DOI: 10.1590/2317-1782/20162015115

Original Article

Artigo Original

Assessment for oral feeding in preterm infants

Avaliação para o início da alimentação oral de recém-nascidos pré-termo

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Keywords

Sucking Behavior
Preterm Infant
Feeding
Evaluation
Feeding Behavior

ABSTRACT

Purpose: To assess the accuracy of the Preterm Oral Feeding Readiness Scale (POFRAS) on the beginning of oral feeding in preterm infants and to verify the concordance between this tool and the Oral Feeding Skill Level. **Methods:** 82 preterm infants were assessed by POFRAS regarding their readiness to initiate oral feeding and by the oral feeding skill level evaluation during the first oral feeding. POFRAS's accuracy was estimated regarding proficiency by a Receiver Operating Characteristics (ROC) curve. The concordance between the tools was obtained by analysis of the Kappa coefficient. **Results:** POFRAS's global accuracy was of 71.29%. The cut-off value of 29 was the one that presented most optimization of the sensitivity based on specificity. The Kappa coefficient has shown a weak concordance between the instruments to identify infants able and unable to oral feeding (k=0.281). **Conclusion:** POFRAS's accuracy to initiate oral feeding considering the proficiency was similar to that obtained with the technique of translactation. We observed a weak concordance between the instruments. We suggest that, in clinical practice, both instruments should be used in a complementary manner, since both present important aspects of the preterm feeding behavior that together will better guide the necessary conduct to provide an effective and quick transition to full oral feeding in this population.

Descritores

Comportamento de Sucção
Recém-nascido Pré-termo
Alimentação
Avaliação
Comportamento Alimentar

RESUMO

Objetivo: avaliar a acurácia do *Preterm Oral Feeding Readiness Scale* - POFRAS para iniciar a alimentação oral de recém-nascidos pré-termo e verificar a concordância entre este instrumento e o instrumento de avaliação do Nível de Habilidade Oral. **Métodos:** foram avaliados 82 recém-nascidos pré-termo quanto à prontidão para o início da alimentação oral por meio do POFRAS e da avaliação do Nível de Habilidade Oral, durante a primeira alimentação oral. A acurácia do POFRAS foi estimada em relação à variável proficiência, através da Curva ROC (*Receiver Operating Characteristic Curve*). Para a análise da concordância entre os instrumentos, foi utilizado o coeficiente Kappa. **Resultados:** a acurácia global do POFRAS foi de 71,29%. O ponto de corte 29 foi o que apresentou melhor equilíbrio entre sensibilidade e especificidade. O coeficiente Kappa mostrou fraca concordância entre os instrumentos na identificação dos RN aptos e inaptos a mamar por via oral (k=0.281). **Conclusão:** a acurácia do POFRAS para o início da alimentação oral, estimada por meio da variável proficiência, foi semelhante à obtida com a técnica de translactação. Observou-se fraca concordância entre os instrumentos avaliados. Sugere-se, portanto, que estes instrumentos de avaliação sejam usados de forma complementar na prática clínica, uma vez que ambos apresentam aspectos importantes do comportamento alimentar do prematuro, que ao serem analisados conjuntamente permitirão orientar a conduta necessária para propiciar uma transição alimentar mais breve e eficaz para essa população.

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Received: December 06, 2014

Accepted: August 26, 2015

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Financial support: none.

Conflict of interests: nothing to declare.

INTRODUCTION

The transition from gastric to oral feeding is an important aspect to be considered on the assistance to the preterm infant[1-3]. A quick and efficient promotion of this transition is one of the main goals of the speech-language pathologist in the neonatal field[4,5].

Determining the adequate moment to initiate oral feeding in preterm infants is a difficult task, and parameters such as corrected gestational age and clinical conditions must be taken into account[6]. Nevertheless, these parameters are not sufficient to safely initiate oral feeding, what justifies the existence of several protocols for assessing the oral feeding skills of preterm infants[7-12].

The questions arise as whether these tools are satisfactory, since most of them are based on observations of behavioral and sensory aspects[13], which bring some degree of subjectivity to the results.

In Brazil, a frequently used protocol for assessing the readiness of the preterm infant to initiate oral feeding is the one proposed and validated by Fujinaga et al.[9], named Preterm Oral Feeding Readiness Scale (POFRAS). This tool consists in assessing aspects of physiology, behavior, and nonnutritive sucking for establishing the preterm infant readiness to feed orally. The accuracy of POFRAS was assessed by the authors[14], who employed translactation to compare the results obtained by this method with a gold standard represented by the intake of 5 mL of milk.

