

The Effectiveness of Using NIFTY Cup Versus Paladai for Feeding Neonates at a Selected Tertiary Care Hospital in Western Maharashtra

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Abstract:

➤ Introduction:

Breastfeeding, although being the most eminent way of nutrition to a new-born, unfortunately remains a challenge for majority of neonates, especially the preterm neonates. Major organisations like WHO recommends cup feeding to the preterm neonates who are unable to breastfeed. However, the investigation for the most universally acceptable cup-structure is still an ongoing debatable matter, with regards to its adequacy and economical management of the precious breast-milk. NIFTY (Neonatal Intuitive Feeding Technology) cup, being an innovative feeding tool, has gained challengeable recognition in recent few studies and is in the process of undergoing further validation based researches. On the other hand, paladai is one of the widely adopted traditional feeding utensil in India. This study aims to compare the effectiveness of feeding a neonate using the NIFTY cup versus Paladai.

➤ Materials and Methods:

A quasi-experimental study with two-group post-test only design, in which preterm neonates were enrolled and randomly allocated into two group - NIFTY cup group (n=43) and Paladai group (n=43). A standard-sized impermeable gamzee, placed at chin of baby, was weighed on calibrated mini-weighing machine, before and after every feed; and the time duration of feeding was recorded. The data collected over six weeks period in tertiary care hospitals of Western Maharashtra, was compiled, organised and then statistically tested for its significance, using descriptive (frequency distribution, %, mean, SD) and inferential statistics (chi-square, student t-test, ANOVA).

➤ Result:

The mean spillage proportion in NIFTY cup group was 13.85 % $\pm$ 4.32 whereas in Paladai group, was 19.26 % $\pm$ 5.42. The mean duration of feeding in NIFTY cup group was 18.00 $\pm$ 5.85 second per ml and in Paladai group was 19.18 $\pm$ 6.85 second per ml. However, the statistical significance of this mean values, with 95% CI and 5% level of significance, is seen only in case of spillage proportion with p value < 0.001.

➤ Conclusion:

The study revealed better outcome, while feeding with NIFTY cup, in context to spillage of milk. However, more studies with quantitative evaluation of spillage level and time of feeding is recommended, over larger spectrum of population over longer period.

Keywords: NIFTY Cup, Paladai, Effectiveness, Spillage Proportion and Duration of Feeding.

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I. INTRODUCTION

Proper nutrition during the early neonatal period is the cornerstone for overall development and healthy future of a baby. Breastfeeding, although being the most eminent way of nutrition to a new-born, unfortunately remains a challenge for majority of neonates due to multitudinous reasons, related to both maternal (like postpartum complications, lactation and latching- issues, maternal death etc.) as well as neonatal

factors (premature birth, cleft lip/palate, oral ulcer etc.).² In such critical circumstances, feeding the babies becomes a great challenge. In this process of building a bridge, we require alternative methods of feeding a new born.

Unfortunately, preterm neonates make up a considerable proportion of infants with breastfeeding difficulties and neonatal deaths than the term infants. Major organisations like WHO, UNICEF and BFHI, recommends cup feeding to

the preterm neonates who are unable to breastfeed, thereby facilitating the transition to exclusive breastfeeding.

Paladai, a cup with a long snout, has been in traditional use in India for centuries to feed babies.¹¹ In the field of nursing, there is a huge scope of creative, innovative and improvisation in hospital scenario. Hence variety of feeding tools have been into practice, demonstrating their own pros and cons. But, saving precious mother's milk and effective feeding of neonates are the most economical and wise strategy towards enhancing nourishment of neonates at their golden time of first 28 days of life.

One of a current innovation i.e. the NIFTY (Neonatal Intuitive Feeding Technology) cup (developed by Seattle researchers), was found during the process of extensive literature review in this aspect. The three research studies based on this tool, done till date, have identified it to be more promising than that of medicine cup, paladai and katori-spoon, respectively.^{10,12,13}

The increasing number of preterm babies in NICU and the resulting burden and stress over family and hospital, both economically and psychologically, emphasizes upon need of seeking better solution to accelerate the process of nourishment, growth and development, which eventually reduces length of hospitalization and assist in achieving the targeted neonatal mortality rate by the year 2030.

This study is a small attempt towards analysing whether our traditional feeding cup, i.e. paladai, needs to be replaced by a better and innovative cup like NIFTY cup.

➤ Background

Neonatal death is a global concern. According to **UNICEF 2023 update**, India accounts for nearly one-fifth of the world's annual child births and every minute one of those babies dies due to many reasons¹⁵.

Economic Times of India (2022) reports, India had the highest preterm birth (3.02 million), accounting for over 20 % of total preterm births worldwide^{16,17}. Premature birth was announced to be the 'single largest killer' of under five year children, in India¹⁸.

The availability of general intensive care services are only 0.9 per cent beds per thousand live births in India, a number significantly below the recommended three to five beds for every 10,000 population.¹⁹

Preterm neonates with a greater degree of morbidity are mostly at risk of early feeding difficulties^{20, 21}. The use of artificial techniques to feed infants has a really long history since 2000 BC, as outlined in 'The Global Health Network' (2018), an international publication^{3,13}.

Cup feeding has been into history since the time of ancient Egypt, Greece, and Rome, as well as in some African and Asian countries. In 1990s, cup feeding became more popular in the United States and other developed countries, as

an attempt to avoid nipple confusion in preterm and term infants and promote breastfeeding.

