

Larissa Vieira Pinto Menezes^{1,2}
Carla Steinberg¹
Ana Caline Nóbrega¹

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Correspondence address:

Larissa Vieira Pinto Menezes
Departamento de Fonoaudiologia,
Universidade Federal da Bahia – UFBA
Alameda Horto Bela Vista,
808, Salvador (BA), Brasil,
CEP: 41098-030.
E-mail: fono.larissa@hotmail.com

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Complementary feeding in infants born prematurely

Alimentação complementar em lactentes nascidos prematuros

ABSTRACT

Purpose: To investigate if there is difficulty in introducing complementary feeding in premature infants. **Methods:** This is an exploratory, cross-sectional study performed in premature infants between six and twenty-four months of gestationally corrected age, using complementary feeding. Thirty-eight infants born prematurely were included. The feeding difficulties presented by the infants were investigated through an objective question followed by the application of a food behavior checklist for the last month. The children's clinical variables were investigated through a medical record review. An interview was conducted with those responsible for the child to identify the sociodemographic aspects and the type of breastfeeding before the corrected six months of age. **Results:** Asked about the general perception, 50% of parents answered that their children did not present feeding difficulties in the last month. However, when a checklist was applied, 73.7% of the parents reported that their children had at least one defensive behavior at mealtime. Refusal to open their mouths (42.1%), food selectivity (28.9%), and feeding refusal (26.3%) were the most frequent defensive behaviors. The food refusal item (44.4%) had a greater association with formula feeding ($p = 0.033$). **Conclusion:** The present study showed an association between the type of breastfeeding and the difficulties in complementary feeding, especially in premature infants with formula feeding, presenting food refusal during meals. We found the presence of different types of defensive behaviors at mealtime in the majority of premature infants investigated.

RESUMO

Objetivo: Investigar se há dificuldade na introdução da alimentação complementar em lactentes prematuros. **Método:** Trata-se de um estudo exploratório e transversal realizado em lactentes prematuros entre seis e vinte e quatro meses de idade corrigida gestacional, com alimentação complementar. Foram incluídas 38 crianças, 23 do gênero feminino e 15 do gênero masculino. As dificuldades de alimentação apresentadas pelos bebês foram investigadas através de uma pergunta objetiva seguida da aplicação de um *checklist* do comportamento alimentar no último mês. As variáveis clínicas das crianças foram investigadas através de uma revisão de registro médico. Uma entrevista foi realizada com os responsáveis pela criança para identificar os aspectos sociodemográficos e o tipo de aleitamento antes dos seis meses de idade corrigidos. **Resultados:** Perguntado sobre a percepção geral, 50% dos pais responderam que seus filhos não apresentaram dificuldades de alimentação no último mês. No entanto, quando o *checklist* foi aplicado, 73,7% dos pais relataram que seus filhos tinham pelo menos um comportamento defensivo durante as refeições. A recusa de abrir a boca (42,1%), a seletividade alimentar (28,9%) e a recusa de alimentação (26,3%) foram os comportamentos defensivos mais frequentes. O item de recusa alimentar (44,4%) teve maior associação com aleitamento artificial ($p = 0,033$). **Conclusão:** O presente estudo mostrou associação entre o tipo de aleitamento materno e as dificuldades na alimentação complementar, especialmente em lactentes prematuros com alimentação de fórmula, apresentando recusa alimentar durante as refeições. Também encontramos a presença de diferentes tipos de comportamentos defensivos na hora da refeição na maioria dos prematuros investigados.

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¹ Departamento de Fonoaudiologia, Universidade Federal da Bahia – UFBA - Salvador (BA), Brasil.

² Maternidade Climério de Oliveira, Universidade Federal da Bahia – UFBA - Salvador (BA), Brasil.

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INTRODUCTION

Preterm or premature infants are part of a large and heterogeneous group of children born before 37 gestational weeks⁽¹⁾. These infants may evolve with ranging deficiencies from the most subtle to the most severe, with important physiological impact. Faced with the immaturity of many organs and systems, they are at a higher risk of morbimortality when compared to children born at term⁽²⁾.

In this sense, prematurity is one of the main causes of infant mortality and morbidity associated with perinatal conditions in Brazil, accounting for 45% of deaths among newborns. The percentage of live newborns with gestation duration of less than 37 weeks showed great variations between the years 2010 and 2011 in the country. The North region leads the profile change with an increase in the rate of prematurity from 5.5% to 10%, followed by the Northeast region, which increased from 6% to 10.5%, and the Central West region from 6.8% to 10%⁽³⁾.