Videofluoroscopy is undeniably considered the gold standard in the study of swallowing. However, factors such as high cost and exposure to radiation hinder the use of this technique as part of the routine evaluation of oral feeding ability in preterm infants. Studies show that an appropriate quantitative indicator to assess the ability of preterm infants to feed orally is the proficiency parameter – defined by the percentual fraction of the volume prescribed ingested in the first five minutes of feeding[11]. By assessing only the first five minutes, this parameter allows a differentiation between the infant's oral ability and the adversities caused by the fatigue experienced with the lengthening of the feeding time[15-17]. A level of proficiency higher than 30% is associated with an adequate ability to feed orally[11,15-18].

Based on the aforementioned evidence, we felt the need to reproduce the analysis regarding the accuracy of POFRAS considering the proficiency of the first oral feeding as the gold standard, since this parameter is more reliable than the one originally employed[14].

The proficiency and the rate of milk transfer are the aspects considered in the evaluation of the level of oral feeding skills[11]. This instrument aims to analyze, in an objective manner (quantitatively), the oral feeding ability in preterm infants. This method was tested in a population of Brazilian preterm infants and the results endorsed its applicability as an objective indicator to assess their oral feeding skills[17]. It was observed that a higher level of feeding skills is associated with a better feeding performance, and consequently a shorter time of hospitalization.

The two protocols afore discussed are designed to determine the premature capacity for oral feeding, but their evaluation is based on different aspects. Taking that into account, this study aimed to evaluate the accuracy of POFRAS to initiate oral feeding in preterm infants and to verify its agreement with the assessment of the level of oral feeding skills.

METHODS

This transversal and analytical study was developed in the Neonatal Intensive Care Unit of a university hospital. The research project was approved by the institution Ethics Committee under the protocol number 11155312.7.0000.5346. Written parental consent was obtained for all participating infants.

Preterm infants who presented clinical stability and medical prescription to initiate oral feeding were included in the sample. Infants that presented at least one of the following conditions were excluded from the study: head, neck or cardiac malformations, genetic syndromes, grade III or IV intracranial hemorrhage, history of perinatal asphyxia, diagnosis of bilirubin encephalopathy, and bronchopulmonary dysplasia.

The study included 82 preterm infants, 43 male and 39 female, with average weight at birth of 1,821(±527) grams and gestational age of 33(±6.22) weeks. Regarding the intrauterine growth, 71.97% of the sample was classified as appropriate for gestational age, 24.39% as small for gestational age and 3.66% as large for gestational age.

The speech therapist assessments were performed as soon as the infants had medical prescription for oral feeding. At the time of evaluation, the preterm infants had an average gestational age corrected of 35(±1.33) weeks and weight of 1921(±372) grams.

The assessment of the infant's oral feeding readiness, through POFRAS, was performed 15 minutes before the estimated time of first oral feeding. This evaluation was conducted with the infants in lateral decubitus position, with upper and lower limbs flexed and head aligned with the spine. The aspects assessed contemplated the state of behavioral organization (state of consciousness, posture and global tonus); oral posture (lips and tongue); oral reflexes (rooting, sucking, biting and vomiting); and nonnutritive sucking (tongue movement and cupping, jaw movement, sucking strain, sucking/pause, maintenance of sucking/pause and of alert state, and signs of stress); besides the corrected gestational age of preterm infants. A score ranging from 0 to 2 was attributed to each item of the protocol. The performance of the infant was determined by the sum of the scores obtained, which could vary from zero to 36.

Subsequently, the level of oral feeding skills was evaluated during the first oral feeding. The procedure was carried out with the infants in supine position, with their head on midline position and at 45º.

The feeding assessment started at the introduction of the nipple of the bottle into the infant's mouth and lasted for a maximum of 20 minutes. The process could be interrupted upon the examiner's judgment in case of signs of fatigue or stress. The following parameters were observed: total volume of milk prescribed; volume of milk accepted during the feeding;

volume of milk accepted during the first 5 minutes of feeding; and duration of the oral feeding. This information enabled the calculation of the proficiency (percentage of the volume ingested in the first 5 minutes in relation to the volume prescribed) and of the rate of milk transfer (volume of milk accepted per minute). The proficiency (PRO) is monitored when the element of tiredness is minimum, and therefore irrelevant, representing an adequate index of the capacity or skill of the preterm infant to feed itself orally. The rate of milk transfer (RT), on the other hand, is monitored during the entire feeding process, representing an index of resistance to feeding. The level of oral feeding skills was rated from 1 to 4[11]: Level 1: PRO < 30% and RT < 1.5 mL/min (low oral feeding skill and low resistance to feeding – high fatigue); Level 2 = PRO < 30% and RT > 1.5 mL/min (low oral feeding skill and high resistance – low fatigue); Level 3 = PRO ≥ 30% and RT < 1.5 mL/min (high oral feeding skill and low resistance – high fatigue); Level 4 = PRO ≥ 30% and RT ≥ 1.5 mL/min (high oral feeding skill and high resistance – low fatigue).

