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Original Article

Effects of Feeding Nozzle and Cup Feeding on Reaching the Time of Full Oral Feeding in the Premature Infants in the Neonatal Intensive Care Unit

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ABSTRACT

***Background*:** Oral feeding problems are among the most common issues in preterm infants. Various methods and feeding support tools are used in this regard, such as cup feeding and feeding nozzle. The present study aimed to determine the preferred method between cup feeding and feeding nozzle to support oral feeding in premature neonates.

***Methods*:** This clinical trial was conducted on 70 preterm infants with the gestational age of 30-33 weeks in Isfahan, Iran. Infants were divided into two groups of cup feeding and feeding nozzle application. The studied variables were the duration needed to reach the time of full oral feeding, weight changes since birth until full oral feeding, and length of hospital stay.

***Results*:** Mean duration to start full oral feeding was 4.03 and 5.1 days in the cup feeding and feeding nozzle groups, respectively (P<0.05). Mean changes in the weight of the neonates since the initiation of oral feeding until full oral feeding was 49.5 grams in the cup feeding group and 89 grams in the feeding nozzle group. Analysis of covariance was performed by adjusting the duration since initiating the intervention until starting full oral feeding, and no significant difference was observed between the groups in this regard (P>0.05). Mean length of hospital stay was 23.1 and 21.9 days in the cup feeding and feeding nozzle groups, respectively (P>0.05).

***Conclusion*:** According to the results, the time needed to reach full oral feeding was shorter in the cup feeding group compared to the feeding nozzle group. However, the mean length of hospital stay was two days shorter in the feeding nozzle group compared to the cup feeding group. Therefore, feeding nozzle could be utilized as a supportive method in the feeding of preterm infants.

Keywords: Breastfeeding, Enteral feeding, Feeding methods, Infant, Iran, NICU, Premature, Weight gain

Introduction

Survival rate of preterm infants has improved with the advances in neonatal special care, as well as the enhanced quality of the treatments of fetal diseases. However, many of these newborns are faced with several medical issues, such as respiratory disorders, instable body temperature, and nutritional complications (1).

Oral feeding problems are among the most common issues in preterm infants, which occur due to underdeveloped oral-motor skills and lack of coordination in suckling, swallowing, and respiration (2). Suckling and swallowing abilities develop by week 28 of the fetal period and are coordinated by weeks 32-34 (3). Suckling and eating abilities of infants are essential their survival and maintenance of their growth aspects (4). It is often stated that premature infants should have acceptable weight gain and proper feeding in order to be discharged. Ideally, these infants should be breastfed or bottle-fed (5). Findings of previous studies have indicated that preterm infants have specific problems in feeding after discharge. As a result, their parents, especially mothers, must

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be able to feed these infants during hospitalization (6-9).

Preterm infants could be successfully breastfed at the gestational age of 32 weeks (10). However, infants aged less than 32 weeks cannot be exclusively breastfed. Consequently, invasive have been proposed in this regard, including the use of feeding tubes or supportive feeding interventions, such as cup feeding, bottle feeding, use of a syringe, and feeding by spoon (11).

According to the literature, despite the advanced natural evolution, preterm infants should be fed before becoming independent in suckling. In addition, the maturity of these neonates along with feeding training might enable preterm neonates to be fully oral fed earlier than the expected time. The mentioned factors highlight the need for early interventions in order to facilitate oral-motor skills in premature infants (12).

In a study, Shamsher et al. (2012) assessed the feeding behaviors and performance of preterm infants on paladai feeding. The mentioned research was conducted on 20 infants with the gestational age of 28-30 weeks. According to the results, the frequency of interventions had a more significant effect on the oral-pharyngeal ability of the neonates compared to their maturity status at birth and gestational age (13).

Cup feeding is a supportive method of feeding, which is applicable in the infants who cannot suckle properly despite having the swallowing ability (14). Infants with the gestational age of 30-33 weeks can usually be fed using a cup. According to the Neonatal Health Department of Iran Ministry of Health, although cup feeding is a suitable method for the feeding of infants, it has some limitations, such as the waste of milk due to dropping from the infant's mouth. Moreover, long-term cup feeding without the effective stimulation of suckling might postpone breastfeeding (15), and the mothers of these infants tend to utilize syringes, which may injure the gums of the infants if the mothers are not able to apply the syringe properly.

Feeding nozzle could facilitate syringe application for mothers without irritating the gums of the infant (Figure 1). Therefore, use of feeding nozzles is considered an efficient approach for the feeding of infants since the tool seems to cause no problems (e.g., milk aspiration). Furthermore,

Figure 1. Infant Feeding by a Feeding Nozzle

the technique might improve suckling in infants (16). Based on the experience of the researchers, feeding by a nozzle is an appropriate substitute for cup feeding and syringe application.

