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Original Research Article

Comparison between Nifty Cup Feeding and Katori Spoon Feeding in Pre-term Low Birth Weight Neonates: A Randomized Controlled Study

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Abstract:

Introduction: Preterm neonates are unable to feed directly from the breast and have feeding difficulties due to lack of coordination between respiration and sucking-swallowing. Nifty cup is an affordable and simple feeding cup designed to optimize feeding in preterm neonates with breastfeeding difficulties. Aim: The aim of the study was to assess the acceptability of Nifty cup among care providers in the feeding of preterm neonates in resource poor countries.

Method: A randomized controlled study was done in 2 groups of preterm neonates fed by Nifty Cup(test group) and conventional Katori-spoon (control group). A pre-validated questionnaire was used to assess the caregiver's (mothers/nurses) perception of ease and comfort of use of the feeding tools, spillage, ability to control pace of feeding, time taken in feeding, easy maintenance of the feeding tools and acceptability of the feeding methods. the grading of acceptability was considered as good (+3), fair (+2) and not acceptable (+1).

Result: Care providers found Nifty cup to be more acceptable as compared to Katori spoon feeding (p-value <0.05. However, there was no significant difference in growth velocity of the neonates between Nifty cup and Katori spoon groups.

Conclusion: Nifty cup was more acceptable to care providers than traditional Katori-spoon for feeding of preterm neonates.

Keywords: Nifty Cup, Katori-Spoon, Preterm Neonates, Acceptability.

Introduction

The overall burden of low-birth-weight neonates is 15-20 % of all live births, the majority being developing and resource-poor countries. [1] Preterm neonates are unable to feed directly from the breast and have feeding difficulties. This is due to lack of coordination between respiration and sucking-swallowing. Even the late preterm neonates (>34 weeks to <37) also suffer from feeding difficulties. This is due to some sort of delayed adaptation in these neonates coupled with poor sucking efforts and maternal worries which may lead to inadequate feeding.

In such cases, alternative feeding techniques such tube feeding, bottle feeding, spoon feeding, and cup feeding are used until they are term or mature enough to efficiently breastfeed. [2] Feeding neonates via katori-spoon or paladai requires expertise to coordinate feeding with sucking efforts of the baby. [3] Besides, even though different oral feeding techniques are employed in various cultures, no standard cup is available till now.

To overcome the problem of feeding of preterm neonates, Laerdal Global Health has designed a feeding cup called Nifty Feeding Cup. [4] The Neonatal Intuitive Feeding Technology (Nifty) cup was originally designed by Collaborators from the University of Washington, School of Dentistry, the Program for Appropriate Technology in Health (PATH), and Seattle Children's Hospital. [5]

The Nifty cup is made of soft silicone material and has a capacity of 40 ml. Its ergonomics and design optimize the feeding experience for the preterm neonates by making it easy to control milk flow and pace the feeding. The design also makes it easy to clean and prevent injury to the neonates. It is also is large enough for direct collection of breast milk when manual expression is done. It minimises spillage, duration of feeding and regurgitation as

compared to katori-spoon feeding. It is thus an affordable and simple feeding cup designed to optimize feeding in preterm neonates with breastfeeding difficulties.

The aim of the study was to assess the effectiveness and acceptability of Nifty cup, a simple and affordable feeding tool which has the potential of creating a sea change in the feeding of preterm neonates in resource poor countries.

Materials and Methods

A randomized control study was conducted between December 2020 to March 2022 in the Department of Paediatrics of a tertiary care hospital. Eighty-four new-born babies of gestational age 32 - <37 weeks or birth weight less than 1800 grams with inadequate breastfeeding or difficulty in breastfeeding were included in the study. Sick new-borns with prohibited feeding (nil per orally) and those with congenital anomalies like orofacial (cleft palate, cleft lip) anomalies, tracheoesophageal fistula and GI malformations were excluded from the study.

After taking consent from the parents, neonates were enrolled in the study. Allocation of the patients to 2 groups (Test Group - Nifty Cup and Control Group - Katori-spoon) was done by simple randomization using computer-generated sequences. The enrolment and assessment of the participants was done by sequentially numbered, opaque, sealed, stapled envelope for the control and test group.

The Nifty cup is a 40 ml silicone-made reusable feeding cup for neonates. It is a small, soft feeding cup with a tiny reservoir at its spout. It has measurement marking and a groove from which the neonate can lap the milk. It is easy to hold in hand (Figure 1). Katori-spoon is reusable steel utensils of variable sizes commonly used in India to feed neonates (Figure 2). The amount of breast milk was measured with a 10 ml syringe while using katori-spoon.

