

# Alternative feeding methods for premature newborn infants

*Métodos de alimentação alternativos para recém-nascidos prematuros*

*Métodos de alimentación alternativa para recién-nacidos prematuros*

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## ABSTRACT

**Objective:** To present a literature review about the use of glass/cup as an alternative method of feeding premature newborns and to identify if there is a consensus on its indication for this population.

**Data source:** A narrative review of the literature. Articles were selected from Medline, Lilacs, SciELO, and Cochrane databases, regardless of year, using the following specific key-words: feeding, premature newborn, breastfeeding, feeding methods.

**Data synthesis:** Although some studies showed that feeding premature and term newborns using the glass/cup is safe and efficient, most of them did not apply an objective evaluation of the swallowing to identify the effect of the method in this population.

**Conclusions:** There is no consensus in the literature about feeding premature newborn infants by glass/cup. Controlled studies should be conducted in order to evaluate risks and benefits of alternative feeding methods in preterm newborn infants.

**Key-words:** bottle feeding; infant, premature; breast feeding; feeding methods.

## RESUMO

**Objetivo:** Apresentar revisão de literatura sobre o uso do copo/xícara como método alternativo de alimentação para recém-nascidos prematuros e verificar se há consenso sobre sua indicação para essa população.

**Fontes de dados:** Revisão de literatura narrativa, tendo sido selecionados artigos nas bases de dados Medline, Lilacs, SciELO e Cochrane, independentemente do ano, usando descritores específicos: alimentação artificial, recém-nascido prematuro, aleitamento materno, métodos de alimentação.

**Síntese dos dados:** Apesar de alguns estudos afirmarem que o método do copo/xícara é eficaz e seguro para alimentar recém-nascidos pré-termo e a termo, tais estudos não avaliam de forma objetiva o efeito do método sobre a deglutição desses pacientes.

**Conclusões:** Verificou-se não haver consenso na literatura quanto à complementação da alimentação de recém-nascidos prematuros por meio do copo/xícara. Estudos controlados devem ser realizados com a finalidade de rever riscos e benefícios do uso de métodos alternativos na alimentação do recém-nascido prematuro.

**Palavras-chave:** alimentação artificial; prematuro; aleitamento materno; métodos de alimentação.

## RESUMEN

**Objetivo:** Presentar revisión de literatura sobre el uso de vaso/taza como método alternativo de alimentación para recién-nacidos prematuros y verificar si hay consenso sobre su indicación para esta población.

**Fuentes de datos:** Revisión de literatura narrativa, habiendo sido seleccionados artículos en las bases de datos Medline, Lilacs, SciELO y Cochrane, independentemente del año, usando descriptores específicos: alimentación artificial, recién-nacido prematuro, lactancia materna, métodos de alimentación.

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Conflito de interesse: nada a declarar

Recebido em: 28/4/2011  
Aprovado em: 31/10/2011

**Síntesis de los datos:** Aunque algunos estudios afirmen que el método vaso/taza es eficaz y seguro para alimentar a recién-nacidos pre-término y a término, tales estudios no evalúan de modo objetivo el efecto del método sobre la deglución de estos pacientes.

**Conclusiones:** Se verificó que no hay consenso en la literatura respecto a la complementación de la alimentación de recién-nacidos prematuros mediante vaso/taza. Se debe realizar estudios controlados con la finalidad de rever riesgos y beneficios del uso de métodos alternativos en la alimentación del recién-nacido prematuro.

**Palabras clave:** alimentación artificial; prematuro; lactancia materna; métodos de alimentación.

## Introduction

Breastfeeding certainly is the best source of nutrition for children because, in addition to providing the necessary nutrients to child health, the sucking movements promote the growth and normal development of orofacial structures<sup>(1-3)</sup>. The World Health Organization (WHO) recommends that newborns are breastfed for the first six months of life<sup>(4)</sup>.

Premature newborns, who cannot be breastfed or who cannot suck because of their immaturity, should be glass/glass/cup fed, as recommended by the WHO and the Baby-Friendly Hospital Initiative (BFHI)<sup>(5)</sup>.