According to the **WHO e-library** of evidence for nutrition actions (eLENA), WHO had initially recommended cup feed, for LBW babies unable to breastfeed in 2011.²²

A **Cochrane systematic review** update done in **2016**, compared cup feeding to that of various other forms of supplemental enteral feeding among those neonates who cannot fully breastfeed.

II. METHODOLOGY

➤ Study Design

This quasi-experimental study evaluates and compares the effectiveness of feeding a neonate by using paladai and NIFTY cup, in two respective groups, by adopting two group post-test only design and quantitatively assessing the proportion of milk wasted (spilled) while feeding and the time taken to feed per ml of milk, in each feeding sessions of both the groups.

➤ Setting and Samples

The study was conducted in NICU and post natal wards of the selected tertiary care hospitals of Western Maharashtra, as per feasibility. Total 86 samples were selected by convenient sampling and then were randomly (lottery method) allocated into two groups, of 43 samples on each arm. The study included all the admitted preterm neonates with postmenstrual age of 32 weeks to 36 weeks + 6 days, indicated for oral feeding using feeding tool and were hemodynamically stable. Exclusion criteria comprised of those on partial gavage feed, respiratory support or severe RDS, cleft lip/palate like oro-nasal deformity and congenital malformations.

➤ Materials, Intervention and Measurements

The tool for data collection was organized into two sections. Section A consisted of demographic variables of neonatal data and Section B dealt with measurement of spillage level and duration, while feeding the preterm neonates.

➤ The Materials used for the Research Intervention were-

- The feeding tools-
 - ✓ Nifty cup
 - ✓ Paladai
- A standard sized gamzee pad (10 cm x 10 cm, impermeable)
- The digital mini-weighing machine (calibrated from NABL accredited calibration laboratory in Pune)
- The timer clock



Fig 1 The Timer Clock

➤ **NIFTY (Neonatal Intuitive Feeding Technology) Cup:**

A reusable cup, made up of soft silicon material with a tiny reservoir at its spout, specially designed to feed breast milk to neonates with breastfeeding difficulties, which allows them to control the pace of feeding. It is a simple to use, easy to clean and culturally appropriate feeding solution which allows the neonate to control the pace of feeding.

• **Salient Features:-**

- ✓ Safe for food contact according to regulation 1935/2004
- ✓ Operating Temperature:-18 °C to +50 °C
- ✓ Storage temperature: -40 °C to +60 °C
- ✓ Not made with natural rubber latex
- ✓ Reusable, boilable and can be autoclaved
- ✓ Millilitre markings on side of the cup is present for milk measurement.
- ✓ Soft silicone material is gentle against the mouth of the infant.
- ✓ Milk can be squeezed easily into the reservoir at the spout of cup, according to the pace of feeding by neonate
- ✓ Mother can express directly into Nifty.

• **Disinfection:-**

- ✓ Reusable for use by multiple new born babies.
- ✓ Suitable for reprocessing with any of the following methods:-

- ✓ Steam autoclaving at 136 °C, 10-20 minutes
- ✓ Chemical disinfection with 0.5% chlorine solution, 20 minutes, and rinsed 3 times with clean water afterwards
- ✓ Boiling in water, 10 minutes

Though internationally, it is available with varying capacity of 20 ml, 40 ml or 60 ml, but within India, only 40 mL volume is available. So, in this study, NIFTY cup of 40 ml capacity has been used.