A study proforma was used to fill the sociodemographic and clinical profile of the neonates. The study proforma also included details of the amount of milk consumed by the baby; time taken for each feed (in minutes) and time taken to achieve full feeds were recorded. This was done for a total of 3 feeds each day. Spillage calculation of milk (in grams) was also recorded for which dry cotton was used. The dry cotton was weighed before and after feeding on an electronic balance. Nurses or mothers/care givers were initially trained for an accurate method of feeding by the Nifty cup and its maintenance (boiling/autoclaving).

A pre-validated questionnaire was used to assess the caregiver's (mothers/nurses) perception of ease and comfort of use of the feeding tools, spillage, ability to control pace of feeding, time taken in feeding, easy maintenance of the feeding tools and acceptability of the feeding methods. [6] On the basis of these parameters, grading of acceptability was considered as good (+3), fair (+2) and not acceptable (+1). Kangaroo mother care and non-nutritive sucking also continued to be implemented as per standardized protocol of care of preterm neonates in our nursery. Fenton chart was used to assess the growth velocity weekly. [7]

Figure 1: Nifty Cup feeding

Figure 2: Katori spoon feeding

Statistical Analysis

The data was entered into the Microsoft Excel Version 2017 (Microsoft Corporation, New York, USA). The statistical analysis was performed by Statistical Package for the Social Sciences (IBM SPSS Statistics for Windows, Version 22.0. Armonk, NY: IBM Corp.). Normality of each variable was assessed by using the Kolmogorov-Smirnov test. Quantitative data was expressed by mean and standard deviation or median with interquartile range. Difference between the two groups was tested by Student T test or Mann Whitney U test. Qualitative data was expressed in percentage and difference between the proportions was tested by Chi square test or Fisher's exact test. A 'p' value of less than or equal to 0.05 was considered statistically significant.

Results

A total of 109 preterm infants were enrolled in the study. Among those enrolled, 84 were analysed for the primary outcome on completion of study.

Flow diagram depicting eligibility assessment, allocation, randomisation, and analysis (Figure 3).

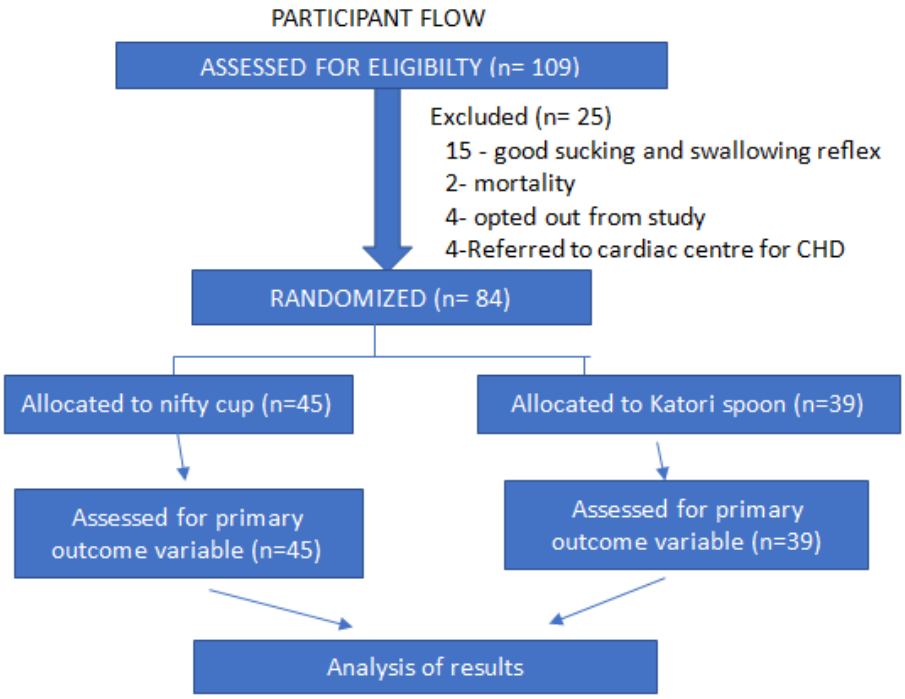

Figure 3: Showing participant flow and flow of study

Table 1 shows the demographic profile of the study population. There was significant difference in the mean average time for feeding and mean amount of spillage between Nifty cup and Katori spoon (p-value <0.05) (**Table 2**).

