



The Effects of Cup Feeding and Finger Feeding Techniques on Weight Gain in Preterm Infants Admitted to the Neonatal Intensive Care Unit

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Abstract

Background: Weight is one of the main indicators of physical growth and brain development in infants, especially preterm infants. Feeding preterm infants is an ongoing challenge for those in charge of feeding infants, especially those with very low birth weights. Feeding difficulties in premature infants lead to long hospital stays and increased costs.

Objectives: This study aimed to compare the effects of cup feeding and finger feeding techniques on weight gain in premature infants.

Methods: This randomized clinical trial study was conducted on 90 premature infants with an average weight of 1784.3 ± 497 g admitted to the neonatal intensive care unit (NICU) of Ali Bin Abi Talib (AS) Hospital located in Zahedan, the southeast of Iran, in 2021. The infants were randomly divided into 3 groups: Cup feeding, finger feeding, and control groups (each with 30 infants). The intervention was performed for 3 consecutive days without interruption, even on holidays for each infant. The amount and frequency of feeding each infant depended on the birth weight and the diagnosis of a specialist. The infant's weight was recorded before and after the intervention. Data analysis was performed using SPSS version 22 using analysis of variance (ANOVA), paired-samples *t*-test, and chi-square test.

Results: The average weight of infants significantly increased in the cup feeding ($P < 0.01$) and finger feeding ($P < 0.01$) groups compared with the control group. The highest weight gain was recorded in the finger feeding group (109.55 g), followed by the cup feeding group (65.8 g) and the control group (31.1 g; $P = 0.001$). The ANOVA results suggested that the finger feeding technique was most effective in gaining weight and achieving independent oral feeding in premature infants.

Keywords: Finger Feeding, Cup Feeding, Independent Oral Feeding, Premature Infants

1. Background

A birth weight of less than 2500 g and a gestational age of less than 37 weeks are common problems for infants and important health indicators in the community. Weight is one of the main indicators of physical growth and brain development in infants, especially premature infants (1). Prematurity and low birth weight are among the most common causes of infant mortality (2, 3), leading to short- and long-term childhood complications, such as developmental defects (4). One of the ways to reduce these complications is effective nutritional support (4, 5), especially for infants with breastfeeding problems (6).

Providing proper nutrition in the first weeks of life is very important for weight gain and brain and neurological

development of infants, especially premature infants (7, 8). The occurrence of nutritional problems hinders the ability of premature infants to be independent in oral feeding. Thus, these infants need nutritional care. The inability to suck, uncoordinated sucking, swallowing and breathing reflexes, and oral feeding restriction in premature infants cause inappropriate weight gain, prolonged hospital stays, delayed discharge, increased costs, decreased emotional relationships with parents, and family stress (9).

Some alternative breastfeeding techniques are used to prepare premature infants to coordinate sucking and swallowing (10). Premature infants are generally fed by gavage from birth to 32 - 34 weeks. Long-term gavage can cause reluctance to suck the breast (11). The cup feeding

and finger feeding techniques are alternatives to gavage and mother's breast sucking for infants (2).

Finger feeding is a method in which milk is given to premature infants by sucking through a tube connected to a syringe attached to the little finger of the gloved hand with adhesive tape (12). In this method, the sensory stimulation caused by the stiffness of the finger is more similar to the nipple, facilitating the development of the infant's motor skills (13). The advantages of this method are increasing the infant's ability to suck, nutritional supplementation, accelerating the transition to breastfeeding, shortening the hospital stay in premature infants, and feeding infants when the mother is not present (13, 14). Furthermore, the amount of milk wasted during the infant's sucking in finger feeding is less compared to feeding with a syringe (15). Cup feeding, which is similar to bottle feeding, is an alternative method for when premature infants are not yet exclusively breastfed or when the mother is unable to breastfeed. Cup feeding allows the infant to adjust suction and control breathing and swallowing more easily because it requires little energy. In addition, parents' participation and eye contact with the infant encourage and help the infant not to use the bottle (16). Cup feeding does not cause nipple confusion and does not affect the sucking performance of premature infants (12), and the ease of washing and cleaning the cup helps control infection (17).

Given the importance of nutrition in the early life of infants, the management of nutrition in preterm infants is an important clinical challenge. Oral feeding, as one of the nursing interventions, is associated with the nurse's responsibility in deciding on the feeding method used to ensure proper nutrition, that is, what is necessary for the growth and development of the premature infant. In the finger feeding method, the sensory stimulation caused by the stiffness of the finger is more similar to the nipple, facilitating the development of the infant's motor skills, more similar to what premature infants have to do during breastfeeding (13). Moreover, Araujo et al. also found that the spillage of milk during the infant's sucking was less in finger feeding than in syringe feeding (15). Many nurses complain about the lack of comfort when using the cup feeding method and do not consider it safe. Many also believe that more milk is wasted in cup feeding, and premature infants show more signs of stress during cup feeding than bottle feeding (13). Given the importance of nutrition in the early life of infants, management of nutrition in preterm infants is an important clinical challenge because optimal diet and nutrition have not yet been achieved despite extensive studies. Therefore, nurses must understand and manage the clinical and nutritional variables that contribute to the adequacy of nutrition of premature infants in hospitals.

