

# Feeding transition time and feeding method at hospital discharge of preterm infants with bronchopulmonary dysplasia

## Tempo de transição alimentar e método de alimentação na alta hospitalar de prematuros com displasia broncopulmonar

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### ABSTRACT

**Purpose:** To compare the time of food transition and the form of oral feeding at hospital discharge, between premature newborns diagnosed with bronchopulmonary dysplasia and premature newborns without the diagnosis. **Methods:** Cross-sectional, retrospective study based on data collection from medical records. Data were collected from 78 newborns, in a reference maternity hospital, in which the sample was stratified into two groups according to the presence or absence of the diagnosis of bronchopulmonary dysplasia. The time of food transition and the feeding method at hospital discharge were analyzed for both groups. **Results:** There was a significant difference in the time of food transition and in the feeding method at hospital discharge between the groups. Preterm newborns with bronchopulmonary dysplasia had an average of 18.03 ( $\pm$  5.5) transition days and left using a bottle. **Conclusion:** The group with bronchopulmonary dysplasia required a longer time of food transition and fewer ( of its ) infants had exclusive breastfeeding compared to the group without the diagnosis.

**Keywords:** Premature newborn; Bronchopulmonary dysplasia; Breast feeding; Eating behavior; Feeding methods

### RESUMO

**Objetivo:** Comparar o tempo de transição alimentar e a forma de alimentação por via oral na alta hospitalar, entre recém-nascidos prematuros com diagnóstico de displasia broncopulmonar e prematuros sem o diagnóstico. **Métodos:** Estudo transversal, retrospectivo com base na coleta de dados nos prontuários. Foram coletados dados de 78 recém-nascidos, em uma maternidade de referência. A amostra foi estratificada em dois grupos, de acordo com a presença do diagnóstico de displasia broncopulmonar, sendo um grupo de prematuros com displasia broncopulmonar e outro sem. Foram analisados o tempo de transição alimentar e o método de alimentação na alta hospitalar de ambos os grupos. **Resultados:** Houve diferença significativa no tempo de transição alimentar e no método de alimentação na alta hospitalar entre os grupos. Os recém-nascidos pré-termo com displasia broncopulmonar apresentaram média de 18,03 ( $\pm$  5,5) dias de transição e saíram em uso de mamadeira. **Conclusão:** O grupo com displasia broncopulmonar necessitou de maior tempo de transição alimentar e teve menor frequência de aleitamento materno exclusivo, em relação ao grupo sem o diagnóstico.

**Palavras-chave:** Recém-nascido prematuro; Displasia broncopulmonar; Aleitamento materno; Comportamento alimentar; Métodos de alimentação

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## INTRODUCTION

Premature birth may have short and long-term consequences for the child's growth and development<sup>(1)</sup>. Premature delivery can trigger respiratory difficulties<sup>(2)</sup> and impair their feeding, due to difficulties in the child's overall organization to remain alert. Moreover, their signs of readiness and oral reflexes may be abnormal<sup>(3)</sup>.

Bronchopulmonary dysplasia (BPD) is a frequently found respiratory difficulty sequelae, particularly in surviving preterm newborns (PTNB) with a gestational age under 32 weeks<sup>(4)</sup>. Also, acute pulmonary injuries, surfactant deficiency, and inflammations in intrauterine development commonly pose risks of BPD after birth. Pulmonary injuries interrupt alveolarization and microvascular development; consequently, the alveolar surface area is lost, affecting the person throughout their life<sup>(5)</sup>.

Thus, PTNB with BPD often have feeding difficulties in their transition from alternative to oral feeding. In combination with the immature airways, they cause a variable degree of respiratory insufficiency, leading to low suction resistance, irregular breathing, and prolonged apnea while swallowing. They also have short low-pressure suction periods with frequent pauses to breathe, causing chokes and/or bronchoaspiration<sup>(6)</sup>. These changes may negatively impact the sucking/swallowing/breathing coordination in the oral pattern<sup>(6,7)</sup> and decrease the awareness level<sup>(7)</sup>.

The use of mechanical ventilation slows and delays the feeding transition<sup>(8)</sup>. Therefore, the team must seek safe, effective, and early transition in BPD patients to diminish their length of hospital stay and stimulate breastfeeding whenever possible<sup>(9)</sup>.

Oral breastfeeding is essential to promote oral motor development and establish correct stomatognathic functions<sup>(10)</sup>. Moreover, mothers must be encouraged to breastfeed during their infants' hospitalization, maintaining breast milk production, increasing motivation and successful breastfeeding after hospital discharge, and avoiding early weaning<sup>(10)</sup>.