Table 1: Distribution of study population as per gestational age and mode of delivery

Variables		Frequency (N)	Percentage (%)
Gender	Male	50	59.6
	Female	34	40.4
Gestational age	28 - 30	13	15.5
	30.1-32	20	23.8
	32.1-34	33	39.3
	34.1-36	18	21.4
Birth Weight	< 1.0 kg	2	2.4
	1.0 -1.5 kg	11	13.1
	1.5 Kg - 2.0 kg	51	60.7
	2.0 - 2.5 kg	17	20.2
	>2.5 kg	3	3.6
Mode of delivery	Caesarean Section	53	63.1
	Vaginal Delivery	31	36.9

Table 2: Comparison of the 2 feeding tools in relation to average time taken for feeding and amount of spillage of milk

Variable	Feeding					
	Nifty cup		Katori spoon			
	Mean	Std. Deviation	Mean	Std. Deviation	t-test value	p-value
Average time for feeding	11.16	1.83	14.08	1.80	-3.198	0.002*
Amount of milk spillage	0.19	0.01	0.22	0.02	9.140	0.001*

Table 3: Acceptability and change in growth velocity of neonates in the two groups

Variables		Nifty cup	Katori spoon	χ^2 value	p-value
Acceptability	Fair	7(15.6%)	30(76.9%)	151.318	< 0.001*
	Good	38(84.4%)	9(23.1%)		
	Not acceptable	0	0		
Growth velocity	No change	45 (100%)	39 (100%)	0.000	1.000
	Change	0	0		

Care providers found Nifty cup to be more acceptable as compared to Katori spoon feeding (p-value <0.05) (Figure 4). However, there was no significant difference in growth velocity of the neonates between Nifty cup and Katori spoon groups (Table 3).

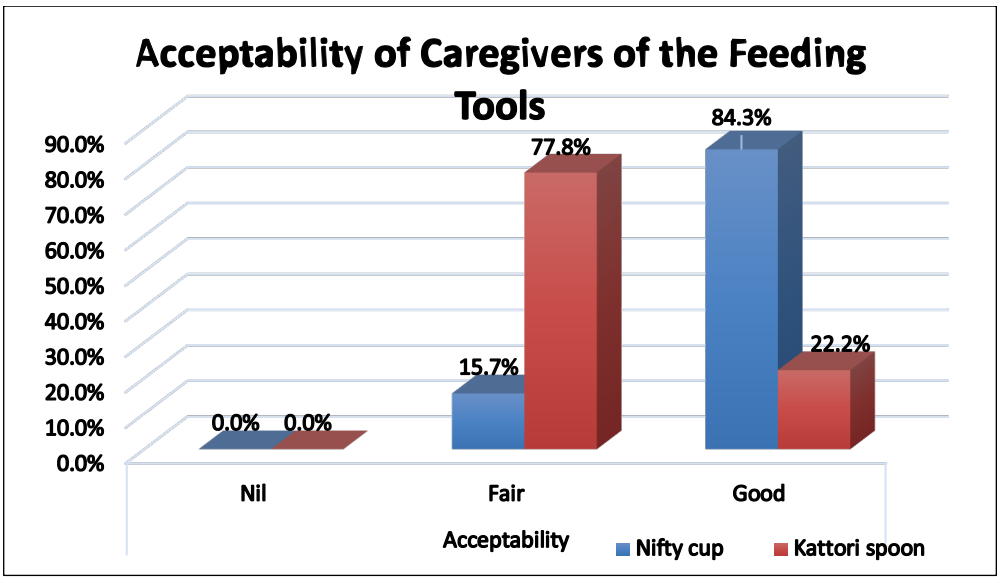

Figure 4: Acceptability of caregivers of feeding tools

Discussion

The World Health Organisation emphasises that ideally all new-borns should be fed breast milk. However, there are many challenges in achieving this goal especially in many million preterm neonates born each year. There is incoordination of sucking swallowing reflexes in these neonates due to prematurity and hence are not able to breastfeed properly.

Feeding these neonates is a big issue especially in developing countries where an alternative feeding method other than bottle-feeding is to be innovated. Alternative feeding techniques are started as soon as possible for preterm new-borns, till the time they are able to begin breastfeeding. The Katori-spoon, the paladai, and the cup feeding methods are some of the alternatives to traditional ways. Each of these methods has their own disadvantages even though they are considered to be superior to bottle feeding. [8,9]

To address this problem, the Nifty cup was developed by Trish Coffey, an expert in neonatal health technologies to facilitate these preterm neonates to drink milk at a pace and flow that each baby establishes. [10] This is possible because of the uniqueness of the cup and the milk flow channels that lets the neonates lap the milk instead it being poured down their throats.

Pilot studies have been done by Dr. McKinney of University of Washington at Sri Ramachandra University in South India. [11] Similar studies were tried out by same investigators in Ghana also. The nifty cup is a relatively new tool for feeding neonates. This is a reusable product designed as a solution for neonates with breastfeeding difficulties. It allows the baby to control the pace of feeding, easy to use and clean and also avoids the wasting of breast milk. They found that it was much easier to feed neonates from the Nifty cup because it was soft and well-designed. They also found that the caregivers accepted it well.

