

TO COMPARE GAVAGE, CUP AND PALADY FEEDING METHODS IN TERMS OF ECONOMY IN PRETERM NEWBORN

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Abstract

Background: UNICEF and WHO recommended that children be exclusively breastfed during the first six months of life. Breast milk is uncontaminated and contains all nutrients necessary for children in the first few months of life.

Methods: This randomized control trial conducted at Umaid hospital, attached to Dr. S.N Medical College, Jodhpur. All preterm neonates with a gestational age between 30 to 34 weeks as defined below were included in the study after a written informed consent. A total of 100 neonates, those meeting the inclusion criteria were taken in the study. These neonates were randomized into four groups – NG group, OG group, Palady group, and Cup group by block randomization comprising of 25 neonates each.

Results- The mean expenditure in NG, OG, PALADY and CUP groups were 15427±10317 Rs., 17065±6807 Rs., 9231±1790 Rs. and 7319±1657 Rs. respectively. The difference was statistically significant for NG vs PALADY, NG vs CUP, OG vs PALADY, OG vs CUP and PALADY vs CUP.

Conclusion: we conclude that feeding in preterm low birth weight neonates who cannot breast feed is best achieved by cup which was found to be the most economical method. Neonates on cup feeding required less expertise. Once mastered under supervision, cup feeding can be used independently in-home setting and in remote areas with less technical manpower at hand.

Keywords: Feeding, Cup, Palady, OG.

Introduction

UNICEF and WHO recommended that children be exclusively breastfed during the first six months of life. Breast milk is uncontaminated and contains all nutrients necessary for children in the first few months of life. The first breast milk is known as colostrum, which has highly nutritious and has antibodies that protect the newborn from disease.¹⁻²

Many infants, in addition to breast milk, are given something else from an early age, such as water, tea or milk. These other food can lead to malnutrition due to inadequate nutritional content and intolerance, which increase infants morbidity and mortality rates.

Is cup feeding a better way to feed babies, rather than giving bottles or feeding with a tube, when mothers are unable to fully breastfeed³

Material and Methods

The current study was a randomized control trial conducted at Umaid hospital, attached to Dr. S.N Medical College, Jodhpur. All preterm neonates with a gestational age between 30 to 34 weeks as defined below were

included in the study after a written informed consent. A total of 100 neonates, those meeting the inclusion criteria were taken in the study. These neonates were randomized into four groups – NG group, OG group, Palady group, and Cup group by block randomization comprising of 25 neonates each.

Inclusion criteria

All the pre-terms (gestational age 30-34 weeks) born in hospitals attached to Dr. S N Medical College or born outside and referred here satisfying the following criteria will be included

1. Baby should be stable and off oxygen
2. There should be no significant respiratory distress, no apnea episodes, temperature instability, severe sepsis at the time of enrolment.

Exclusion criteria

1. Unstable babies requiring inotropes, ventilatory support, CPAP, oxygen
2. IVH/ICH
3. Systemic dysfunctions like renal injury, liver injury
4. Gross congenital malformations

5. Syndromic/dysmorphic babies

Flow of study

- Total enrollment
 - Randomization
 - 4 groups
1. Gavage – NG
 2. Gavage -OG
 3. Palady
 4. Cup

Feeding protocol to be followed

- Starting volume – 20-60 ml/kg/day
- Frequency – 2 hourly
- Increment – up to 30 ml/kg/day as per tolerance
- Maximum – 180 ml/kg/day
- Nonnutritive sucking and trial of breast feeding will be given to all babies as early as possible.
- Good coordinated sucking for sufficient period of time in correct positioning and attachment as witnessed by at least two different observers independently over a 24hour period of time will qualify the child as breast feeding. Directly observed breastfeeding will continue to be the feeding method from here onwards.
- Maintenance of temperature, asepsis and other standard treatment protocols will be uniformly followed in all children