Given the above, PTNBs with BPD are believed to need more time to transition to oral feeding and mostly feed through exclusive breastfeeding at hospital discharge, thanks to interdisciplinary breastfeeding care at the maternity hospital. Thus, this study aimed to compare the feeding transition time and the type of oral feeding at hospital discharge between PTNB with and without BPD diagnosis.

## METHODS

This retrospective cross-sectional study was based on data collected from medical records. It was approved by the Research Ethics Committee of the Universidade Federal do Rio Grande do Norte (CEP/UFRN) under evaluation report no. 3.311.874. Data were collected at the Januário Cicco Teaching Maternity, in Natal, RN, Brazil, between August 2019 and September 2020. All parents/guardians agreed to participate in the research and signed an informed consent form.

Altogether, 78 PTNB's medical records were analyzed, collecting data on their sex; birth weight; gestational age; total number of days in feeding transition; oral feeding method at hospital discharge; and presence of BPD diagnosis.

The oral feeding methods were observed to be exclusive breastfeeding, combined breastfeeding and complementary food, and baby bottles. These are the methods routinely used at the maternity's Kangaroo Intermediate Care Unit, preferably encouraging breastfeeding. The exclusion criteria for this research were as follows: infants with a 5-minute Apgar score (appearance, pulse, grimace, activity, respiration) lower than 7, diagnosed with degree III or IV intracranial hemorrhage, and craniofacial malformations and syndromes.

The feeding transition time was counted in the number of days from when the PTNB began oral feeding until they were able to orally take the whole daily diet volume. Feeding transition in the said unit begins when the newborn is clinically stable (based on the maintenance of vital signs) and shows signs of readiness to begin feeding<sup>(11,12)</sup>, regardless of the PTNB's gestational age. Then, the speech-language-hearing therapist begins oral training, and the infant receives part of the breast milk orally and the rest through an enteral usually nasogastric tube. All PTNBs in the sample transitioned to breastfeeding with the tube/breast method.

The sample was divided into two groups based on BPD diagnosis – one group had PTNBs with BPD and the other, without BPD. This diagnosis considered the parameters established by the institution's neonatology team, following previously proposed criteria<sup>(13)</sup>. Hence PTNBs were diagnosed with BPD when they needed supplementary oxygen for at least 28 days after birth, with less than 36 weeks of gestational age, and radiologic confirmation of parenchymal lung disease. The pathology may be classified in three degrees of severity, according to the need for ventilatory support. The present study was based on the radiologic findings after prolonged ventilatory support.

All PTNBs were followed up in neonatal care by experienced speech-language-hearing therapists, who work specifically to favor an adequate transition from enteral to full oral feeding, preferably encouraging breastfeeding.

Data were analyzed in the Statistical Package for the Social Sciences (SPSS), version 20.0.0. Descriptive statistics presented the distribution of variables in frequencies, percentages, means, and standard deviations. The normal distribution was verified with the Kolmogorov-Smirnov test, and the Student's t-test was used to compare the feeding transition time in days between the groups. The occurrence of oral feeding methods (baby bottle, food supplement, and exclusive breastfeeding) at hospital discharge was compared with Pearson's chi-square test for categorical variables. The statistical significance was set at  $p < 0.05$ .

## RESULTS

The sample had 78 PTNB, mostly males (53.8%), classified with a mean "very low birth weight" (1,332.76 g). Table 1 presents information on the general characterization of the sample regarding their sex, gestational age, and birth weight.

The sample was divided into two groups, one with and the other without BPD diagnosis. The data analysis showed a mean statistically significant difference ( $p < 0.001$ ) between gestational age and birth weight between the groups, but not between the presence of the pathology and the infant's sex ( $p = 0.572$ ) (Table 2).

There was a significant difference in feeding transition time between the groups ( $p < 0.001$ ). The group with BPD needed more days on average to transition from alternative to full oral feeding. Also, female infants needed a mean of 19.9 ( $\pm 4.8$ ) days, whereas male infants needed 16.6 ( $\pm 5.6$ ) days (Table 2).

Altogether, 78.7% (26) of the group with BPD and 73.3% (33) of the group without BPD needed speech-language-hearing therapy at the admission to the unit, before the feeding transition. There was also a statistically significant difference in the feeding method at the hospital discharge between the

groups – exclusive breastfeeding occurred less often in the group with BPD than in the one without BPD ( $p = 0.002$ ) (Table 3).

## DISCUSSION

This study demonstrated a statistically significant difference in the feeding transition time and feeding method at hospital discharge between PTNBs with and without BPD, even though the speech-language-hearing therapists used the same method to stimulate both groups to transition.