The present study was done to compare the acceptability of the new Nifty cup to the conventionally used method in India of katori-spoon amongst the care providers. The study results showed that the Nifty cup had better acceptability than Katori spoon amongst the care providers as per the questionnaire parameters like spillage, duration of feeding, comfort while feeding, ease of use and maintenance. Out of the enrolled participants, 84.4% of caregivers of the test group found Nifty cup to be a good feeding tool and 23.1% of the control group felt that Katori spoon was a good feeding tool. In a study by McKinney et al. in South India, [11] it was observed that the mothers were comfortable to manually express milk into the Nifty cup with more comfort, ease and confidence.

In their study, comparison of Nifty cup to the paladai (steel cup with spout used for feeding in South India) showed similar results on most feeding parameters like spillage, regurgitation, gag reflex, and damage. Similar to the present study, they also claimed that feeding with the Nifty cup required less time. In the primary point of care for breastfeeding, the Nifty cup scored above the paladai by the caregivers. Similar results were found in another study by McKinney et al in another teaching hospital in Ghana. [5] It was also found that there was less amount of spillage of milk with the Nifty cup (average spillage noted at 0.19 grams) as compared to Katori spoon where the average amount of spillage was 0.22 grams. In a similar study in Ghana5, a randomised cross-over trial comparing Nifty cup with a locally available medicine cup showed that caregivers preferred the Nifty cup over the medicine cup to feed their preterm infant.

However, McKinney et al. [5] in their study found that Nifty cup had superior performance over the medication cup but this difference was not statistically significant. Besides, the investigators were not sure of the amount of spillage and the method used for calculating the spillage. In another study, spillage was as much as 30% for every cup feed [12] the mothers were being regularly monitored regarding the techniques of feeding thereby making them more cautious during the feed and hence again the performance bias can alter the results of the study.

The duration of feeding was also significantly less in the Nifty group as compared to Katori-spoon group as there was no requirement of filling up the cup repeatedly as compared to the Katori-spoon. The Nifty cup had a continuous flow of milk as the cup can be filled up to 40 ml in one go. In a study by Malhotra et al. [13], three methods of feeding preterm neonates - paladai feeding, glass/cup feeding and bottle feeding were compared. The authors concluded that the neonates were able to consume the greatest volume in the shortest amount of time by using the glass or cup, although the risk of spillage was much more.

There was also no significant difference in the growth velocity of the neonates of the 2 different groups which was measured weekly on Fenton's growth chart. In a study by Rocha et al. who evaluated the effects of bottle feeding and cup feeding on oxygenation, weight and growth. Found that there was no significant difference between the two groups during the 1st week of oral feeding. [14] On the contrary to the above-mentioned findings and study, a pilot study was

conducted by Aloysius et al. on preterm neonates concluded that the infant took less amount of milk by paladai as compared to bottle feeding. They also found that paladai feeding took more time to feed which could also lead to less weight gain. [15]

On the contrary, Dalal et al found that the infants accepted paladai feedings in all behavioural states. They also concluded that oropharyngeal ability is possibly influenced more by the postnatal experience than by maturity at birth. [16] The present study found that the transition to breastfeeding from oral feeding completely was dependent on the maturity of the infant and the gestational age. There is no association between the type of feeding and the time taken by the infant to completely start on breastfeeding. In preterm new-borns, the stability and coordination of sucking and swallowing appear to be more influenced by post-conceptional age than by chronological age, suggesting cerebral maturation processes. Similar finding was concluded by Gewolb et also. [17]

In the present study, it was found that Nifty cup could appropriately fit into the WHO recommendations regarding supplemental feeding. [18] However, since the studies we have on Nifty Cup have all been conducted by the original designers themselves, there could be a bias and can affect the generalisability of the results and preference of a particular study tool could be subjective also. Hence, large multi-centric trials where modalities of feeding preterm neonates by methods other than bottle-feeding should be carried out for robustness of the acceptability of the Nifty cup in resource poor countries.

Limitations of the study

Due to the nature of the intervention, blinding was not possible for the participants and assessors. Since there is limited awareness regarding the feeding tool (Nifty cup), it is readily available only at selected outlets in metro cities. Due to limited availability, presently cost is very high ranging 300-700 INR (Indian Rupee) per unit, which may be considered as a limitation for its use in resource-limited settings. Besides, Fenton's charts were used in this study instead of latest intergrowth charts, and hence growth velocity was measured weekly instead of daily weight gain.

Conclusions

The study concluded that Nifty cup was more acceptable to care providers than traditional Katori-spoon for feeding of preterm neonates. Parameters like spillage, duration of feeding, comfort while feeding, ease of use and maintenance were used for assessing the acceptability. Therefore, the Nifty cup has the potential to provide a better alternate feeding method for preterm infants as compared to Katori spoon except for the limitation of its easy availability and the cost of the cup.

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