Feeding Methods

Gavage (NG & OG) Feeding

1. Remove the plunger of a 10 or 20 ml sterile syringe.
2. Connect the barrel of the syringe to the end of the gastric tube.
3. Fill the barrel of the syringe with the required volume of milk.
4. Let the milk run from the syringe through the gastric tube under gravity.
5. DO NOT force milk through the gastric tube by using the plunger of the syringe.
6. Hold the syringe 5-10 cm above the infant until the syringe is empty.
7. It should take a few minutes for the milk to flow into the infant's stomach. Changing the height of the syringe will also affect the speed of milk flow. Lowering the syringe slows the milk flow, raising the syringe makes the milk flow faster.
8. Observe the infant during the entire gastric tube feed. Do not leave the infant unattended. Stop the tube feed if the infant shows any of the following signs: breathing difficulty, color change (looks blue), becomes floppy or vomits.
9. Cap the end of the gastric tube after the milk has been instilled. There is no need to rinse the tube with water. Keep tube capped between feeds.



Figure 1: Palady feeding

1. The infant should be awake and held sitting semi-upright on the caregiver's lap and wrapped to provide support and to keep the arms out of the way, as for cup feeding.
2. Put a measured amount of milk in the palady.
3. Hold the palady so that the pointed tip rests lightly on the infant's lower lip.
4. Tilt the palady to pour a small amount of milk into the infant's mouth gently.
5. Feed the infant slowly.
6. Make sure that the infant has swallowed the milk already taken before giving any more.
7. When the infant has had enough, will close his or her mouth and will not take any more. Do not force-feed the infant.
8. Estimate the amount of milk taken.
9. Wash the palady with soap in running water and air-dry it before and after each use



Figure 2: Cup feeding

1. The infant should be awake and held sitting semi-upright on the caregiver's lap. Wrap the infant in a cloth to provide support and to keep his or her arms out of the way and put a small cloth on his or her front to catch drips of milk.
2. Put a measured amount of milk in the cup.
3. Hold the cup so that it rests lightly on the infant's lower lip.

4. Tilt the cup so that the milk reaches the infant's lips.
5. Allow the infant to take the milk himself. (A younger infant will initially lap the milk into his mouth with his tongue. A full term or older infant will suck the milk.)
6. Do not pour the milk into the infant's mouth. Hold the cup to the infant's lips so that and he or she can take it himself or herself.
7. Feed the infant slowly.
8. Make sure that the infant has swallowed the milk before offering more. When the infant has had enough, he or she will close his or her mouth and will not take any more. Do not force-feed the infant.
9. To estimate the amount of milk taken, subtract the milk left in the cup from the original amount. Also subtract the estimated spillage, if any.
10. Wash each utensil with soap in running water and air-dry it before and after each use.

Change in the feeding method

The feeding method will be changed if the baby will not be gaining the expected weight, attendant will not comfortable with it or if not doing it properly or the baby able to tolerate a more interactive method. Reason for the change will noted and progress on the new feeding method will be recorded separately and compared with progress on prior method.

End point

Achievement of exclusive breast feeding or development of complication like hypoglycemia, aspiration or NEC.

Acceptability

A score was design to quantify the ease of use of each method by the care giver:

Quantify ease of use

Score	
01	I could not adapt to the method at all and wish to switch to another method of feeding.
02	It was difficult to adapt and required professional help from time to time.
03	It was slightly difficult to follow the method alone and I needed the support of my family.
04	I could adapt to the method easily but sometimes required help from family and professionals.
05	The method was simple, easy to use and satisfactory.

Expenditure

To quantifying the economy of feeding method following data was used

OG /NG

Number of Feeding tubes required X Rs. 15 per tube
 Number of 5 ml Syringes Required X Rs. 5 per Syringe
 Number of DW Ampoules required X Rs. 10 per vial

Number of Man hours of trained staff required X Rs. 50/hour

CUP/PALADY

Number of CUP/PALADY required X Rs. 15 per piece
 Number of Man hours of trained staff required X Rs. 50/hour