Aiming to support the neuropsychomotor development of the premature infant, exclusive breastfeeding (EBF) is seen as one of the main interventions for the reduction of neonatal mortality, besides being an effective and low-cost method that provides the contact and the strengthening of the link between the mother and the infant. Breast milk is the best choice for the newborn as it provides all the nutrients needed for neonatal growth and development^(4,5).

However, breastfeeding a premature infant is a difficult process due to the unstable conditions and the physiological immaturity of this population. In addition, some conditions influence the initiation and maintenance of EBF in premature infant, such as maternal psychological conditions and inadequate assistance to promote and support breastfeeding by health professionals^(6,7).

Given the importance of breastfeeding (BF), the Ministry of Health recommends maintaining exclusive breastfeeding, whenever possible, until six months of age. From this point on, supplementary feeding should be started, and all infants should receive complementary foods. This feeding should be introduced slowly and gradually, and breastfeeding should be continued until two or more years of age. From five to eight months old, children must receive transitional foods, and by eight months they can receive the food eaten by the family, provided it is adapted (smashed, shredded, chopped or cut). In the first two years of life, adequate complementary food of the breastfed infant is the source of optimal growth and development^(8,9).

This onset of introduction of the child's complementary food will depend on his/her neurological maturity. For premature infants, the corrected age is used as the decision parameter. It is very common to experience difficulties in the transition from breastfeeding to complementary food in children born prematurely, and its determinants are multifactorial. These eating problems in premature infants may be related to the immaturity inherent in their situation and (or) to neurological deficits, neonatal morbidities, or caused by the memory of multiple and unpleasant procedures during the previous periods of hospitalization. In addition to the aspects above mentioned, there may be the involvement of emotional, socioeconomic

factors and the interaction between the child and his/her family, particularly the mother⁽¹⁰⁾.

Therefore, knowledge and deeper appreciation of the "introduction of complementary food" issue, should favor the promotion of adequate infant nutrition, satisfactory child growth and the development of efficient oral functions. Thus, the objective of this study was to investigate if there is difficulty in introducing complementary feeding in premature infants.

METHODS

This is a quantitative and correlate exploratory cross-sectional study with contemporary and historical data approved by the Research Ethics Committee of Climério de Oliveira Maternity under number 1,376,761. The Free and Informed Consent Form was signed by the parents and/or legal guardians of the premature infants participating in the research.

Thirty-eight prematurely born children, that is, born until the last day of the 37th gestational week (259 days or 36 weeks and 6 days) participated in the study. Data collection took place from March 2016 to June 2016, for a convenience sample, in outpatient follow-up clinic for high-risk newborns at the Climério de Oliveira (MCO) and Prof. José Maria de Magalhães Netto (MRJMMN) maternity hospitals, during the routine consultations of each family. Children who had started complementary feeding, aged between 6 and 24 months (gestationally corrected age) were selected for the study.

Children who were assisted by the multiprofessional team in the outpatient follow-up clinic for high-risk newborns at the respective institutions were eligible, they had also begun complementary feeding. Exclusion criteria were: medical diagnosis of neuropathies, syndromes, craniofacial malformations, heart diseases and severe respiratory diseases that prevented them from eating safely, and children who developed oropharyngeal or esophageal dysphagia. Children using the alternative feeding route and whose informants did not participate in their feeding process were not included in the study.

The Protocol of the research data collection of interest, constructed and applied by the researchers, was based on previous studies on the process of premature infant feeding⁽¹⁰⁾ and composed by a structured interview answered by the mothers or their substitutes. Socio-demographic data, type of breastfeeding (maternal breastfeeding, mixed feeding and exclusive formula feeding) until the six-month of corrected age of the premature infant, the existence of parafunctional habits and the occurrence of difficulties in the process of introducing complementary food were investigated. The evaluator was blinded in the questionnaire's topics of the variable of difficulty in introducing complementary food.

The presence of difficulty in the food introduction process was investigated through the mother's perception of defensive behavior of her children during last month meals. Initially, a second evaluator asked an objective question about the presence of difficulty in introducing complementary food, and then applied the checklist of events proposed by the Brazilian Society of Pediatrics⁽¹⁰⁾ that determine difficulty in the feeding process during the child's meals. The checklist consists of nine defensive

behaviors that most commonly occur during the introduction of complementary feeding performed by infants as crying, back arching, refusal to open the mouth, nausea, increasing space, food selectivity, solid food refusal, feeding refusal and difficulties in chewing and swallowing. An affirmative response to any item on the checklist was considered as an indicator of food difficulty presented by the child. For the food refusal item, if the infant presented a refusal at any meal of the day during the last month, it was considered difficulty in the introduction of complementary feeding.