2. Objectives

The present study sought to compare the effects of finger feeding and cup feeding techniques on weight gain of premature infants admitted to the neonatal intensive care unit (NICU) of Ali Bin Abi Talib (AS) Hospital in Zahedan in 2021.

3. Methods

This randomized clinical trial study was conducted on 3 groups of premature infants less than 37 weeks of gestation at the time of birth and with a gestational age between 30 - 35 weeks who were admitted to the NICU of Ali Bin Abi Talib (AS) Hospital in Zahedan in 2021. The objectives of the study were explained to the parents of the infants, and written informed consent was obtained from all of them to show their willingness to participate in the study. Necessary permissions to conduct the study were obtained from the Vice-Chancellor for Research and Technology of Zahedan University of Medical Sciences and Ali Bin Abi Talib Hospital (IRCT20220302054171N1).

Inclusion criteria were infants with stable clinical conditions, receiving full nutrition through a nasogastric tube, having underlying disease, genetic syndromes, structural abnormalities in the mouth and pharynx, the absence of neurological disorders or congenital abnormalities in the head and neck or the central nervous system, not taking sedative/hypnotic drugs, heart rate between 80 and 160 beats per minute, the oxygen saturation level of more than 80%, and the absence of addiction or use of certain drugs by the mother. Exclusion criteria were the lack of parental consent, infant death, infant intolerance, and nothing by mouth (NPO).

The interventions started 1 week after the infant was admitted to the NICU and when, according to the neonatologist, the infant had reached physiological stability and had no symptoms such as respiratory arrest and heart rate drop.

Considering the mean and SD of the time to achieve independent oral feeding (18), taking a 95% CI and 90% test power, the sample size was estimated as 6.36 persons multiplied by the square root of 2 (1.41) for the 3 groups using a formula. Thus, the sample size for each group was estimated as 8.9 patients. However, following similar studies and considering the possible drop-out of the patients, the sample size for each group was considered 30 persons (90 persons for the 3 groups) (Equation 1):

$$n = \frac{\left(Z_{1-\frac{\alpha}{2}} + Z_{1-\beta}\right)^2 (S_1^2 + S_2^2)}{\left(\bar{X}_1 - \bar{X}_2\right)^2} = 6.36 \quad (1)$$

$$Z_{1-\alpha/2} = 1.96; S_1 = 3.27; \bar{X}_1 = 2.25; Z_{1-\beta} = 1.28; S_2 = 6.2; \bar{X}_2 = 14.25$$

A total of 90 infants who met the inclusion criteria were selected through simple random sampling based on their standard medical records. An envelope containing cards equal to the total number of infants was prepared and arranged randomly. A card was assigned to each participant selected to determine their group membership (cup feeding, finger feeding, or control). Following random sampling, each participant had an equal chance to be placed into 3 groups. The infants were fed with the mother's freshly expressed milk when they woke up.

3.1. Cup Feeding Group

In the cup feeding method, a specific volume of the mother's fresh milk, determined by the doctor, was poured into the cup. The cup was placed on the lower lip of the infant with its edges touching the outer part of the upper lip of the infant, who was in a semi-sitting position at a 45° angle. Then, the infant had the milk by licking the cup (Figure 1) (16).

3.2. Finger Feeding Group

In the finger feeding technique, tube No. 5 was connected to a syringe on one side and to the little finger of the researcher's/mother's hand on the other side. In each case, the infant was placed in a semi-sitting position at a 45° angle, and 3 to 5 mL of milk was slowly poured on the tongue or the space between the gum and the cheek, and the infant was allowed to swallow the milk (Figure 1) (15, 19).

3.3. Control Group

The infants in the control group received no intervention except for routine care in the NICU.

During feeding, if possible, the infants were placed on the researcher's lap and, in the absence of the researcher, on the assistant researcher's lap. In addition, parents' involvement and their body and eye contact with the infant encourage and help the infant not to use the bottle (16). Otherwise, the bed slope was set at a high position at a 45° angle (21). The feeding time of the infants in each group was 15 - 20 minutes. The feeding amount and frequency for each infant were determined by the NICU medical team and were divided into 8 to 12 meals based on the infant's weight. The infants weighing 1500 g were fed every 3 hours, and those weighing less than 1500 g were fed every 2 hours. Feeding was initiated when the infant showed signs of physiological stability and evidence of early feeding behaviors such as strong sucking and hand-to-mouth behaviors (19).

The intervention was performed for 3 consecutive days without interruption for each infant. The weight of the infants was measured before the intervention and at the end of the intervention without clothes and diapers using a calibrated Beurer scale (1). Other data such as gender, mother's age, gestational age, and birth weight were recorded in the data collection form. The collected data were analyzed using SPSS version 22 (SPSS Inc., Chicago, IL, USA) using analysis of variance (ANOVA), paired-samples t test, and chi-square test. P-values less than 0.05 were considered statistically significant.