Many awareness campaigns are designed to promote breastfeeding, especially in developing countries, where breastfeeding is the most common feeding method and is related children's survival. The United Nations Children's Fund (UNICEF) and the WHO have invested in the implementation of the BFHI in hospitals and maternity hospitals in these countries by means of campaigns, publications, and support. Such initiative recommends that those children who cannot be breastfed should be offered expressed breast milk using a glass/cup because the use of bottles and pacifiers could cause "nipple confusion," hindering breastfeeding<sup>(5-8)</sup>.

Premature newborns often have feeding difficulties because they are too immature to suck and due to lack of coordination among the functions of breathing/sucking/swallowing, among other problems<sup>(9-11)</sup>. Therefore, there is need for the use of an alternative feeding method, complementary feeding, and long-term hospitalization. Considering these patients' overall immaturity, there is also immaturity of the biomechanics of swallowing and the gastric condition, which may cause problems related to feeding methods and type of

food<sup>(12)</sup>. Thus, there is need to investigate the early feeding practices and the type of diet used upon hospital discharge for premature newborns. A study investigating these aspects has revealed that the lower the premature newborn's weight, the longer the time to start enteral feeding<sup>(13)</sup>.

Thus, in view of premature newborns' feeding difficulties, the objective of the present study was to review the literature on glass/cup feeding as an alternative feeding method for premature newborns and to investigate whether there is consensus on its indication for this population.

## Method

The present study is a narrative review of the literature. We searched the following databases: National Library of Medicine (Medline), Latin-American and Caribbean Center on Health Sciences Information (Lilacs), Scientific Electronic Library Online (SciELO), and Cochrane, regardless of the year of publication. Our search was performed using these keywords: artificial feeding, premature newborn, breastfeeding, feeding methods. Of the 421 articles found in English and Portuguese, only 31 were included considering the objective of our study. The studies included in our review investigated the use and effects of glass/cup feeding both in full-term and preterm infants. We excluded those articles addressing other types of artificial or complementary feeding. All articles, regardless of the degree of evidence, were considered in our search.

## Results and discussion

With the purpose of promoting and supporting breastfeeding, the WHO and Unicef suggest the implementation of a premature newborn feeding program in some BFHI maternity hospitals. This program consists of ten steps, including aspects related to the use of artificial nipples such as pacifiers and bottles. Children who cannot be breastfed or have difficulties sucking should be glass/cup fed and should not be bottle fed or use pacifiers, according to the ninth step, to avoid "nipple confusion", which could impair breastfeeding<sup>(7,8,14,15)</sup>.

Considering the possibility of "nipple confusion", a term used for infants who confuse their mother's breast nipple with the bottle nipple, one of the few randomized studies we found was aimed at comparing the effect of artificial nipples with the use of glass/cup feeding on premature newborns. This study included 319 premature

infants (23 to 33 weeks of gestational age). Both groups were breastfed and received additional milk using a glass/cup or a bottle. The results showed that the use of artificial nipples did not affect breastfeeding, but glass/cup feeding significantly increased the likelihood that the infant will be exclusively breastfed at hospital discharge, although it increases the length of hospital stay<sup>(16)</sup>.

Glass/cup feeding has been suggested to support and complement breastfeeding. Most studies have demonstrated that this feeding method brings benefits to low gestational age infants, but there are not reports regarding the performance of objective examinations investigating the swallowing function in premature newborns or the effectiveness of the method. In this context, glass/cup feeding is recommended by the WHO for infants who have breastfeeding difficulties or when there is possibility of poor bottle sterilization<sup>(5,17,18)</sup>.

Some of the benefits of glass/cup feeding are: non-invasive method, reduced possibility of “nipple confusion,” and infants’ ability to regulate their milk intake when the glass/cup is placed so that the milk only touches their lips instead of being poured inside their mouth<sup>(5,18)</sup>. According to Lang, Lawrence, and Orme<sup>(5)</sup> and Malhotra *et al*<sup>(18)</sup>, feeding premature newborns using a glass/cup is simple, practical, affordable, and its most important role is to provide a safe artificial method of feeding low birthweight and premature babies until they are strong and/or mature enough to be exclusively breastfed.