Clinical variables such as gestational age, birth weight, type of delivery, use of ventilatory support, alternative feeding and *Apgar* in the first and fifth minutes were investigated through a medical record review^(11,12).

Descriptive analysis was performed for sociodemographic variables (mean, standard deviation, median and quartiles). To verify the existence of associations between the qualitative variables, the Chi-Square test or Fisher's exact test was applied and, to identify significant differences between the age of the

mother and the type of breastfeeding, ANOVA test was used. The level of significance established for this study was 5%.

RESULTS

The sample consisted of 38 children, 23 (60.5%) were female. Table 1 shows the clinical characteristics related to gestational age, birth weight, type of breastfeeding up to the sixth month of corrected age, parafunctional habits and use of ventilatory support by premature infants. All the children in the sample (N = 38) had alternative feeding and none of the exclusively breastfed infant had any kind of parafunctional habit before the sixth month of gestationally corrected age.

When asked about their general perception, 50% of the parents answered that their children did not present feeding difficulties in the last month. However, when a checklist was applied, 28 (73.7%) parents reported that their children had at least one defensive behavior at meal time. Table 2 presents the percentage of positive responses regarding the occurrence of all investigated defensive behaviors.

Table 1. Distribution of clinical characteristics of premature infants

Variables	N = 38	%
Gestational age		
Extremely premature	2	5.3
Very premature	22	57.9
Moderate premature	14	36.8
Birth weight		
Extremely low weight	2	5.3
Very low weight	22	57.9
Low weight	14	36.8
Type of breastfeeding		
EBF	17	44.7
Formula feeding	9	23.7
Mixed	12	31.6
Parafunctional habits		
Yes	23	60.5
No	15	39.5
Types of parafunctional habits		
Pacifier	2	8.7
Bottle feeding	6	26.1
Pacifier and Bottle feeding	15	65.2
Use of ventilatory support		
Yes	20	52.6
No	18	47.4

Caption: EBF = Exclusive breastfeeding; N = Number of participants

Table 2. Distribution of complementary food difficulties presented by premature infants

Variables	N = 38	%
Crying	3	7.9
Back arching	10	26.3
Refusal to open the mouth	16	42.1
Nausea	7	18.4
Increasing space*	8	21.1
Food selectivity	11	28.9
Solid food refusal	6	15.8
Feeding refusal	10	26.3
Difficulties in chewing and swallowing	8	21.1

*Increasing the space between meals (>40 minutes)

Caption: N = Number of participants

In the present study, Table 3 shows an association between the type of breastfeeding and difficulty in introducing complementary food in premature infants. After the application of the checklist, the food refusal item presented a greater association ($p = 0.033$) with formula feeding, 44.4% of the infants presented this defensive behavior during meals.

From this result, we can observe that formula feeding increases the chances of children presenting complementary food difficulties in 41% compared to exclusive breastfeeding and mixed feeding. Table 4 presents the percentages of chances of presenting feeding difficulty by type of breastfeeding, adjusted for gestational age and birth weight.

Table 3. Distribution of breastfeeding types and complementary food difficulties in premature infants

Variables	Breastfeeding type						p-value
	EBF		Formula		Mixed		
	n	%	n	%	n	%	
Crying							0.589
Yes	2	11.8	1	11.1	-	-	
No	15	88.2	8	88.9	1	100.0	
Back arching							0.461
Yes	6	35.3	1	11.1	3	25.0	
No	11	64.7	8	88.9	9	75.0	
Refusal to open the mouth							1.000
Yes	7	41.2	4	44.4	5	41.7	
No	10	58.8	5	55.6	7	58.3	
Nausea							1.000
Yes	3	17.6	2	22.2	2	16.7	
No	14	82.4	7	77.8	1	83.3	
Increasing space							1.000
Yes	4	23.5	2	22.2	2	16.7	
No	13	76.5	7	77.8	1	83.3	
Food selectivity							0.536
Yes	4	23.5	4	44.4	3	25.0	
No	13	76.5	5	55.6	9	75.0	
Solid food refusal							0.854
Yes	2	11.8	2	22.2	2	16.7	
No	15	88.2	7	77.8	1	83.3	
Feeding refusal							0.033*
Yes	1	5.9	4	44.4	5	41.7	
No	16	94.1	5	55.6	7	58.3	
Difficulty in chewing and swallowing							0.884
Yes	3	17.6	2	22.2	3	25.0	
No	14	82.4	7	77.8	9	75.0	

*Significative values ($p < 0.05$)

Caption: EBF = Exclusive Breastfeeding

Table 4. Distribution of multivariable analysis between the type of breastfeeding and complementary food difficulties in premature infants