Fig 2 NIFTY Cup

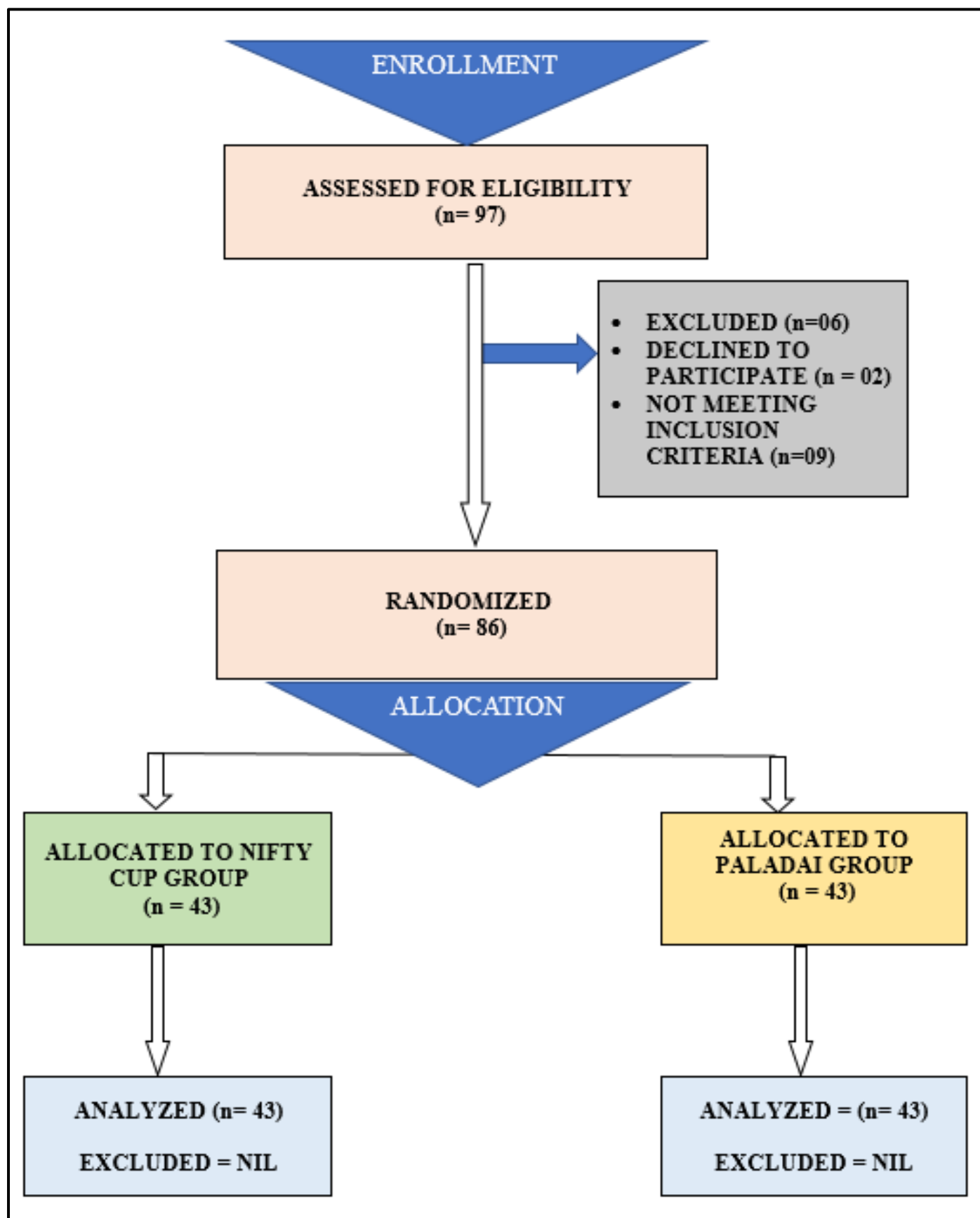


Fig 3 CONSORT Diagram

The steps of feeding intervention while data collection, included mainly three procedures- cleaning/sterilization of feeding tool, expression of breast-milk (either manually or by

using breast pump) and then feeding of neonates using the allotted feeding tools, namely- nifty cup or paladai.

Table 1 Steps of Paladai/ NIFTY Cup Feeding

- a) The weight of the dry gamzee-pad is measured and recorded by the researcher, on a high precision (0.01g) digital weighing machine.
- b) Place the neonate in up-right posture on lap.
- c) Check whether the neonate engages actively into non-nutritive sucking on stimulation.
- d) Keep a gamzee pad around the neck, for the spillage
- e) Take the required amount of expressed breast milk by using a clean syringe
- f) Fill the feeding tool (paladai or the Nifty cup) with milk little short of the brim.
- g) Hold the feeding tool from the sides (so that your fingers do not come into contact with the milk)
- h) Place the paladai tip at the lips of the baby in the corner of the mouth and start the timer.
- i) Tilt to pour a small amount of milk into the mouth
- j) Feed the neonate slowly, so that he/she swallow the milk.
- k) Repeat the process until the required amount has been fed.
- l) Weigh the weight of the wet gamzee, to estimate the amount of spillage.
- m) While estimating the milk intake, deduct the amount of milk left in the cup and the amount of spillage.
- n) Feed the balance milk to the baby, as per advised volume.
- o) Wash the feeding tool with soap and water and then put in boiling water for 20 minutes to sterilize before next feed.

Prior to the intervention, the NICU staffs were made acquainted to the technique of feeding by NIFTY cup, through a video by the laerdal company (the producer of NIFTY cup) .⁸⁸ The enrolled neonates were being fed for 2 days with the assigned feeding tool and then on the third day of feeding, the data was recorded. The research intervention

was performed during morning and evening feeding sessions by the shift-wise available trained NICU staff, while the recording of weight and time, was done by the investigator. The obtained data was organized on a master data sheet. Appropriate data analysis method was carried out.



Fig 4 Paladai/NIFTY Cup Feeding by a Trained Nicu Staff

III. STATISTICAL ANALYSIS

➤ The Following Statistical Tests were used to Evaluate outcome of the Research Intervention.

Table 2 Statistical Tests

S. No	Data Analysis	Method	Remarks
1.	Descriptive analysis	Frequency distribution, percentage, SD and the mean	To explain the demographic variables and compare mean spillage and duration of the two groups.
2.	Inferential statistics	Chi- square	To verify the homogeneity of the two groups.
3.	Inferential statistics	Unpaired t- test	To evaluate and compare the statistically significant findings in terms of mean spillage and mean duration of feed, between the two groups
			To associate the mean spillage and mean duration of feed with the demographic data having two variables.
5.	Inferential statistics	One way ANOVA test	To associate the mean spillage or mean duration of feed with the demographic data having more than two variables

Table 3 (a): Comparison of mean spillage while feeding with NIFTY cup and paladai (n=86)

