

## Comparison of feeding methods in neonates - A retrospective cohort study from India

P C Nayana Prabha, R Kishore Kumar, Arvind Shenoi

From Department of Neonatology and Pediatrics, Bengaluru, Karnataka, India

**Correspondence to:** Dr. P C Nayana Prabha, Department of Neonatology and Pediatrics, Cloudnine Hospitals, 1533, 9<sup>th</sup> Main, 3<sup>rd</sup> Block Jayanagar, Bengaluru - 560 011, Karnataka, India. E-mail: poovadan@hotmail.com

Received - 09 June 2017

Initial Review - 09 July 2017

Published Online - 17 September 2017

### ABSTRACT

**Background:** Preterm babies who are unable to breastfeed but are able to swallow are commenced on cup or paladai or bottle as alternative feeding methods. Although the World Health Organization recommends the use of cup owing to reduced infection risk, many neonatal units use the bottle for feeding. **Objectives:** The aim was to compare the two groups with regard to time taken to commence oral feeds, breastfeeds, achieve full oral feeds, complications, gestational age at discharge, discharge weight, and infant formula use at discharge. **Material and Methods:** This retrospective observational study was performed to compare two cohorts of preterm babies who were fed either by bottle or paladai (small feeding cup with a long spout traditionally used in India) during their transition from tube to breastfeeding. **Results:** During the study period, there were 68 babies in Center 1 where paladai was used and 71 in Center 2 where bottle was used. The gestational age at which oral feeding was commenced, full oral feeds, gestational age at discharge, and discharge weight were similar in both the groups. Breastfeeding was commenced significantly earlier in the bottle-fed group ( $p < 0.05$ ). The use of infant formula was also significantly more in this group. One baby aspirated in the paladai group. **Conclusion:** With adequate training and attention to hygiene, paladai or feeding bottles could be equally safe methods of feeding in hospitalized preterm neonates.

**Key words:** Bottle feeding, Feeding method, Neonate

It is a universal recommendation that neonates be breastfed. However, in preterm infants, the sucking and swallowing coordination occurs around 32-34 weeks. Consequently, these babies are often transitioned to breastfeeding from tube feeding by adopting various oral feeding techniques such as paladai, cup, or bottle. Each method of alternative feeding has its advantages and disadvantages in terms of physiological stability during oral feeding, safety, breastfeeding rates, duration to breastfeeding, length of hospitalization, and weight gain [1-3]. The World Health Organization (WHO) and the Baby Friendly Hospital Initiative (BFHI) recommend cup feeding during the transition phase from tube to breastfeeding [4]. BFHI discourages the use of artificial teats and feeding bottles.

Although the exact prevalence of bottle feed use is not known, many neonatal units all over the world continue to adopt this method [5]. It is in this background that this study was undertaken to compare two cohorts of preterm babies of which one group was bottle fed and the other fed by paladai. Paladai is a small cup with a long spout traditionally used in India during their transition from tube to breastfeeding. A small amount of milk is poured into the neonates' mouth slowly allowing the baby to swallow the milk before administering a further amount. The aim of this study was to compare the feeding with paladai and bottle with regard to time taken to commence oral feeds, breastfeeds, achieve full

oral feeds, complications, gestational age at discharge, discharge weight, and infant formula use at discharge.

### MATERIAL AND METHODS

This was a retrospective study of all neonates with a primary diagnosis of prematurity with no other complicating factor and gestation age of  $\leq 34$  weeks, consecutively admitted to the neonatal intensive care unit of 2 branches of an urban maternity hospital over a period of 18 months between January 01, 2014, and June 30, 2015. Before the study, an approval was obtained from the Institutional Ethics Committee (IEC) to review the clinical case records of patients retrospectively. The data were anonymized before analysis. As it was a retrospective survey, the IEC deemed that informed consent was not applicable. (Project Number IEC/C9791/3004/16008 Dated 30/06/2016).