Variables	OR ¹	CI 95%	OR ²	CI 95%	OR ³	CI 95%	OR ⁴	CI 95%
Type of breastfeeding								
EBF	1.00		1.00		1.00		1.00	
Formula feeding	1.41	0.27-7.13	0.29	0.26-3.15	0.75	0.12-4.68	0.21	0.02-2.55
Mixed	1.13	0.26-4.94	0.89	0.18-4.36	0.64	0.12-3.37	0.73	0.14-3.91

¹gross; ²adjusted by gestational age; ³adjusted by birth weight; ⁴adjusted by gestational age and birth weight

Caption: OR = Odds ratio; CI = Confidence interval; EBF = Exclusive Breastfeeding

DISCUSSION

In this study, we sought to investigate the difficulties in introducing complementary food in a sample of infants with a history of prematurity between 6 and 24 months of corrected age.

The majority of the cases in the present study was of very premature children with very low weight who presented difficulties in the process of introducing complementary food. In this sense, it was observed that parents whose infant remained in formula feeding reported three or more defensive behaviors presented during meals in the last month, of which refusal to open their mouths, food selectivity, feeding refusal and back arching were more frequently. These difficulties in complementary food during childhood may be multifactorial. Among the factors, we can highlight gestational age and birth weight, rupture of the mother-baby bond due to maternal labor conditions and early exclusive breastfeeding weaning, previous maternal experience and family eating habits⁽¹³⁾. These factors may impact on the children's food acceptance, damaging nutritional and emotional aspects and adequate global development. In addition, difficulties in this complementary feeding process can bring emotional distress to parents, as they know that good nutrition is essential for the health and well-being of their children⁽¹⁴⁾.

Feeding difficulties may persist throughout childhood, manifesting in delayed feeding skill development, food refusal, difficulties weaning, oral motor dysfunction, oral hypersensitivity, and eating behavior problems. A study proposed by Johnson *et al.* showed that infants born very prematurely were at increased risk of oral motor problems and picky eating behaviors at 2 years of age compared with infants born at term⁽¹⁵⁾.

Given this scenario, it was verified that some parents cannot identify these difficulties in the complementary feeding presented by the children during the meals. However, when investigated more specifically, the parents confirm their occurrence. This can be justified by the lack of knowledge of the child's guardians regarding food introduction and defensive behaviors in this process of introducing complementary food. Therefore, in clinical practice, general investigation of feeding difficulty presence in infants may not be sufficient, underestimating its occurrence. It is necessary a more thoroughly research that can help the recognition of these difficulties in the feeding process, thus avoiding nutritional damage in the child's development.

It is noteworthy that, after investigation in the literature for instruments to follow the complementary feeding of premature infants, we did not identify records of studies that used standard protocol. The checklist used in this research, proposed by the Brazilian Society of Pediatrics⁽¹⁰⁾, aimed to help in the diagnosis of feeding difficulties related to the children's behavior during meals and while in the follow-up clinics for the high-risk premature infants. However, it is recommended to carry out prospective studies in order to develop an instrument of validation which can guide professionals and parents in the management of the adequate feeding development of premature infants.

The association observed between the type of breastfeeding and difficulty in complementary feeding, especially in food refusal, as well as increased chance of formula-fed infants to present difficulties in complementary eating in comparison to

other types of breastfeeding (EBF and mixed) suggests that these formula-fed infants are more prone to harmful oral cavity experiences, requiring specialized care and are more susceptible to environmental overstimulation. In addition, they also need prolonged hospitalization, contributing to low maternal milk production or even to disrupt the mother-baby bond which may decrease the chances of establishing a full breastfeeding pattern⁽¹⁶⁾.

Lok *et al.*⁽¹⁷⁾ showed a study whose objective was to examine the effect of breast milk feedings and formula on the growth and short-term outcomes of preterm infants. In a single-center retrospective cohort study, we included 642 preterm infants at gestational age <37 weeks, with birth weights <2200 g. The results suggest that LBW infants fed with breast milk had better growth z-scores and lower small-for-gestational-age status at discharge compared with those preterm predominately fed formula.

A systematic review proposed by Pagliaro⁽¹⁸⁾ sought to analyze publications that investigated feeding difficulties in premature children during the first years of life. It was possible to affirm that premature children, especially those with very low birth weight, are more likely to present feeding problems in the early stages of life and during childhood, when compared to children born at term.

Picky eating is a frequent eating problem in childhood that concerns many parents. In young children, picky eating can contribute to a poor dietary intake and growth status and may have long-term effects⁽¹⁹⁾. Moreover, the eating behavior of early childhood, including food refusal, a common problem for pediatric practitioners, is a topic without clarity. The prevalence rates vary from 13% to 22% or 13% to 50%, depending on the age⁽¹⁹⁻²²⁾.