Parameter	NIFTY Cup (n=43)		Paladai (n=43)		t Value	p Value
	Mean	SD	Mean	SD		
Proportion of spillage (%)	13.85 %	4.32	19.26 %	5.42	5.113	<0.001

$$t(0.05, df 84) = 1.990$$

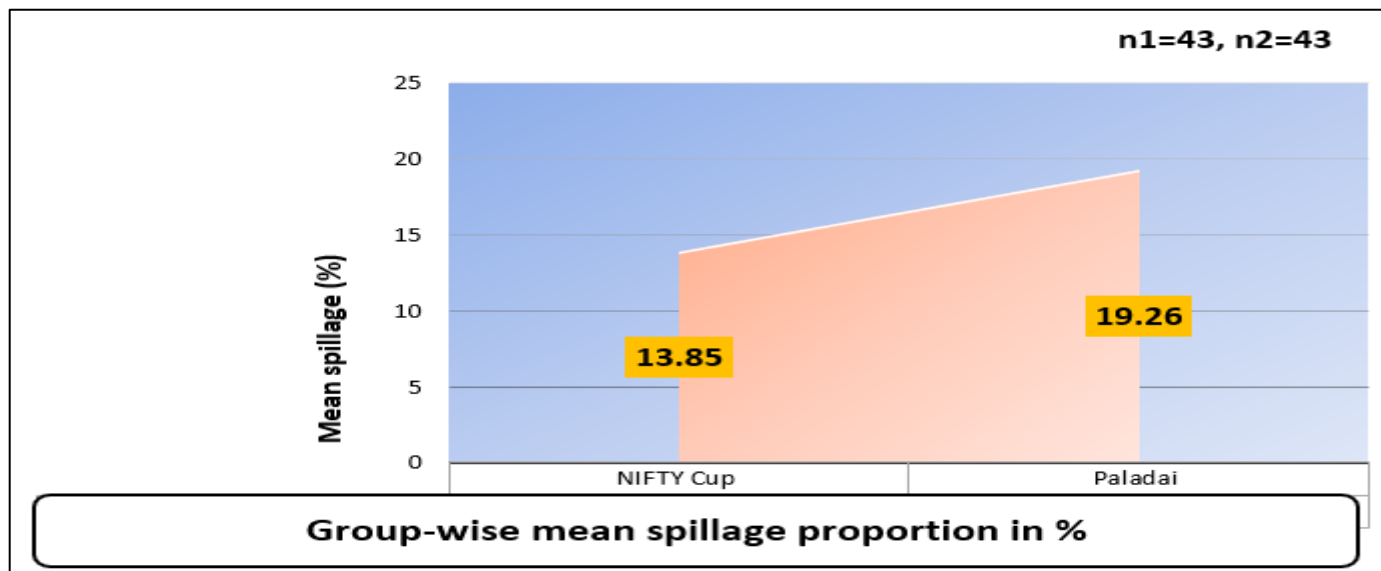


Fig 5 (a): Comparison of mean spillage while feeding with NIFTY cup and Paladai

Table 3 (a) and figure 5 (a) outlines comparison of the mean proportion of milk spilled while feeding the subjects, using NIFTY cup and paladai in their respective groups. As we can infer from the figure, in NIFTY cup group, the mean proportion of spillage while feeding the subjects was 13.85 % whereas, in paladai group it was 19.26 %. After statistical analysis, the student's t-test value was extrapolated as 5.113, which exceeds the critical value of t-test (i.e. 1.990) for degree of freedom (df) 84 and 5% significance level. So, we

can reject the null hypothesis and infer that there is statistical difference in the spillage level between the two groups. Further, the p-value is <0.001, which indicates stronger evidence against the null hypothesis. Therefore, this lesser spillage level in NIFTY cup group, than that in paladai group has statistical significance.

➤ *Section 4.4 (b): Comparison of mean duration of Feeding while using NIFTY Cup and Paladai*

Table 3 (b): Comparison of mean duration of feeding while using nifty cup and paladai (n=43)

Parameter	Nifty cup (n=43)		Paladai (n=43)		t Value	P Value
	Mean	SD	Mean	SD		
Duration of feeding (Sec/ml)	18.00	5.85	19.18	6.85	0.863	0.391

$$t(0.05, df 84) = 1.990$$

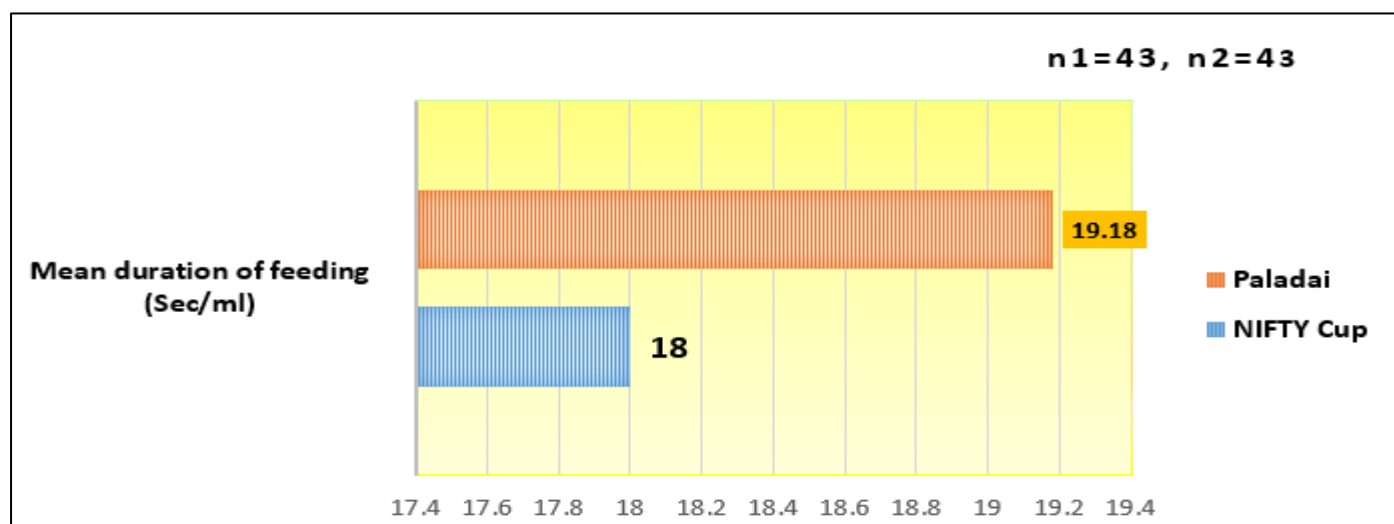


Fig 5 (b): Comparison of mean duration of feeding while using NIFTY cup and paladai