The literature<sup>(14)</sup> indicates that BPD diagnosis is more related to males, which agrees with data found in this study, as 57% of the sample were males. On the other hand, the same study<sup>(14)</sup> reports that female PTNB with BPD transitioned to exclusive oral feeding earlier, whereas the findings in the present study show that girls took a mean of 19.9 days to transition from tube to oral feeding, and boys took approximately 16.6 days – hence, females had a longer feeding transition.

In their first days of life, newborns on exclusive breastfeeding normally lose weight, in which a loss of up to 10% of the birth weight is considered acceptable<sup>(14)</sup>. However, posterior weight gain is indicative of adequate breastfeeding and posterior PTNB's hospital discharge<sup>(8)</sup>. The group with BPD had extremely low birth weight infants ( $< 1,000$  g) – which is one of the causes that lead to a BPD diagnosis<sup>(4)</sup>. The present study could not

**Table 1.** Characterization of the sample according to sex, gestational age, and birth weight

Variables	N	
Sex (%)		
Females	36	46.1%
Males	42	53.8%
At birth*		
Gestational age (weeks)	78	30.40 ( $\pm 3.54$ )
Weight (grams)	78	1,332.76 ( $\pm 446.95$ )

\*Values in means and standard deviations

Subtitle: N (%) = Absolute frequency

**Table 2.** Comparison of sex, gestational age, birth weight, and feeding transition time between the groups with and without bronchopulmonary dysplasia

Variables	Groups		p-value
	With BPD (N = 33)	Without BPD (N = 45)	
Sex N (%)			
Females	14 (42%)	22 (49%)	0.572 <sup>PC</sup>
Males	19 (58%)	23 (51%)	0.572 <sup>PC</sup>
Gestational age (weeks)*	27.42 ( $\pm 2.7$ )	32.58 ( $\pm 2.2$ )	$< 0.001$ <sup>ST</sup>
Birth weight (grams)*	997.27 ( $\pm 379.92$ )	1578.78 ( $\pm 313.53$ )	$< 0.001$ <sup>ST</sup>
Feeding transition (days)*	18.03 ( $\pm 5.5$ )	9.96 ( $\pm 5.8$ )	$< 0.001$ <sup>ST</sup>

\*Values in means and standard deviations; <sup>ST</sup>Student's t-test; <sup>PC</sup>Pearson's chi-square test; the normality between the groups was verified with the Kolmogorov-Smirnov test

Subtitle: N (%) = Absolute frequency; BPD = Bronchopulmonary dysplasia

**Table 3.** Comparison of oral feeding methods at hospital discharge between the groups with and without bronchopulmonary dysplasia

Variables	Groups		p-value
	With BPD (N = 33)	Without BPD (N = 45)	
Feeding method N (%)			
Exclusive breastfeeding	11 (33.3)	29 (64.4)	0.002 <sup>ST</sup>
Complementary food	10 (30.3)	13 (28.9)	0.002 <sup>ST</sup>
Baby bottle	12 (36.4)	3 (6.7)	0.002 <sup>ST</sup>

<sup>ST</sup>Student's t-test

Subtitle: N (%) = Absolute frequency; BPD = Bronchopulmonary dysplasia

compare birth weight with the feeding transition time, but a previous one did not find significant correlations between these two variables<sup>(6)</sup>. The pathology negatively influences the acquisition of oral skills, worsening feeding performance<sup>(9)</sup>.

The division of the sample showed a greater occurrence of BPD in PTNB whose gestational age was under 28 weeks. This agrees with a cohort study<sup>(14)</sup> that found that PTNBs with a gestational age of 27 or fewer weeks were at greater risk of being diagnosed with BPD and other pediatric morbidities. It is believed that the prolonged use of invasive oral stimulation, mechanical ventilation equipment, and enteral feeding can deprive newborns of oral motor development due to the lack of efficient oral stimulation to ensure a good and timely feeding transition. The newborn's expected growth and development must be followed up frequently and constantly according to anthropometric standards to verify growth deviations during the transition, respecting the health service's routine<sup>(15)</sup>.

PTNB's feeding transition in the group with BPD took practically twice as many days as in the group without the pathology. These results are similar to those in a previous study<sup>(7)</sup>, which researched the feeding transition time in PTNBs with BPD and found a mean of 18.22 days. Another study<sup>(16)</sup> also researched the feeding transition time but with a different stimulation technique, the semi-demanded method, and found a mean of 12.3 days. Hence, data suggest a consensus that PTNBs with BPD have longer feeding transitions than those without the pathology, although there is still little evidence and a variety of methods in the literature. Data in the present study also show discrepant differences in this population's feeding methods at hospital discharge, as only 33.3% of PTNBs with BPD left the maternity on exclusive breastfeeding, in contrast with previously published results, which indicated a greater frequency of exclusive breastfeeding at hospital discharge.