Observations

It was a randomized control trial conducted over a period of one year at UMAID hospital attached to Dr. S.N medical college, Jodhpur after approval from the institutional ethical committee. During the study period a total 100 neonates of gestational age between 30-34 weeks were enrolled in the study. These neonates were randomized into four groups – NG group, OG group, Palady group, and Cup group by a random number table comprising of 25 neonates in each group. Feeding started in each group with assigned method according to the NICU feeding protocols. Routine neonatal examination done every day and looked for any complications (Hypoglycaemia, Apnoea, Aspiration, Feed-Intolerance, NEC, and Other Infections). Weight and temperature noted twice daily. Counselling of caregiver (Mother / Father / Maternal Grandmother / Paternal Grandmother / Maternal Aunt / Paternal Aunt / Maternal Uncle / Paternal Uncle / Other) was done about the feeding method used. Problems reported by the caregiver about use of the feeding method were verified by the paediatrician and noted and appropriate actions were taken to correct those problems in form of counselling of the caregiver, repeat demonstration of correct method of feeding, confidence building, or other help needed. Feed was given in 2 hourly intervals, Pre and Post feed abdominal girth was monitored for feed intolerance, frequency of urine, motion was noted for adequacy of feed. If any baby required to change the feeding method, reason for the change noted and progress on the new feeding method was recorded separately and compared with progress on prior method. All the four groups were compared in terms of weight gain, volume of feed ingested, number of hours taken to achieve complete breast feed, associated complications and overlap time with breast feeding, acceptability, expenditure incurred on the method of feeding.

Table 1: Age wise distribution of cases in all groups

Age (in days)	NG	OG	PALADY	CUP	TOTAL
1-3	6 (24%)	12 (48%)	9 (36%)	9 (36%)	36
4-6	11 (44%)	13 (52%)	13 (52%)	14 (56%)	51
7-9	2 (8%)	0	1 (4%)	2 (8%)	5
>10	6 (24%)	0	2 (8%)	0	8
Mean± SD	6.12±3.97	4.08±1.32	4.76±2.20	4.32±1.42	--
Total	25	25	25	25	100

[NG vs OG $p=0.018$, NG vs PALADY $p=0.140$, NG vs CUP $p=0.038$, OG vs PALADY $p=0.192$, OG vs CUP $p=0.541$ and PALADY vs CUP $p=0.407$]

The mean age of enrolment for NG group 6.12 ± 3.97 days, for OG group 4.08 ± 1.32 days, for PALADY group 4.76 ± 2.20 days and for CUP group was 4.32 ± 1.42 days.

Maximum number of the newborns in all the four feeding methods enrolled are between 4 to 6 days of age. Total of 51 newborns out of 100 (51%) in this range.

Table 2: Gender wise distribution of cases in all groups

Gender	NG	OG	PALADY	CUP	TOTAL
Male	19 (76%)	13 (52%)	16 (64%)	17 (56%)	65
Female	6 (24%)	12 (48%)	9 (36%)	8 (32%)	35
Total	25	25	25	25	100

[NG vs OG $p=0.077$, NG vs PALADY $p=0.354$, NG vs CUP $p=0.528$, OG vs PALADY $p=0.390$, OG vs CUP $p=0.248$ and PALADY vs CUP $p=0.765$]

The number of male of male neonates were higher in all the feeding groups. Male to female ratios in NG, OG, PALADY, and CUP feeding group were 3.1:1, 1.08:1, 1.7:1, 2.1:1 respectively. Statistically no significant difference was observed between the groups based on gender distribution.

Table 3: Gestational age wise distribution of cases as per Modified Ballard Scoring

Gestational age (in weeks)	NG	OG	PALADY	CUP	TOTAL
30±2	4 (16%)	4 (16%)	1 (4%)	6 (24%)	15
32±2	21 (84%)	20 (80%)	13 (52%)	18 (72%)	72
34±2	0	1 (4%)	11 (44%)	1 (4%)	13
Mean± SD	31.68±0.74	31.76±0.87	32.8±1.15	31.6±1.0	--
Total	25	25	25	25	100

[NG vs OG $p=0.730$, NG vs PALADY $p=0.0002$, NG vs CUP $p=0.750$, OG vs PALADY $p=0.0008$, OG vs CUP $p=0.550$ and PALADY vs CUP $p=0.0003$]

Mean gestational age (in weeks) of neonates in NG, OG, PALADY and CUP groups were 31.68 ± 0.74 , 31.76 ± 0.87 , 32.8 ± 1 and 15 , 31.6 ± 1.0 respectively.