Despite the paramount importance of feeding in premature infants, no studies have investigated and compared the feeding methods in the current literature. With this background in mind, the present study aimed to compare the effects of cup feeding and feeding nozzle on the time required to reach full oral feeding in preterm infants. Our findings could help determine the preferred method, enabling premature infants to receive favorable feeding, which meets their requirements until they are prepared for normal oral feeding and their alimentary system is sufficiently developed.

Methods

This clinical trial was conducted in the neonatal intensive care units (NICUs) of Shahid Beheshti and Alzahra teaching hospitals, affiliated to Isfahan University of Medical Sciences in Isfahan, Iran during June-December 2016. Sample size of the study was calculated based on the following formula:

$$n = (z_{1+}z_2)^2(2s^2)\mathrm{d}^2 n = \frac{\left(\frac{1}{96}+\frac{0}{84}\right)^2(2s^2)}{\frac{0}{49s}^2} = 32$$

By controlling the sample loss, number of the samples was considered to be 10% higher, and 35 subjects were assigned to study group (17). Final sample size included 70 preterm infants with the gestational age of less than 33 weeks.

Infants were divided into two groups of feeding nozzle (intervention) (n=35) and cup feeding (control) (n=35). Subjects were selected via convenience sampling, followed by random allocation.

Inclusion criteria of the study were as follows: 1) gestational age of 30-33 weeks; 2) absence of infectious diseases, chromosome anomalies, cardiac diseases, and intracranial hemorrhage grade II or III; 3) fully conscious neonates and 4) written physician's order for the initiation of oral feeding according to the medical records. Exclusion criteria were the willingness of the parents to withdraw from the study, preterm infants with severe conditions, and death of the newborns.

Data were collected using a questionnaire with two sections, including the demographic data (e.g., gender, postnatal age, mode of delivery, weight of the neonates on the first day of the intervention) and the main study variables (interval until the initiation of full oral feeding, weight changes since the beginning of the intervention until full oral feeding, and length of hospital stay). Demographic data of the subjects were extracted from their medical records or through enquiries with the mothers.

The devices used in the study were finger feeders and cups. A finger feeder is a suitable tool for the infants with suckling problems, which is attached to a syringe. The cups and finger feeders were made of compact plastic and soft silicone, respectively (Medela, Switzerland) in order to avoid oral cavity injuries (16). The finger feeder was considered as a feeding nozzle since we used fingers in its application and it was not merely a connector.

In the present study, full oral feeding was defined as eight times of independent oral milk feeding per day. The times of successful oral feeding were evaluated and recorded daily, and the infants in the intervention and control groups were weighed prior to the study. Afterwards, feeding was performed by the mothers under the supervision and training of the researchers.

On the first day of the study, feeding was repeated three times in each group in accordance with the feeding tolerance of the infants. On the following days, the number of the oral feeding meals increased based on the tolerance of the newborns, and the intervention continued until reaching full oral feeding (i.e., eight times of feeding within 24 hours). All the infants were weighed on the day of reaching full oral feeding.

Statistical analysis

Data analysis was performed in SPSS version 20 using Chi-square, Fisher's exact test, independent t-test, and analysis of covariance, and P-value of less than 0.05 was considered statistically significant.

Ethical considerations

The permit for performing the study was provided by the related organization. In addition, informed consent was obtained from the parents of the neonates, and the study objectives and procedures were explained to the parents as well. Participants were allowed to withdraw from the study at any given time, and they were assured of confidentiality terms regarding their information. This clinical trial has been registered under the code IRCT27294.

Results

According to the results, there were no significant differences between the intervention and control groups in terms of the demographic characteristics, such as gender, postnatal age, post-conceptional age, mode of delivery, and weight on the first day of the intervention (P>0.05) (Table 1).

