sample (100%), followed by liquids (89.70%), whereas only 24.14% accepted solid foods – which is not expected for their age.

This sample comprised children with microcephaly, with impaired overall and oral motor development. These deficits interfere with their feeding, affecting bolus uptake, preparation, and conduction^{16,28} – which is why they usually have pureed and liquid consistencies, as they require less from the oral phase of swallowing.

Most caregivers reported that the children masticated less and slower than other ones. Those with neurological changes tend to grind the food with anteroposterior tongue movements and vertical mandible movements, which is rather inefficient^{16,28}. Moreover, the greater the oral motor dysfunction, the longer the meals³.

Since pureed consistencies are more easily manipulated and prepared for swallowing, they are frequently chosen to feed children with neurological changes.

The liquid consistency was also frequently used in this sample. Even though this type of diet does not require bolus preparation for swallowing, it needs attention because it flows more easily, posing a risk to subjects with dysphagia.

Signs such as coughs and chokes when feeding – which were frequently reported in the sample – may indicate changes in the pharyngeal phase of swallowing^{7,8,18}. These findings indicate a risk to swallowing safety, requiring instructions to the families

regarding adequate posture, consistencies, and utensils.

Utensils must be appropriate for the age and made of resistant material². The ones cited in this sample were baby bottles, cups, spoons, and syringes.

According to the Ministry of Health², children older than 6 months should be given liquids in cups. However, baby bottles were very frequently used in this sample, though not expected for their age. Furthermore, caregivers needed to change the nipple hole, enlarging it to give them pureed food.

Other studies also found highly frequent use of baby bottles in children with neurological changes^{4,17}. Pureed foods are particularly served this way, requiring the nipple hole to be changed/enlarged.

Using the cup demands greater mandible control and stability²⁵. Children with neurological deficits have difficulties, such as opening the mouth too much or biting the cup rim²⁵. The research did not identify difficulties using the utensils, but strategies such as using sippy cups and/or straws may be an option to minimize them.

By 4 months old, children are expected to have the oral skills to use a spoon, initially with an oral pattern similar to sucking from a baby bottle, and then by 6 months old, using the upper lip to take the food²⁵. All children in the sample used spoons, although baby bottles are knowingly often used in their stead.

It is important to point out that spoons must be small enough to fit in the child's mouth², placing it comfortably over their tongue, and stimulating the use of the upper lip when removing the spoon²⁵.

Syringes were also used to give them food. This utensil is not considered adequate to feed them because it is harmful to their orofacial development, and it is not safe to handle²⁸.

Lastly, it must be highlighted that the research was based on the caregivers' perception, and the initial nutrition data were retrieved from their memory. Moreover, the children's stomatognathic systems were not assessed. Further research should address these limitations to furnish more information, especially regarding the use of utensils to feed children.

The importance of nutrition to child development and the occurrence of signs suggestive of changes in mastication and swallowing (as described by the caregivers of children with microcephaly) emphasize the need to identify feeding difficulties as soon as possible, enabling adequate diagnosis and treatment to minimize their impacts on child development.

CONCLUSION

The caregivers in the sample, responsible for children with microcephaly, indicated a low prevalence of exclusive breastfeeding by 6 months old, delayed progress in consistencies, the use of uncommon utensils for the age, and necessary adaptations to feed the children, orally.

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MLV: study conception and design, writing review, data collection, analysis, writing original draft;

GASA, LMAL-F, LP: study conception and design, writing review.