The difference was statistically significant for NG vs PALADY, OG vs PALADY and PALADY vs CUP groups.

Table 4: Weight wise distribution of cases

Weight (kg)	NG	OG	PALADY	CUP	Total
≤1.2	5 (20%)	3 (12%)	0	1 (4%)	9
1.2-1.5	18 (72%)	22 (88%)	14 (56%)	22 (88%)	76
>1.5	2 (8%)	0	11 (44%)	2 (8%)	15
Mean± SD	1.34±0.15	1.35±0.11	1.52±0.13	1.38±0.09	--
Total	25	25	25	25	100

[NG vs OG $p=0.801$, NG vs PALADY $p<0.0001$, NG vs CUP $p=0.270$, OG vs PALADY $p<0.001$, OG vs CUP $p=0.322$ and PALADY vs CUP $p=0.0002$]

Mean weight of the neonates for NG, OG, PALADY and CUP groups were 1.34 ± 0.15 kg, 1.35 ± 0.11 kg, 1.52 ± 0.13 kg and 1.38 ± 0.09 kg respectively.

Maximum number of neonates were in between weight band 1.2 to 1.5 kg.

The difference was statistically significant for NG vs PALADY, OG vs PALADY and CUP vs PALADY groups.

Table 5: Ease of use-Acceptability

Score	NG	OG	PALADY	CUP	Total
1	0	0	1 (4%)	0	1
2	5 (20%)	2 (8%)	1 (4%)	0	8
3	20 (80%)	23 (92%)	23 (92%)	6 (24%)	72
4	0	0	0	15 (60%)	15
5	0	0	0	4 (16%)	4
Mean± SD	2.8±0.41	2.92±0.28	2.88±0.44	3.92±0.64	--

[NG vs OG $p=0.229$, NG vs PALADY $p=0.508$, NG vs CUP $p<0.0001$, OG vs PALADY $p=0.702$, OG vs CUP $p<0.0001$ and PALADY vs CUP $p<0.0001$]

The mean score of ease of use by the neonates in NG, OG, PALADY and CUP groups were 2.8 ± 0.41 , 2.92 ± 0.28 , 2.88 ± 0.44 and 3.92 ± 0.64 respectively.

The difference was statistically significant for NG vs CUP, OG vs CUP and PALADY vs CUP.

The difference was highly statistically significant when CUP is compared with any of the three methods.

Table 6: Economy of feeding method

Expense (in thousand Rs.)	NG	OG	PALADY	CUP	Total
<10	10 (40%)	5 (20%)	20 (80%)	24 (96%)	59
10-20	7 (28%)	13 (52%)	5 (20%)	1 (4%)	26
21-30	5 (20%)	7 (28%)	0	0	12
>30	3 (12%)	0	0	0	3
Mean± SD	15427±1031	17065±680	9231±179	7319±165	---
	7	7	0	7	

[NG vs OG $p=0.510$, NG vs PALADY $p=0.004$, NG vs CUP $p<0.0003$, OG vs PALADY $p<0.0001$, OG vs CUP $p<0.0001$ and PALADY vs CUP $p=0.0003$]

The mean expenditure in NG, OG, PALADY and CUP groups were 15427 ± 10317 Rs., 17065 ± 6807 Rs., 9231 ± 1790 Rs. and 7319 ± 1657 Rs. respectively.

The difference was statistically significant for NG vs PALADY, NG vs CUP, OG vs PALADY, OG vs CUP and PALADY vs CUP.

Table 7: Change in the feeding methods

Feeding method	Change to methods				Total
	NG	OG	PALADY	CUP	
NG	0	0	3 (12%)	5 (20%)	8 (32%)
OG	1 (4%)	0	2 (8%)	0	3 (12%)
PALADY	1 (4%)	0	0	0	1 (4%)
CUP	0	0	0	0	0

In NG group 8 newborns (32%) needed to change the feeding method. Out of 8 newborns 5 (20%) changed to Cup feeding (graduating for more interactive feeding method / existing method not giving desired results) and 3 (12%) to Palady feeding (graduating for more interactive feeding method).