Also with the purpose of analyzing the use of alternative feeding methods for premature newborns, Marinelli, Burke, and Dodd<sup>(19)</sup> compared glass/cup feeding with bottle feeding in 56 premature infants (34 weeks of gestational age) whose mothers intended to breastfeed. The authors used physiological measurements (heart rate, respiratory rate, and oxygen saturation) to evaluate the effectiveness of each method. Measurements were recorded in ten-minute intervals before and during feeding. The results showed no difference in respiratory pattern, cough, sleep apnea, and bradycardia between the two feeding methods. Infants who were bottle fed had more periods of saturation below 90% and higher heart rate than those who were glass/cup fed. Intake volume was lower and feeding duration was longer during the use of glass/cups. The authors concluded that those infants who were glass/cup fed were physiologically more stable compared with those who were bottle fed; they also concluded that glass/cup feeding is a safe method for premature children who are learning to breastfeed<sup>(19)</sup>.

Also considering that glass/cup feeding can be safer than bottle feeding for this population, Lang, Lawrence, and Orme<sup>(5)</sup> found that glass/cup-fed infants do not have changes in the physiological measurements and are more stable than those who were bottle fed<sup>(5)</sup>. Rocha, Martinez, and Jorge<sup>(20)</sup>, in turn, found decreased incidence of episodes of reduced oxygen saturation in glass/cup-fed children and higher prevalence of breastfeeding at three months among those who were already being breastfed<sup>(20)</sup>.

Malhotra *et al*<sup>(18)</sup> investigated one hundred newborns (66 full-term infants, 20 full-term infants with abnormal development, and 14 preterm infants). Infants were bottle fed, glass/cup fed, and received milk using the *paladai* (a small glass glass/cup made of an oil lamp with a long spout used at temples in India and adapted to supply liquids in some communities in Southern India)<sup>(18)</sup>. Each child was fed using the three methods. The parameters evaluated were volume ingested, duration of the feed, degree of spilling, and satiety. The results revealed that low birthweight infants ingested a larger volume in a shorter time using the glass/cup and the *paladai* when compared with the bottle. Milk spilling was greater with the use of the glass/cup or *paladai* when compared with the bottle, but spilling with *paladai* was lower in relation to the glass/cup. In addition, there was greater satiety when using the *paladai* when compared with the bottle. The authors concluded that the infants took the maximum volume in the least time with the use of the glass/cup, despite spilling was very high, especially with preterm infants. These authors also concluded that infants should be monitored during glass/cup or *paladai* feeding and that these methods serve as a complement for the natural feeding for low birthweight children who cannot suck their mother’s breast<sup>(18)</sup>.

Thus, several authors have suggested that feeding full-term and preterm infants using a glass/cup is effective and allows for successful breastfeed, without the occurrence of “nipple confusion”<sup>(5,15,16,18,21,22)</sup>, as previously described. Conversely, other studies have suggested that this form of feeding may lead to longer hospital stay, thus increasing the risk of infection<sup>(23,24)</sup>. In addition, a recent survey has shown concern regarding hospital costs and the maintenance of the technique by the mother (post-discharge), with great possibility of poor performance of the technique<sup>(16,25)</sup>.

Therefore, the scientific literature is still controversial as to the effectiveness of the use glass/cup feeding as a form of breastfeeding supplementation. In this sense, the biggest problem lies in the fact that the studies use data collected

from patient records and based on the observation of mothers/teams at hospital nurseries. We could not find any studies that objectively measured the effectiveness of the method.