Long-term eating difficulties are likely to contribute to an unbalanced dietary intake and failure to thrive and are a source of major practical and emotional problems to families. A study proposed by Migraine *et al.*⁽²³⁾ had as aims to determine whether eating behaviors and eating habits at 2 years of corrected age differed between children born preterm and full term and, if so, to identify maternal and neonatal factors that predispose individuals to later alterations of eating behaviors at 2 years of age. As conclusion, preterm children have more eating difficulties than term children do, but after adjustment for maternal and neonatal characteristics, gestational age is not associated with impaired eating behaviors at the age of 2 years.

In order to collect data on the context in which food refusal is inserted, it is important to evaluate the relationship between the family and the child through food habits. Furthermore, there are children who, due to the lack of the mother-baby dyad, do not eat. The relationship that the individual will establish with food throughout all his/her life is fruit of the dynamics of the first experiences he/she created as a baby with the mother, the family and everything that was around. For the baby, feeding is the moment of affective contact and bonding with the mother⁽²⁴⁾.

It is known that few days of separation of the mother-baby dyad are sufficient to interfere negatively with breastfeeding. Mothers need to be guided, among other aspects, to pump breast milk in order to maintain lactation, since anxiety, preoccupation with the baby and the late milk expression can determine lactic insufficiency. Thus, in addition to social and cultural factors,

birth weight, gestational age and prolonged hospitalization may interfere with the breastfeeding process.

The majority of premature infants observed in the present study in exclusive breastfeeding up to six months of gestationally corrected age may be justified by the fact that the hospitals included in the study are recognized by their Baby-Friendly Hospital Initiative (BFHI). Changes in hospital practices, based on the BFHI's "Ten Steps to Successful Breastfeeding", have shown a prevalence increase of breastfeeding in these units. Studies pointed out favorable impacts in hospitals that have adhered to the BFHI steps, with a consequent increase in the prevalence rates of EBF^(25,26). Besides that, a strategy created specifically for premature infant with low birth weight is the Kangaroo Method⁽²⁷⁾. Such care has as one of the focuses the incentive to the BF, and has been configured widely viable, since the skin-to-skin contact stimulates the milk production, favors the affective bond and diminishes the periods without sensorial stimulation.

Thus, knowledge of breastfeeding rates is important for public policies making and implementation of actions in health services and communities. In the field of maternal and child health, the incentive to breastfeeding is one of the main actions for primary care professionals. To improve the BF rates, it is necessary the mothers' adequate learning with active participation of health professionals, providing timely guidance and support for pregnant women and infants⁽²⁸⁾.

Freitas et al.⁽²⁹⁾ showed data from a retrospective cohort of premature infants followed from 2010-2015 in the municipality of Viçosa, Minas Gerais. The rates of breastfeeding were higher than those of infants born at term in Brazil. In premature infants less than 37 weeks old, the median duration of breastfeeding was five months, the risk of discontinuing breastfeeding of children younger than 32 weeks was 2.6 greater. In premature infants on mixed feeding at the first consultation after hospital discharge, the risk was three times greater for discontinuation breastfeeding compared to exclusive breastfeeding at that time. These good indicators of breastfeeding are reflections of an integration of tertiary care with primary care in the municipality.

Despite several studies that have demonstrated the importance and benefits of exclusive breastfeeding up to six months of age in premature infants, the strong marketing of the food industry still shows great impact worldwide on it through advertisements on TV and internet, free distribution of infant formulas, financing of scientific events, among others. Thus, investments in supervising and monitoring adherence to the standard are required, besides to the professionals working in the field of neonatology to encourage the EBF since the presence of the premature infant in a neonatal intensive care unit (NICU)⁽³⁰⁾.

Although the limitations related to sample size, which does not allow generalization of conclusions, this study makes clear the need to develop more extensive research aimed at establishing specific guidelines on appropriate complementary feeding practices for premature infants, to be used by both mothers/caregivers and health professionals.

CONCLUSION

As a conclusion, the findings of the present study showed the presence of different types of defensive behaviors in premature infants during meals. However, the eating difficulties are often not identified by the child's parents. We also found an association between the type of breastfeeding and the difficulties in complementary feeding, especially in formula-fed premature infants, with food refusal during meals.

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Author contributions

LVP participated in the idealization of the study, data collection, analysis and interpretation, and article writing; *CS* participated in the idealization of the study and data collection; *ACN* participated, as guide, in the idealization of the study, analysis, interpretation of data, and writing of the article.