Thus, the results confirm the need for further questioning and clinical trial studies with methodological rigor to demonstrate what is the best oral stimulation technique for this population's timely feeding transition, so infants can leave the maternity hospital breastfeeding – as the feeding transition time and the feeding method were different using the tube-breast and the semi-demanded techniques<sup>(7,16)</sup>. As the maternity in question is accredited by the Baby Friendly Hospital Initiative, the speech-language-hearing clinical practice preferably encourages breastfeeding. Hence, oral stimulation strategies are commonly used, and food is introduced with the tube-breast technique to help stimulate the PTNB's feeding readiness and oral skills. The tube-breast technique, used in the service where this study was conducted, helps introduce feeding as physiologically as possible, conveniently helping them learn to suck, and stimulating breastfeeding.

Knowingly, the coordination between sucking, swallowing, and breathing in PTNBs with BPD tends to be disorganized because they take longer breathing pauses when feeding to compensate for the low respiratory reserve<sup>(17)</sup>. Hence, their transition to oral feeding is expected to take longer due to the countless respiratory complications and chronic respiratory discomfort at the beginning of the feeding process, which is characteristic of this population, hindering their weaning from the alternative feeding route. Clinical complications, such as the need for orotracheal intubation and continuous positive airway pressure (CPAP) influence their transition time from alternative to oral feeding<sup>(8)</sup>.

PTNBs with BPD were the fewest on breastfeeding at hospital discharge and, consequently, had a higher frequency

of baby bottle use – which, however, negatively influences the newborn's breastfeeding as it increases the odds of milk aspiration. This is probably due to the low intraoral pressure and increased liquid flow from the baby bottle into the oral cavity<sup>(7,9)</sup>. The great volume to be ingested probably causes disorganization, discomfort, and the risk of aspiration in PTNBs with respiratory complications.

The literature lacks studies correlating baby bottle use with increased feeding transition time in PTNBs with BPD, though it is a fact that the milk flow can influence feeding performance<sup>(7,17)</sup>. Baby bottles' physical characteristics must be considered to reduce flow. Some strategies can be used in standard ones to decrease the milk flow, such as diminishing the volume contained in it, holding it level with the mother's nipple, and feeding the infant half-seated, which can facilitate the coordination between sucking, swallowing, and breathing<sup>(18)</sup>. It is important to highlight that using artificial nipples contributes to early weaning, increases the activity of the buccinator muscle, and reduces that of the masseter muscle, compromising the development of stomatognathic functions<sup>(19)</sup>.

Therefore, complementary food must only be given to newborns based on rigid norms and in specific cases<sup>(3,7,16)</sup>. Nevertheless, this study found that some infants were discharged from the hospital taking complementary food and baby bottles, probably because the mother could not breastfeed or to complement insufficient milk production, as children in this development phase need greater calorie intake to help them gain weight. Exclusive breastfeeding has countless benefits and contributes to the proper development of the newborn's stomatognathic functions<sup>(10)</sup>. The concentration of immunoglobulins, lactoferrin, lysozyme, and antibodies against nosocomial pathogens is five times greater in PTNBs' mothers' milk<sup>(3)</sup>.

Studies<sup>(20,21)</sup> show that BPD impairs the child's pulmonary structure, possibly compromising and decreasing its functioning over time, and increasing the risks of respiratory symptoms in adulthood. Hence, these children must be followed up by a multiprofessional team after hospital discharge to detect early any changes that may impair their pulmonary and neuromotor development, minimizing future sequelae.

As a limitation of the study, it did not research the PTNBs' weight after the feeding transition or the reasons why the team indicated complementary food. Furthermore, prospective studies are needed to understand the long-term influence and progress of BPD, helping the team's procedure, and providing better care to this population. This study helped understand differences in the feeding transition time and feeding methods at hospital discharge between infants with and without BPD, using the tube-breast technique. Nonetheless, other methodological approaches should be used to distinguish the effects of current techniques that aim to minimize morbidity and mortality and contribute to an efficient feeding transition, without health risks to PTNBs diagnosed with BPD.

## CONCLUSION

The transition time from enteral to full oral feeding in the group of PTNBs diagnosed with BPD was significantly longer than in those without this diagnosis. The feeding method at hospital discharge was significantly different in the group with BPD, which used baby bottles more often than the other group.

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