To address the first purpose of this study, we determined the overall accuracy, sensitivity and specificity of POFRAS using the Receiver Operating Characteristics (ROC) curve approach. The ROC shows the full spectrum of sensitivity and specificity of a test for each cut-off point to discriminate between two different health states[18]. Tests are classified according to their accuracy by the area under the curve, as follows: low accuracy, if the area varies from 0.5 to 0.7; moderate accuracy, from 0.71 to 0.9; and high accuracy, when above 0.9[19].

The proficiency obtained in the first oral feeding was considered a gold standard to estimate global accuracy, specificity and sensitivity of POFRAS with bottle. A proficiency equal or superior to 30% corresponds to an adequate oral skill, while any value inferior to 30% corresponds to a low oral skill[11,15,16,20]. Following, the study proceeded to the construction of the ROC curve using the Stata 10 software.

To address our second goal, i.e., to verify whether there is a concordance between the two assessment instruments, the results were dichotomized in "able to feed" or "unable to feed". To be considered able to feed by POFRAS, infants should reach a score ≥ 29, while by the assessment of level of oral feeding skills, they should be classified as level 4, i.e. proficiency ≥ 30% and rate of milk transfer > 1.5 mL/min.

The data obtained with both instruments were subjected to statistical analysis using Kappa coefficient in order to analyze the concordance between them. The values of the Kappa coefficient were interpreted as: poor concordance (k < 0), slight concordance (k = 0-0.20), weak concordance (k = 0.21-0.40), moderate concordance (k = 0.41-0.60), substantial concordance (k = 0.60-0.80), and excellent concordance (k > 0.80)[21].

RESULTS

The area under the ROC curve (global accuracy) was of 71.29% (Figure 1), indicating that POFRAS is moderately capable[19] of evaluating the infant's readiness to initiate oral feeding, when considering the proficiency obtained on the first feeding. The cut-off value of 29 was the one that presented greatest balance between sensitivity and specificity (Table 1). The lowest and highest scores obtained for the assessed sample were of 14 and 34 points, respectively, while the mean was of 27(±4.2).

Regarding the identification of infants as able or unable to feed, the Kappa coefficient (k=0.28) showed a weak concordance between POFRAS and the level of oral feeding skills assessment.

It was verified that 62.96% of the preterm infants considered able to feed by the quantitative assessment were also considered able to feed by POFRAS (Table 2). Additionally, 67.28% of the infants considered unable to feed by the quantitative protocol were also considered unable by POFRAS. In general, both protocols agreed on the assessment of 65.85% (N = 54) of the sample of preterm infants.

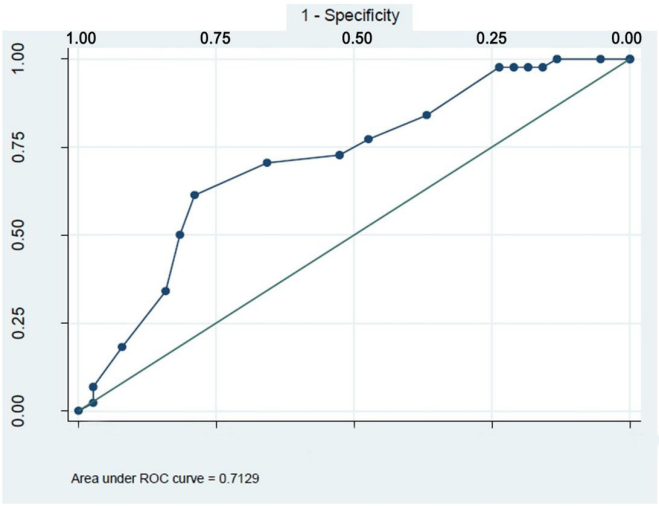

Figure 1. ROC curve obtained from each infant's scores on POFRAS in relation to proficiency

Table 1. POFRAS' cut-off values and results of sensitivity and specificity

Cut-off (≥)	Sensitivity (%)	Specificity (%)
16	100	0.00
18	100	5.26
19	100	13.16
20	97.73	15.79
21	97.73	18.42
23	97.73	21.05
24	97.73	23.68
25	84.09	36.84
26	77.27	47.37
27	72.73	52.63
28	70.45	65.79
29	61.36	78.95
30	50.00	81.58
31	34.09	84.21
32	18.18	92.11
33	6.82	97.37
34	2.27	97.37