Table 3 (b) and figure 5 (b) depicts the comparison of mean duration of feeding time taken by subjects of both the groups. The subjects in NIFTY cup group took a mean duration of 18 sec per ml of feed (equivalent to 3.3 ml/min) whereas those in paladai group took 19.18 sec per ml of feed (equivalent to 3.12 ml/min). This finding was tabulated on SPSS 23 software and the obtained t-test value was 0.863, which exceeded the critical table value of t-test (1.990) for 84 degree of freedom and 5% level of significance, but since the p value i.e. 0.391 is greater than the significance level i.e. 0.05, we fail to reject the null hypothesis at 95 % confidence interval.

IV. MAJOR FINDINGS OF THE STUDY

➤ Demographic Variables

- The gender distribution of the 86 samples, conveys the male and female frequency were comparatively same in both the groups. However, total frequency of females (51.2 %) were slightly more in number than the males (49.8 %).
- Out of 86 samples, the majority of the subjects were of low birth weight category i.e. 54 (62.8%), followed by that of normal birth weight (4.6 %) and very low birth weight (32.6 %) category. The number of subjects with LBW, in the NIFTY cup was 23 while in paladai group was 31. The subjects of normal birth weights in the two groups were 17 and 11 respectively, followed by those with VLBW which included 3 and 1 subjects respectively.
- 26 % of the subjects were late preterm in NIFTY cup group compared to 19 % in paladai group. Then, 81 % of the subjects in paladai group were of postmenstrual age 32 to 36 weeks and 6 days (moderate preterm), while in NIFTY cup there were 74 % of the same category. Overall, majority of the subjects were moderate preterm (78 %), while the rest were late preterm (22%) in the study.
- Majority of the subjects before enrolment were on paladai feeding (50%), while remaining practiced diverse methods of feeding before getting enrolled into the study.

➤ Comparison of Feeding Effectiveness between the Two Groups

- The mean spillage proportion in NIFTY cup group was 13.85 ± 4.32 %, while that in paladai group was 19.26 ± 5.42 %. So, the difference in the mean spillage level between the two groups was 5.41 ± 1.1 %. The obtained value of unpaired t-test exceeds the table value, inferring a statistically significant comparison. Moreover, the p value being <0.001 , depicts higher chances of this result to be significant with 5 % level of significance and 95 % confidence interval.
- The mean duration of feeding in case of NIFTY cup group is 18 ± 5.85 sec/ml (equivalent to 3.3 ml/min) and that with paladai is 19.18 ± 0.863 sec/ml (equivalent to 3.12 ml/min). So, the difference between the mean values between both groups was 1.18 ± 1 . The unpaired t-test value extrapolated on statistical software was 0.863, which is less than the table value of 1.990. This implies

we cannot reject the null hypothesis, and so there is no significant difference between the two groups on this aspect.

However, the degree of dispersion around the mean value in case of NIFTY cup group is relatively less than that in paladai group, so we can conclude its obtained data to be more consistent and generalizable than the other group.

Hence, NIFTY cup group maintained consistently lesser duration of feeding compared to paladai group, still the duration of time taken to feed using both tools, but still NIFTY cup group maintained consistently lesser duration of feeding compared to paladai group.

Therefore the final interpretation drawn in context to overall effectiveness can be deduced in favour of NIFTY cup compared to the paladai group.

V. COMPARISON OF MAJOR FINDINGS OF THE STUDY WITH OTHER SIMILAR STUDIES

➤ Effectiveness of NIFTY Cup while Feeding Neonates.

NIFTY cup being newly designed cup, has undergone only three validation studies. All the three studies, aimed to compare this cup to familiar feeding tools of our society, namely- a paladai, katori-spoon and medicine cup respectively.^{10, 12, 13}

In the present study, preterm neonates of group 1 were administered feed using NIFTY cup. As mentioned in the major findings, the level of spillage in this group was 13.85 ± 4.32 %, out of the total feed intake. Further, the ultimate result of this study, affirms that effective feeding was achieved by NIFTY cup group, when compared to the other group.

Similar result is shown in the very first random clinical trial on NIFTY cup by **McKinney CM et al**, which was conducted during Aug 2017 to Sept 2018, in case of preterm neonates of a tertiary care hospital of Ghana, West Africa. The study aimed to compare NIFTY cup to a medicine cup. The methodology of the study was same as the present study in which the spillage is quantified using digital weighing machine and a standard sized baby bib. Also, the time taken for feeding was recorder by using a timer clock.

The spillage level recorded in this RCT, was 8.9 ± 6.7 % with NIFTY cup, which is numerically not identical but close to the spillage proportion in present study, i.e. 13.85 ± 4.32 %, but the spillage level by NIFTY cup, in contrast to the comparing feeding tool in the respective studies (i.e. medicine cup in similar study and paladai in the present study) was reported to be lesser. However, unlike present study, this difference was not statistically significant in the similar study, at $p = 0.35$ with 95 % CI.