In OG group 3 newborns (12%) needed to change the feeding method. Out of 3 newborns 1 (4%) changed to NG feeding (frequent displacement of OG tube), 2 (8%) changed to Palady feeding (graduating for more interactive feeding method).

In PALADY group 1 newborn (4%) need to change the feeding method to NG feeding (existing method not giving desired results)

In CUP group no newborn required to change the feeding method.

Discussion

It was a randomized control trial conducted over a period of one year at UMAID hospital attached to Dr. S. N. Medical College, Jodhpur after approval from the institutional ethical committee. During the study period a total 100 neonates of gestational age between 30-34 weeks were enrolled in the study. These neonates were randomized into four groups – NG group, OG group, Palady group, and Cup group by a random number table comprising of 25 neonates in each group. Feeding was initiated as early as possible and gradually increased as per NICU feeding protocols. Routine neonatal examination was done every day and a special note was made for complications like Hypoglycaemia, Apnoea, Aspiration, Feed-Intolerance, NEC, and Other Infections. Weight and temperature noted twice daily. Counselling of caregiver (Mother / Father / Maternal Grandmother / Paternal Grandmother / Maternal Aunt / Paternal Aunt / Maternal Uncle / Paternal Uncle /Other) was done about the feeding method used. Problems reported by the caregiver about use of the feeding method were verified by the paediatrician and noted and appropriate actions were taken to correct those problems in form of counselling of the caregiver, repeat demonstration of correct method of feeding, confidence building, or other help needed. Feed was given in 2 hourly intervals, Pre and Post feed abdominal girth was monitored for feed intolerance,

frequency of urine, motion was noted for adequacy of feed. The feeding method was changed if the baby was not gaining the expected weight, attendant was not comfortable with it or was not doing it properly or the baby was able to tolerate a more interactive method. Reason for the change was noted and progress on the new feeding method was recorded separately and compared with progress on prior method.

The mean score of ease of use by the neonates in NG, OG, PALADY and CUP groups were 2.8 ± 0.41 , 2.92 ± 0.28 , 2.88 ± 0.44 and 3.92 ± 0.64 respectively.

The difference was statistically significant for NG vs CUP, OG vs CUP and PALADY vs CUP.

The difference was statistically highly significant when CUP was compared with any of the three methods.

N Malhotra et al, reported nurses unanimously preferred the Palady over the bottle and cup without a pour spout and thought it took less time and effort of the infant to feed than the other methods.⁴

We found a similar observation that nurses for ease of administration preferred palady, but chances of aspiration, improper positioning of newborn and laceration have been reported by other authors although we did not find these complications as our newborns were under direct supervision.

The mean expenditure in NG, OG, PALADY and CUP groups were 15427 ± 10317 Rs., 17065 ± 6807 Rs., 9231 ± 1790 Rs. and 7319 ± 1657 Rs. respectively.

The difference was statistically significant for NG vs PALADY, NG vs CUP, OG vs PALADY, OG vs CUP and PALADY vs CUP.

In a study Collins et al, reported no difference in duration of hospital stay among those who complied with their assigned feeding method ($p=0.27$), and found that length of stay after supplemental feeding by cup or bottle was started was similar for infants fed by cup versus bottle (12 versus 11 days, $p=0.05$)⁵

One RCT by Collins et al, in Australia reported extended hospital stays among cup fed infants relative to bottle fed infants, which has raised concern that cup-feeding increases cost and demand for limited resources⁶

In our study we don't used bottle as a feeding method as ours is a baby friendly hospital and bottle feeding is not practiced here. Early transition to complete breast feeding on oral feeding methods (cup and palady) because they are easy to learn, more acceptable and convenient, made these methods more cost effective.

Conclusion

We conclude that feeding in preterm low birth weight neonates who cannot breast feed is best achieved by cup which was found to be the most economical method. Neonates on cup feeding required less expertise. Once mastered under supervision, cup feeding can be used independently in-home setting and in remote areas with less technical manpower at hand.

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