Table 1. Demographic Characteristics of Infants in Intervention and Control Groups

Variables	Feeding Nozzle		Cup Feeding		χ^2	t	P-value
	N (%)	Mean (SD)	N (%)	Mean (SD)			
Gender							
Male	19 (54.3)	-	16 (45.7)	-	0.51		0.47
Female	16 (45.7)		19 (54.3)				
Postnatal Age (day)	-	13.6 (10.3)	-	14.3 (13.5)		0.24	0.808
Post-Conceptional Age	-	32.9 (3.5)	-	32.1 (0.9)		1.33	0.20
Mode of Delivery	-						
Natural Vaginal	3 (8.6)	-	5 (14.3)	-	-		0.710
Caesarean Section	32 (91.4)	-	30 (85.7)	-			
Weight on First Day of Intervention (g)	-	1488.9 (293.4)	-	1556.03 (372.1)		0.84	0.41

Table 2. Comparison of Time to Reach Full Oral Feeding, Changes in Weight Gain, and Length of Hospital Stay in Intervention and Control Groups

Variables	Feeding Nozzle	Cup Feeding	t	P-value
	Mean (SD)	Mean (SD)		
Time to Reach Full Oral Feeding (since the first day of intervention) (day)	5.1 (2.7)	4.03 (1.6)	2.13	0.04
Changes in Weight at Time of Full Oral Feeding (compared to initial weight) (g)	89 (18.4)	49.5 (12.1)	3.72	0.0001
Length of Hospital Stay (day)	21.9 (11.4)	23.1 (15.02)	0.33	0.708

According to the information in Table 2, mean duration for the initiation of full oral feeding was significantly shorter in the cup feeding group compared to the feeding nozzle group. Mean changes in the weight of the neonates since the beginning of the study until reaching full oral feeding was 89 and 49.5 grams in the feeding nozzle and cup feeding groups, respectively. Moreover, the results of independent t-test indicated that the mean changes in the weight of the infants at the time of independent oral feeding since the first oral feeding was significantly higher in the nozzle group compared to the cup feeding group ($P<0.05$).

Analysis of covariance was performed by adjusting the duration since the beginning of the intervention until the initiation of full oral feeding. According to the results, changes in the weight of the neonates since the beginning until the time of full oral feeding had not significant difference between the two groups ($P=0.68$). On the other hand, mean length of hospital stay was observed to be shorter in the feeding nozzle group (21.9 days) compared to the cup feeding group (23.1 days); however, the difference in this regard was not statistically significant (Table 2).

Discussion

The present study aimed to determine the preferred feeding method between cup feeding and feeding nozzle use in premature infants. The results demonstrated that the neonates in the cup feeding group reached full oral feeding earlier than the infants in the feeding nozzle group. On the other hand, no significant difference was observed between the groups in terms of the changes in weight at the time of full oral feeding compared to the initial weight.

Although the mean length of hospital stay was shorter in the feeding nozzle group, the difference was not statistically significant, which is consistent with the study by Yilmaz et al. The mentioned research aimed to investigate the effects of bottle feeding and cup feeding on the independent feeding of infants during hospitalization, at the time of discharge, and three and six months after discharge. According to the findings, cup feeding had the highest similarity to exclusive breastfeeding at the time of discharge, as well as three and six months after discharge. Mean length of hospital stay was reported to be 25.68 and 25.96 days in the cup feeding and bottle feeding groups, respectively, which denoted no significant difference between the study groups. Furthermore, no significant differences were observed between the groups in terms of weight gain, nutritional issues, and duration of feeding in the hospital (18).

In a research, Abouelfettoh et al. assessed cup feeding and bottle feeding, reporting the higher mean duration of breastfeeding in the cup feeding group compared to the bottle feeding group, while the difference in the length of hospital stay was not considered significant between the groups (19). Another study in this regard was performed by Sabrina et al. (2012) in Brazil, aiming to compare the consumed volume (volume/min) and milk spillage volume in preterm and low-birth-weight infants in the two groups of cup feeding and bottle feeding. The findings showed no significant difference in the milk spillage volume between the groups, while the volume of consumed milk was lower in the cup feeding group compared to the bottle feeding group. Moreover, the infants in the cup feeding group required more time to reach the time of full oral feeding, which might have been due to the fatigue of the newborn and milk aspiration.

Considering the aforementioned results, cup feeding may not be the feeding method of choice by healthcare providers (20). In a study by Marofi et al., the infants fed by palady reached full oral feeding earlier than those fed by cups, and the weight changes since birth until full oral feeding were reported to be higher in the palady group as well (21).

In the present study, feeding nozzle was not observed to be a superior tool in the feeding of the

preterm infants. During the research, it was observed that milk aspiration was less frequent in the feeding nozzle group compared to the cup feeding group. Consequently, the mothers were less concerned about milk aspiration and more willing to utilize the feeding nozzles.

Conclusion

According to the results, the required time to reach full oral feeding was shorter in the cup feeding group compared to the feeding nozzle group. While the evaluated variables in the study indicated that reaching full oral feeding could be easier using feeding cups, the length of hospital stay was observed to be shorter in the feeding nozzle group, and these infants were likely to be discharged earlier than those in the cup feeding group. Therefore, it could be concluded that cup feeding is a suitable method for the feeding of preterm infants, and feeding nozzles could also be considered as a supportive oral feeding technique.