The frequency of participants experiencing feeding duration greater than 20 minutes, was assessed in the similar study, which did not show significant variation in both the groups (i.e. 31.5 % in NIFTY cup group versus 28.6 % in

medicine group, at $p = 0.26$). Similarly, in the present study also the variation between the feeding duration, though favoured NIFTY cup, but was not statistically significant.

Further, the preference assessment performed using Likert scale also favoured NIFTY cup, by being preference for 85 % (versus 57 % in the other group) of the total participants in the similar study.¹²

Hence, in gist, the overall assessment concluded that both the studies found NIFTY cup to be comparatively more effective feeding tool.

Christy M. McKinney et al, conducted an interviewer-administered survey in 2019 at Sri Ramachandra Medical College and Research Institute, using subjective assessment tool of acceptability (in English and Tamil) based on 10 parameters- spillage, regurgitation, feeding takes too long, difficult to do, infant gagging, infant irritable, insufficient, injury, cost and cleaning. It aimed to compare the NIFTY cup to paladai (which is commonly utilized for feeding in India).

So, contrary to the present study which approaches to evaluate effectiveness in objective terms, this similar study by **McKinney et al**, evaluates the same parameters (spillage and duration of feeding), in subjective terms.

Only 32.6% and 27.6 % of the caregivers and health professionals respectively, reported significantly more spillage with NIFTY cup (at $p < 0.01$). So, majority of the participants reported favourable response towards acceptability of NIFTY cup in context to preventing spillage. This ultimate inference of both the studies were same, by reporting statistically significant spill over of feed by using NIFTY cup.

Further, in terms of feeding duration, majority of the caregivers (52.4 %) and the health professionals (37.9 %) reported that paladai takes longer feeding time than the NIFTY cup (with $p < 0.01$). In contrast, the feeding duration was statistically not proven to be significant in the present study.

Hence, in gist, similar to the present study, the overall conclusion drawn is parallel to this similar study, showing greater effectiveness of feeding with NIFTY cup.¹⁰

In an another study (in 2022) based on NIFTY cup, which aimed to compare it with katori-spoon method, at Neonatal unit of Nehru Hospital, PGIMER, Chandigarh, India, conducted by **Kalyan G et al**, although there was no assessment done in context to spillage level or duration of feeding, however, the findings revealed that neonates in the Nifty cup group reached earlier full breastfeeds than those in the Katori-spoon group, with a mean difference of **12.6 days**. Neonates experienced less vomiting (9.4%) with NIFTY cup compared to the Katori-spoon group; and **both mothers' and nurses'**, found breast milk expression and feeding with the NIFTY cup to be more convenient (than katori-spoon).

Hence, the overall conclusion stands same as the present study, inferring preference towards NIFTY cup.¹³

➤ *Effectiveness of Paladai while Feeding Neonates.*

In the present study, the mean spillage proportion obtained was 19.26 ± 5.42 % and the duration of time taken was 19.18 ± 6.85 seconds per ml of feed administered.

A similar kind of RCT, conducted by **Thandaveshwara D. et al**, published on journal of Breastfeeding medicine in Mar 2022, compared volume of milk spilled over and the time taken, during oral feeding with paladai and syringe feeding methods, to preterm babies. The investigator followed similar method of data collection, as in present study. The median spillage volume was 3.33 mL while paladai feeding and 3.23 mL with syringe feeding. However the spillage was not statistically significant. But contrary to this, in the present study the mean proportion of spillage (%) has been recorded as 19.26 ± 5.42 %, which is statistically significant.

The median duration in the similar study was 3.57 minutes in the paladai group and 3.5 minutes in the syringe group, which is not significant. So, both the studies (similar study and the present study) shared similarity in not giving significant result regarding the feeding duration or rate.

The feeding satisfaction by the selected 75 nurses recorded using 5 point Likert-scale, demonstrated greater satisfaction while syringe feeding than paladai feeding.⁶⁷

Hence, the overall inference drawn, concludes paladai feeding did not prove effective feeding, when compared to the other feeding tool being compared in respective studies.

In yet another study, by **Santanu Deb et al**, conducted at Nazareth Hospital, Shillong, India in July 2020, compared paladai to katori-spoon method for feeding low birth weight neonates. This randomised cross sectional study, did not give significant difference between the two feeding methods, in terms of mean weight gain, mean spillage, mean time taken to achieve breast-feeding and complications. The mean spillage by using paladai was 0.629 grams and by katori-spoon was 0.617 grams. The feeding duration was not studied in this research.

Further, Nurses expressed that paladai was preferred in prospect of logistical management while katori – spoon, was convenient in preparation of articles and acceptability.⁶⁸

Hence, the present study contrast this study by not giving significant spillage difference in paladai group, but is in congruence to it by showing that paladai feeding method had no prominent effectiveness over the second feeding method of respective studies.

Chandra K. Natarajan et al, in a cross sectional study, evaluated the performance on paladai feeding of preterm infants with Broncho pulmonary dysplasia (BPD), in a neonatal unit of North India, during 2019. They studied PMA at first successful feed, proficiency (during only active feeding) and efficiency (during total duration of feeding),

proportion of feed accepted and the heart rate and SpO₂, while paladai feeding. Though study did not specified the mean spillage during Paladai feeding sessions but it was comparable between the BPD group and the 'No BPD' group and was not significant.