In this context, glass/cup feeding of premature babies is frequently carried out in developed and developing countries. The current recommendation is that the glass/cup is tilted so that the milk only touches the child's lips. Children should lick or sip up the milk by sticking out their tongue to get small amounts of milk, which are kept in the mouth for some time before being swallowed<sup>(5,18,19)</sup>. When infants ingest milk this way, they seem to be able to regulate their own intake in relation to time and amount, while spending very little energy, and the tongue and jaw movements are similar to the movements required for successful breastfeeding. In Brazil, the practice of glass/cup feeding is quite widespread in hospital nurseries and neonatal intensive care units, with the purpose of reducing the causes of weaning related to the use of bottles<sup>(15)</sup>.

Health professionals have been highly concerned about preterm infants, especially regarding their initial feeding difficulties, as well as the risk of oropharyngeal dysphagia, which can lead to laryngeal penetration and laryngotracheal aspiration. The introduction of oral feeding in low weight infants depends on the clinical assessment based on the clinical decision regarding the infants' ability to feed themselves and on the policy established at the nursery. However, such evaluation should be accompanied by a specialized assessment to identify the risk of oropharyngeal dysphagia. In this sense, studies have suggested that breastfeeding is the safest way to feed an infant, but breastfeeding is not a simple practice and its success is not easily achieved, mainly by low gestational age children<sup>(13,15)</sup>.

Preterm newborns have some disadvantages that lead to difficulties in oral feeding. Their orofacial muscles have reduced volume and the balance of the tendons and the structures of the ligaments are not fully developed<sup>(26)</sup>. Muscle volume and facial fat are important for postural stability during feeding, and because premature infants' sucking ability is usually weak, the oral phase of swallowing may be impaired in these children<sup>(14,26-28)</sup>. Considering these difficulties, one of the concerns is the risk of laryngotracheal aspiration, because with the use of both glass/cup and bottle feeding large amounts of food may be inserted in the oral cavity and, due to the immaturity of the structures involved in the swallowing process, the neonate may not coordinate sucking, swallowing, and breathing, with consequent aspiration of food to the airways. This has been one of the concerns described in the literature as a disadvantage in the use of glass/cup feeding

of preterm infants<sup>(6,17,29)</sup>. In this sense, several authors have emphasized the importance of providing training to health professionals and guidance to parents regarding the correct procedure for offering milk using a glass/cup<sup>(13,22,30)</sup>.

One of the few studies that has objectively evaluated premature infants' oropharyngeal swallowing using glass/cup and bottle feeding based on videofluoroscopic swallowing study found that most patients were not able to sip up the food using their tongue the first time they used the glass/cup. In addition, those who managed to sip ingested very small amounts, had to make a great effort, had difficulties, and took longer to feed themselves, although none of them had laryngeal penetration or laryngotracheal aspiration. Some premature infants showed irritation and excessive head and limb movement during glass/cup feeding. The authors concluded that their patients showed better performance in bottle feeding when compared to glass/cup feeding, because sucking was present at the first moment of ingestion<sup>(31)</sup>.

The studies included in the present review of the literature show that no consensus has been reached about the most effective alternative feeding method for premature infants. Although some of them claim that the practice of feeding preterm newborns using a glass/cup is an effective and safe method, there are few studies using objective instruments to assess the safety of oropharyngeal swallowing in this population. There is no consensus in the national and international literature on complementary feeding of neonates using a glass/cup or bottle. In addition, the generalized use of glass/cup feeding as an alternative feeding method for low weight infants does not take into account individual difficulties, which may be associated with the neuromotor control of oropharyngeal swallowing in premature infants and lead to compensation of the oral and functional structures, with risk of laryngotracheal aspiration. In addition to the risk of aspiration, there is risk of low weight gain since a large amount of the food offered may be expelled by the child's tongue as a defense mechanism or because of the inability to deal with a stimulus that is not innate to human beings.

We conclude that there is no consensus in the literature as to the complementary feeding method of premature infants. Controlled studies should be conducted with the purpose of comparing different methods of feeding transition in premature infants, aiming to define which one of them is the best. In addition, the choice of one method should consider the characteristics of the group of premature infants so that its generalized use does not pose a risk to the safety and effectiveness of oral feeding.

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