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Conflicts of interest

None declared.

References

1. Abdeyazdan Z, Ghassemi S, Marofi M. The effects of earmuff on physiologic and motor responses in premature infants admitted in neonatal intensive care unit. Iran J Nurs Midwifery Res. 2014; 19(2):107.
2. Asadollahpour F, Yadegari F, Soleimani F, Younesian S. The effect of Beckman prefeeding oral stimulation program on feeding performance of preterm infants. J Res Rehabil Sci. 2013; 9(4):683-92.
3. Younesian SH, Yadegari F, Soleymani F, Karimloo M. Assessment effect of beckman oral stimulation programm on access time to independent oral feeding in preterm infants in neonatal intensive care unit. J Child Neurol Tavanbakhshi. 2010; 11(5):64-70.
4. Verklan MT, Walden M. Core curriculum for neonatal intensive care nursing. New York: Elsevier Health Sciences; 2015. P. 192.
5. Mousavi SZ, Shahbodaghi MR, Kadivar M, Khosravi N, Mirzazade M. The study of oral feeding disorders incidence in infants in NICU of Tehran University of medical sciences hospitals. J Modern Rehabil. 2015; 9(4):1-7.
6. Zamanzadeh V, Namnabati M, Valizadeh L, Badiee Z. Professional's efforts to simultaneously discharge infants and mother fromneonatal intensive care unit in Iran: a qualitative study. J Car Sci. 2013; 2(1):39-45.
7. Zamanzadeh V, Namnabati M, Valizadeh L, Badiee Z. Mothers' experiences of infants discharge in Iranian NICU culture: a qualitative study. Adv Neonat Care. 2013; 13(4):E1-7.
8. Valizadeh L, Namnabati M, Zamanzadeh V, Badiee Z. Factors affecting infant's transition from neonatal intensive care unit to home: a qualitative study. Iran J Nurs Midwifery Res. 2013; 18(1):71-8.
9. Namnabati M, Zamanzadeh V, Valizadeh LV, Nyqvist KH. Theory of infants' transition management from the neonatal intensive care unit to home: a qualitative study. Int J Pediatr. 2017; 5(1):4059-69.
10. Arvedson J, Clark H, Lazarus C, Schooling T, Frymark T. Evidence-based systematic review: effects of oral motor interventions on feeding and swallowing in preterm infants. Am J Speech Langouage Path. 2010; 19(4): 321-40.
11. Pinelli J, Symington AJ. Non-nutritive sucking for promoting physiologic stability and nutrition in preterm infants. Midirs Midwifery Digest. 2010; 20(4):504.
12. Bahaadinzadeh ES. Preterm infant feeding. 1st ed. Tehran: Boshra Publication; 2011.
13. Dalal SS, Mishra S, Agarwal R, Deorari AK, Paul VK, Sankar MJ. Feeding behaviour and performance of preterm infants on Paladai feeding. Acta Paediatr. 2013; 102(4):e147-52.
14. Alertnative methods of feeding a baby. Unicef. Available at: URL: www.unicef.org.uk; 2008.
15. 15. Vakilian R, Haidarzadeh M. Kangaroo mother care. Tehran: Ideh Pardasan Company; 2012.
16. Finger feeder for premature infant. Medela. Available at: URL: https://www.medela.com/ breastfeeding-professionals; 2014.
17. Cohen J. Statistical power analysis for behavioral sicence. Massachusetts: Academic Press; 1998.
18. Yilmaz G, Caylan N, Karacan CD, Bodur I, Gokcay G. Effect of cup feeding and bottle feeding on breastfeeding in late preterm infants: a randomized controlled study. J Hum Lact. 2014; 30(2):174-9.
19. Abouelfettoh AM, Dowling DA, Dabash SA, Elguindy SR, Seoud IA. Cup versus bottle feeding for hospitalized late preterm infants in Egypt: a quasi-experimental study. Int Breastfeed J. 2008; 3(1):27.
20. Sabrina L. Evaluation of feeding efficiency and spillage in preterm infants during bottle and cup feeding: a randomized controlled trial. J

Pediatr Neonat Care. 2017; 6(4):252.
21. Marofi M, Abedini F, Mohammadizadeh M, Talakoub S. Effect of palady and cup feeding on premature infants' weight gain and reaching full oral feeding time interval. Iran J Nurs Midwifery Res. 2016; 21(2):202.