Hence concluding that paladai feeding is equally effective for both BPD and non- BPD neonates.⁷⁰

In a similar RCT, comparing palady to cup feeding by **Marofi, et al** in NICU of Al-Zahra and Shahid Beheshti hospital, Isfahan, Iran, during May to Sept 2014, 69 samples of preterm babies. The investigators did not compare the effectiveness of feeding on the same parameter (spillage & feeding duration) as the present study but do study other parameters over longer research period, like the length of hospitalization, time period taken to achieve full oral feeding, weight gain and the association between age of preterm and the effectiveness. The result outcome favoured Palady group, by giving significantly shorter mean hospitalization time (30.4 days) compared to the cup group (39.01 days), reaching earlier full oral feeding (24.1 days) than the cup group (33.7 days), attained significantly greater weight gain (198.8 grams) compared to the cup group (146.7 grams). The investigator concluded that paladai feeding can be effective in premature neonates with gestational ages over 30 weeks and physiological stability.⁷²

Similarly, **S. Dalal et al**, in his published article on the international journal of Acta paediatrica, in Jan 2013, supported paladai for effective feeding by 30 weeks of PMA.

Although the study assessed the gestation age- wise proficiency of paladai feeding but did not specify it numerically. The significant findings unfolded that the median proficiency increased from 5.5 to 10.1 mL/min (28 to 30 weeks) and 6.2 to 11.5 mL/min (31 to 32 weeks) in groups.¹¹

This finding was close to the mean feeding duration in present study i.e. 19.18 sec/ml (equal to 3.3 ml/ min) in paladai group.

Also, our textbooks of *AIIMS Protocols in Neonatology and Essential Paediatrics* by Om P. Ghai, illustrate (using flow-chart), on paladai feeding for preterm neonates during transition phase between gavage feeding to exclusive feeding. It also describes the steps of paladai feeding, including process of sterilization^{73,74}

➤ Comparison of Effectiveness while Feeding with NIFTY Cup and Paladai.

Only one study has been performed till date to compare NIFTY cup and paladai, in context to effective feeding. Moreover, the present study is one of its own kind with novel approach of proportionately quantifying the spillage level and rate of feeding in each session, to evaluate in objective terms, unlike the similar study conducted by **McKinney et al**, in which subjective assessment of the participants have been done on the basis of interview oriented survey at Sri Ramachandra Medical College and Research Institute in

2016, after feeding intervention with both, NIFTY cup as well as paladai, by the participants. The questionnaire were based on 10 parameters- spillage, regurgitation, feeding duration, difficulty level, infant gagging, infant irritability, feed insufficiency, injury, cost and cleaning.

Unlike, the present study the sample size was larger in this similar study, with total 43 caregivers and 28 health care providers. Also, the feeding intervention included all with their infants of less than 12 month age, and not only preterm neonates, as in case of present study.

The result reported that, 65.1% of caregivers and 50 % of the health care providers, perceived more spillage with paladai while only 32.6% and 27.6 % of them respectively, reported more spillage with NIFTY cup. Further, in terms of feeding duration, majority of the caregivers (52.4 %) and the health professionals (37.9 %) reported that paladai takes more feeding time than the NIFTY cup. These findings were statistically significant at $p < 0.01$. So, majority of the participants were favourable perception towards NIFTY cup in terms of spillage and feeding duration.¹⁰

Hence, although statistical significance in terms of spillage can be proved in both the studies but in terms of feeding duration, this significance is seen only in similar study and not in the present study.

VI. SUMMARY OF THE STUDY

The present study was conducted on selected preterm neonates of PMA 32 weeks to 36 weeks & 6 days, admitted at the selected tertiary care hospitals of Western Maharashtra, with an aim to assess the effectiveness of using NIFTY cup versus paladai for feeding neonates.

It was an experimental study with a quantitative approach, implemented on total 86 samples, eligible as per the inclusion and exclusion criteria. These samples were randomly allocated into two groups of NIFTY cup and paladai respectively. The data collection was done during Sept 2023 to Nov 2023. The research intervention was performed during morning and the evening routine feeds of third day of feeding, to each subjects. Each feeding session lasted within 20 minutes duration (maximum). The intervention was done by trained NICU staff, shift wise, for all the samples. The recordings of the time (in seconds) and the weight of gamzee before and after spillage was done by the researcher.

The digital, mini-weighing machine used for the study was, calibrated and certified for its validity and reliability, by an accredited laboratory of Pune, before the data collection. The master sheet of the obtained data was compiled and organised for analysis cum interpretation.

The important findings of the study revealed the overall interpretation about effectiveness. It can be stated that though there is no significant difference in the rate of feeding, using both tools, but proportion of spillage in both the groups have significant difference. The NIFTY cup resulted into less

spillage than that of paladai, hence is more effective than that of paladai.

VII. IMPLICATION OF THE STUDY

Since an intense emphasis is made on the preventive and promotive aspects of health care, in our modern era, there exist a huge implication of such studies which are performed for seeking improvement in feeding tools and techniques, in order to facilitate adequate nourishment to the neonates and combat increasing mortality rate of new born babies, which is one of a major concern world-wide. The results of the present study have manifold implications in the field of nursing, including nursing practice, nursing education, nursing research and nursing administration.

➤ *Implication in Nursing Practice*

Since many mothers' experienced smoother and effortless and enjoyable experience while using NIFTY cup in terms of expressing milk directly into the cup, the volume measurement, control in the pace of milk flow to baby's mouth, hence it can be practiced by any less experienced mothers too.