Babies were excluded from the study if they had concurrent diagnoses or conditions that would interfere with oral feedings. These included chromosomal defects, congenital anomalies involving face, malformation of the digestive tract, neurological conditions affecting feeding, babies with grade 3 or 4 intracranial hemorrhage, hydrocephalus, seizures, meningitis or encephalopathy, babies with growth restriction or abnormal antenatal Doppler in whom feed advancement may be slow,

babies who required to be kept nil oral for more than 3 days, and babies who needed continuous positive airway pressure or ventilator support at 33 weeks. Babies were also excluded from the analysis if tube feeds were continued because of poor weight gain.

As per the hospital nursing policy, all preterm babies born between 28 and 34 weeks on exclusive gavage feeding were gradually transitioned to oral feeding when oral reflexes such as mouthing, licking, rooting, and sucking were present or emerging and demonstrated positive non-nutritive sucking (NNS). If positive NNS was demonstrated on two consecutive attempts, oral feeding was commenced. The babies in Center 1 were offered exclusive oral feeds by paladai and those in Center 2 exclusive bottle feeds. Bottle feeding, though recommended not to be used by BFHI, is widely practiced in India as reflected from the sales figures of bottles across India. Hence, we wanted to compare and contrast the two methods of feeding. Preterm infant formula was used only if expressed breast milk was not available. The volume and number of feeds offered orally were gradually increased depending on the neonates' ability to complete the feed without signs of physiological instability such as bradycardia, desaturation, tachypnea, or bradypnea. If the neonate did not complete the prescribed volume of feed by paladai or bottle, the remaining milk was given by gavage feed. The baby was defined to have commenced oral feeds if the neonate was able to consume >25% of the prescribed feed volume orally. The baby was considered to have achieved full oral feeds when the neonate was able to take >90% of the prescribed feed volume orally.

The data were obtained from the admission registers and by case file review. Baseline information regarding baby's sex, gestational age, birth weight, antenatal Doppler results, mode of delivery, indication for cesarean section, birth order, and place of birth were recorded. The corrected gestational age and weight at which tube feeds and oral feeds (bottle, spoon, paladai, or breast feeds) were commenced, the gestational age and weight at which baby attained full oral feeds, the type of feeds given during the hospital stay (breast milk/formula feeds), the gestational age, weight, mode of feeding, and type of feed at the time of discharge were recorded. Complications encountered with either feeding mode were documented.

Statistical analysis was done using R software. Comparison between all the above variables in the study population was done using feeding modality as the grouping variable. Chi-square test was used for categorical variables and independent *t*-test for continuous variables. All tests were two tailed and  $p < 0.05$  was considered significant.

## RESULTS

There were 103 neonates in Center 1 (paladai group) and 118 in Center 2 (bottle group) between 26 and 34 weeks of gestation out of whom 68 and 71 were included in the analysis. Table 1 describes the baseline characteristics of the neonates.

The mode of delivery, male-to-female ratio, in both centers was comparable. Table 2 describes the clinical profile of the neonates. The mean birth weight was significantly lesser in bottle-fed group. Breastfeeding was commenced earlier in bottle-fed group, and the use of formula feed on discharge was also more in this group. Both of these were statistically significant. One baby aspirated during paladai feeds. There were no episodes of aspiration or gastroenteritis in the bottle-fed group.

## DISCUSSION

This was a study from a tertiary neonatal center comparing the two commonly used modes of preterm feed supplementation, namely, paladai and bottle. Although the study was done in a tertiary neonatal unit, the babies included in the study had a similar profile of those in a special care baby unit with no other complications. This study is limited by its retrospective design.