Table 2. Distribution of preterm infants regarding the results obtained with both assessment protocols, considering the dichotomization able to feed and unable to feed

POFRAS	Level of Oral Feeding Skills		Total n (%)
	Able to feed n (%)	Unable to feed n (%)	
Able to feed	17(62.96)	18(32.72)	35(100)
Unable to feed	10(37.04)	37(67.28)	47(100)
Total	27(100)	55(100)	82(100)

Caption: POFRAS – Assessment of the infant's readiness to initiate oral feeding

DISCUSSION

The feeding assessment protocols for preterm infants are currently recommended in order to decide more precisely when to initiate oral feeding. The proper identification of this moment provides the infants with better oral feeding experiences as they wean from tube feeding. Also, it leads to a reduction of the time for obtaining full oral feeding, contributing to a consequent decrease on time of hospitalization and on the financial costs related to it[22-25]. Additionally, an adequate assessment can indicate the need of therapeutic conducts in order to achieve full oral feeding[12].

POFRAS is an instrument of easy and quick employment on clinical practice that considers various aspects, including level of maturity, state of consciousness, and oral-motor skills[9,14]. In this study, the results found in the analysis of accuracy of POFRAS are similar to those obtained in a study[14] that used the ingestion of 5 mL of breast milk by translactation as gold standard. The global accuracy obtained for this instrument in this study was of 71.3%, indicating a moderate capacity of determining the readiness for oral feeding initiation in preterm infants.

The diagnostic accuracy is a paramount element on the decision making in health care. Therefore, an instrument with moderate accuracy as POFRAS should be used with caution, and preferably in combination with other available assessment protocols to improve the introduction of oral feeding in preterm infants.

Another aspect studied was the correlation between the results obtained by POFRAS and by the assessment of level of oral feeding skills[11]. This comparison was outlined since the assessment of the level of oral feeding skills evaluates the nutritive sucking of the preterm infant, while POFRAS considers behavioral aspects as well as nonnutritive sucking.

The evaluation of the readiness to feed orally based on behavioral data may not guarantee the success in oral feeding[18,26]. This is because, in nutritive sucking, other aspects are also relevant, especially the coordination between the functions of sucking, swallowing and breathing[11,27].

Our analysis shows that the correlation between the two instruments was weak. A possible explanation for such result might be the fact that the assessment of the level of oral feeding skills takes into account the resistance (fatigue) of the infant when feeding orally, besides the skill itself. In this case, the resistance to oral feeding is assessed by the rate of milk transfer (mL/min) during the total feeding time. An important study[28] shows that resistance during oral feeding is a complex phenomenon involving not only the ability of the infant to sustain a pattern of suction, but also their ability to maintain a consistent behavioral status, respiratory rate and oxygen saturation throughout the oral feeding session.

The signs of fatigue are likely to appear after a certain period, being minimum at the first five minutes of feeding. Therefore, the identification of infants with low resistance for oral feeding using POFRAS, i.e. based on behavioral aspects and evaluation of nonnutritive sucking for 1 minute, is rather complex.

All infants classified as level 4 on the oral feeding skill assessment, i.e. showing suitable oral skill and adequate feeding resistance, were considered able to feed. The achievement of this level at the first oral feeding was associated with a shorter time to reach independent oral feeding[15-18,29]. In addition, both the ability and resistance for oral feeding seem to have similar importance in determining the success of oral feeding[11,13]. Therefore, infants at level 3, i.e. exhibiting high oral feeding skill and low resistance, were considered unable to feed.

Given the moderate accuracy of POFRAS and the weak concordance between the assessed instruments, we suggest the use of POFRAS associated to the assessment of level of oral feeding skills in a complementary manner in clinical practice. Both methods outline important aspects of the feeding behavior of preterm infants that, when analyzed together, allow a quicker and more effective transition to oral feeding.

CONCLUSION

Our results showed that the accuracy of POFRAS to determine the time to initiate oral feeding, based on the proficiency of the first bottle-feeding, was moderate, being similar to that obtained by translactation. Also, there was a weak correlation between the POFRAS and the level

ACKNOWLEDGEMENTS

We thank the *Coordenação de Aperfeiçoamento de Pessoal de Nível Superior* (CAPES) for the scholarship grant.

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Author contributions

GPB tabulated and analyzed the data, and collaborated in the writing and correction of the study; LSP assessed the subjects, and collaborated in every stage of the writing and correction of the paper; LCB, LKC, RCCY collaborated with data collection and in the writing of the study; ARMW supervised the paper, analyzed the data, and made corrections, collaborating in the writing of the study; AMTS co-supervised the study, contributing to the writing and correction of the manuscript.