An updated tools and technology, which may bring amazing impact on saving lives of helpless babies, through small change or attempts, must be encouraged into clinical practice.

The innovative cup like NIFTY cup has been designed, integrating the art and science of feeding a neonate, such that it curtails the common feeding issues like adequacy, spillage, oral injury, regurgitation and proper control in the pace of milk flow. The reusable and durable (as it is heat and UV resistant) feature of NIFTY cup makes it safe to extensive use.

Nurses should act as a collaborator and encourage the primary care givers by facilitating the feeding experience and inculcating interest in feeding their neonates by themselves with the use of such innovative tools.

➤ *Implication in Nursing Education*

The future nurse educators and nursing care providers are the present nursing students.

Although breast feeding is the best way to nourish neonates, but nursing students must act practically to situations where breastfeeding is a real challenge, especially in case of premature babies due to physical and physiological compromise. Also, many a times there arise issues with lactation and expression of breast milk, which makes every drop of it very precious.

Hence, nursing curriculum should be planned, in such a manner that the students get sensitized about the neonatal incompetency in breastfeeding and various problems faced by the mothers while breastfeeding, to ignite their minds to seek for better feeding tools and techniques- a scientific approach of utmost significance in saving lives of the most vulnerable neonates and improve neonatal mortality rate from 20 in 2020 to 16 or 18 by 2025.¹⁴

Further, that students can facilitate and develop confidence of mothers in feeding their neonates by themselves.

A nurse educators should encourage the students to utilize research based practices.

➤ *Implication in Nursing Administration*

The findings of the present research will appraise the nurse administrator regarding the need for choosing a better feeding tool, which may lead to better outcome in health condition of admitted neonates and eventually result into lesser hospital stay, thereby reaching out to a cost-effective and economical step.

A nurse administrators can encourage further researches as per recommendations and are at a pivotal position to formulate policies and implementation of evidence-based practice in clinical settings.

➤ *Implication in Nursing Research*

The research studies not only provide information but also update the existing knowledge about any subject.

Extensive review of literature explicit the need to seek for much better techniques in the field of feeding and nutrition, for preterm neonates, especially in India (having the highest number of preterm babies). The researcher of the present study has put forth, an attempt to evaluate outcome of a new feeding cup (NIFTY cup), which affirms to be a promising and an innovative technology to overcome the difficulties related feeding babies^{10,12,13}. However, scarcity of evidences on NIFTY cup, indicates need for more studies.

Hence, more research studies on competent feeding cups, must be conducted, the outcome of which, will provide a framework for getting an insight of how we can help our neonates and enable them to grow and reach early exclusive breast feeding.

This research also serves as an evidence based guide to inform quantitative spillage level and feeding rate that can be anticipated in future.

VIII. LIMITATIONS OF THE STUDY

- The assessment parameters used in the study are spillage proportion and feeding duration/rate. However, other parameters like time/days taken for transition from gavage feed to exclusive breastfeed (or full oral feed), total period of hospitalization, gain in weight of babies, incidences of oral injury, regurgitation etc. could be studied over wide spectrum of neonatal population, over extensive research period in future.
- The sample size of the study was not adequate enough, which limits its generalization to general population.

➤ *Strength of the Study*

- Since only quantifiable and objective parameters of data collection (i.e. spillage level and the time taken) has been assessed therefore bias is not significant in the study.
- Only preterm neonates, with statistically homogenous groups have been studied, for better generalization.

IX. SUGGESTION AND RECOMMENDATION

Based on the present study, the researcher suggests and recommends that more researches can be implemented, considering the other parameters also, like time/days taken for transition from gavage feed to exclusive breastfeed (or full oral feed), total period of hospitalization, gain in weight of babies, incidences of oral injury, regurgitation, physiological stability etc. can be studied in near future, over wide spectrum of neonatal population, over extensive research period, to evaluate whether significant variation can be brought in context to these parameters (which are crucial to early neonatal period). This will satisfy generalizability and provide a framework for establishing standardized protocol in near future.

X. CONCLUSION

The study is based on comparison of effective feeding achieved by using two different feeding tools- one being an innovative tool undergoing validation (i.e. NIFTY cup) while the other being the most commonly adopted feeding tool at NICU settings of India (i.e. Paladai). The chapter covers the discussion of the major findings, its comparison to the similar studies, nursing implications of the present study, summarization of entire study, limitations and strengths of the study and finally the suggestion and recommendation for future researches.

The findings revealed that though there is no significant difference in the rate of feeding, using both tools, but proportion of spillage in both the groups have significant difference at 5 % level of significance with 95 % confidence interval. The NIFTY cup resulted into less spillage than that of paladai, hence is more effective than that of paladai.

Further, it was also observed by the investigator that mothers and the nursing staff shared an interesting experience with NIFTY cup. It was not only an easy, convenient and controllable feeding experience but also enjoyable.

Since NIFTY cup is newly introduced feeding tool, it has undergone only three researches out of which only one research has compared it with paladai, as in case of present study. However, the similar study was a survey whereas the present study has an experimental approach. Extensive review of literature explicit the need to seek for much better techniques in the field of feeding and nutrition, for preterm neonates, especially in India (having the highest number of preterm babies). The researcher of the present study has put forth, an attempt to evaluate outcome of a new feeding cup (NIFTY cup), which affirms to be a promising and an innovative technology to overcome the difficulties related

feeding babies^{10,12,13}. However, scarcity of evidences on NIFTY cup, indicates need for more studies.

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