In our study, both paladai- and bottle-fed babies achieved full suck feeds at similar gestation. In contrast, few previous studies have demonstrated that paladai-fed babies achieved oral feeding early [6,7]. We found that the mean corrected gestation age and discharge weight were similar in babies from both centers suggesting that both the methods of feeding could be equally effective. Breastfeeding could be commenced significantly earlier in the bottle-fed group. There is a limited body of evidence to suggest that bottle-fed babies achieve better sucking, swallowing, and breathing coordination [8]. In this study, more babies in the paladai group were exclusively given breast milk as compared to the bottle-fed group. Previous studies and the WHO have reiterated that introduction of bottle feeds negatively impacts future breastfeeding [3-5]. On the contrary, a recent Cochrane review found that cup feeding does not result in maintenance of breastfeeding beyond discharge [9].

Many complications have been reported during initiation of feeding in preterm infants. The commonly reported complications with paladai feeding include aspiration, oral thrush, and lip laceration [10-12]. There was only a single complication of feeding reported in our study. One baby in the

**Table 1: Comparison of baseline characteristics of the study population (Center -1 - n-68 and Center 2 - n-71)**

Parameters	n (%)		P
	Center 1 (paladai group)	Center 2 (bottle group)	
Male	36 (52.9)	37 (52.1)	0.922
Female	32 (47.1)	34 (47.9)	
Cesarean section	60 (88.2)	67 (94.4)	0.198
Inborn	65 (95.6)	67 (94.4)	
At discharge			
Breastfeeding	68 (100)	71 (100)	
Infant formula use	22 (32.4)	63 (88.7)	<0.001

Table 2: Clinical profile of neonates

Characteristics	Mean±SD		p
	Center 1 (paladai group)	Center 2 (bottle group)	
Gestational age (days)	223±12.2	220±12.5	0.092
Birth weight (g)	1716.6±399	1570.3±360.3	0.026
Oral started (corrected gestational age in days)	234.2±6.3	230.3±24.3	0.197
Breastfeeding commenced (corrected gestational age in days)	237.4±5.9	231.2±24.3	0.043
Full oral feeds (corrected gestational age in days)	238.5±5.64	236.8±24.9	0.584
At discharge			
Corrected gestational age (days)	243.3±6.4	243.1±6.3	0.923
Weight (g)	1899.3±200.4	1833.1±213.02	0.061

SD: Standard deviation

paladai-fed group developed aspiration during feeds. This was managed with oronasal suctioning. The baby was continued on tube feeds for 48 h and oral feeds with paladai commenced. During paladai feeds, the caregiver should administer the feed slowly in concordance with the speed at which the neonate is able to swallow to prevent aspiration. Prolonged feed times with paladai can result in fatigue and a consequent increased risk of aspiration. Training and comfort of the caregiver in the use of paladai is important in prevention of complications [10]. There were no complications in the bottle-fed group during the hospital stay in our study. Bottle feeding has been associated with the development of increased risk bacterial contamination resulting in diarrhea and infections both in developed and developing countries [13,14]. This has also been reported to occur even when expressed breast milk is not handled appropriately [15]. The low rate of complications in both our groups could be owing to the high standard of hygiene which could be offered owing to the high staff-patient ratio and maintenance of standards in our centers which are not resource constrained.

This finding is limited by its retrospective design. In this study, rigorous attention was paid to hygiene and sterilization of feeding equipment. The feed preparation utensils, feeding bottles and paladai, were sterilized after every use. Hence, further generalizability to the use of feeding bottles could be only to centers without constraint of resources.

## CONCLUSION

Paladai or feeding bottles could be equally safe methods of feeding in hospitalized preterm neonates. While the WHO recommendations of paladai feeding to be more hygienic with less complications in resource-poor setting are still relevant, in other institutions with greater access to financial and human resources, both forms of feeding could be equally effective with no difference in complications. Clear instructions, training, and meticulous hygiene are essential with either mode of feeding to minimize morbidities.

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Funding: None; Conflict of Interest: None Stated.

**How to cite this article:** Nayana Prabha PC, Kumar RK, Shenoi A. Comparison of feeding methods in neonates - A retrospective cohort study from India. *Indian J Child Health*. 2017; 4(4):584-586.