4. Results

In this study, 90 infants were examined in 3 control, cup feeding, and finger feeding groups, each with 30 infants (90 infants in total). The mothers' average age was 27.7 ± 5.58 years. The birth weight of the infants in the control, cup feeding, and finger feeding groups were 1750.5 ± 501.8 , 1792.5 ± 473.9 , and 1810 ± 528.9 g, respectively (Table 1).

Table 1 shows the descriptive statistics for the mothers' and infants' demographic data in the 3 groups. The average age of the mothers in the control, cup feeding, and finger feeding groups was 27, 28.3, and 27.7 years, respectively. The average gestational age in the 3 groups was 32.1, 32.3, and 32.7 weeks, respectively. Besides, the average birth weight was 1772.5, 1795.5, and 1810 g, respectively. The male infants in the control, cup feeding, and finger feeding groups were 43.3%, 53.3%, and 46.7%, respectively. No significant difference was observed between the 3 groups in terms of maternal age, gestational age, birth weight, and gender ($P < 0.05$), and the 3 groups were homogeneous in terms of these variables. Table 2 shows a comparison of the infants' weights before and after the intervention.

A comparison of the infants' weight before and after the intervention between the 3 groups showed no significant difference in the weight changes before and after the intervention in the control group ($P = 0.1$), but after the intervention, the infant's weight in the cup feeding group ($P < 0.001$) and the finger feeding group ($P < 0.001$) increased significantly compared to their weight before the intervention. Moreover, a comparison of the infants' weight between the 3 groups before the intervention did not show a significant statistical difference, as confirmed by ANOVA results. However, there were significant differences between the 3 groups in terms of the infant's weight after the intervention ($P = 0.001$). The results of the Scheffe post hoc test showed the weight differences between the finger feeding, cup feeding, and control groups. The lowest weight change (31.1 g) was



Figure 1. A, Finger feeding and; B, cup feeding

Table 1. The Descriptive Statistics for the Participants' Demographic Data

| Variables | Groups | | | P-Value |
|---------------------|----------------|----------------|----------------|--------------------|
| | Control | Cup Feeding | Finger Feeding | |
| Maternal age (y) | 27 ± 5.9 | 28.3 ± 5 | 27.7 ± 5.6 | 0.671 ^a |
| Gestational age (w) | 32.1 ± 1.4 | 32.3 ± 1.6 | 32.7 ± 1.6 | 0.446 ^a |
| Birth weight (g) | 1750.5 ± 501.8 | 1729.5 ± 473.9 | 1810 ± 528.9 | 0.895 ^a |
| Infant sex, No. (%) | | | | 0.733 ^b |
| Female | 17 (56.7) | 14 (46.7) | 16 (53.3) | |
| Male | 13 (43.3) | 16 (53.3) | 14 (46.7) | |

^a ANOVA

^b Chi-square

Table 2. A Comparison of the Infants' weights Before and After the Intervention

| Groups | Infant Weight (g) Before the Intervention | Infant Weight (g) After the Intervention | P-Value |
|----------------|---|--|---------|
| Control | 1772.5 ± 500.4 | 1772.5 ± 464.4 | 0.1 |
| Cup feeding | 1822.4 ± 510.6 | 1888.538 ± 3.5 | 0.001 |
| Finger feeding | 1846.513 ± 5.7 | 1955.6 ± 521 | 0.001 |

observed in the control group, and the highest weight change (109.1 g) was observed in the finger feeding.

5. Discussion

Choosing an optimal method for feeding premature infants is an important challenge for clinical professionals in hospitals (16). This study aimed to compare the effectiveness of 2 methods of feeding premature infants in gaining weight and achieving independent oral feeding.

The data showed that the increased weight of infants in the control group after the intervention was not significant compared to before the intervention, while the weight of the infants in the finger feeding and cup feeding groups increased significantly. Nunes et al. compared finger feeding and cup feeding techniques and reported a significant increase in the average weight in both groups, as was indicated in the present study (16). The finger feeding method is an artificial feeding technique and is known as a physiological method that facilitates the transition to breastfeeding and improves sucking and breathing coordination. The finger-fed infants had fewer symptoms of physiological stress and a better comfort level and showed earlier sucking and swallowing functions (14). Cup feeding is a simple feeding method that has some advantages, such as enhancing positive physical contact and eye contact in the infant. Besides, the infant receives positive tactile and olfactory stimulation, and oxygen and respiratory saturation are maintained. Moreover, the

speed of feeding and the total volume of milk consumed by the infant are controlled. Thus, the risk of aspiration and energy expenditure of the infant are minimized (20, 21).

The present study revealed that finger feeding and cup feeding techniques were effective in increasing the weight of premature infants compared with the control group. Feeding techniques can affect the amount of milk leakage and feeding efficiency in infants (18). Thus, milk leakage during feeding can be one of the reasons for more weight gain in the finger feeding group compared to the cup feeding group. Waste of milk during feeding and, as a result, not consuming the prescribed volume, in addition to weight loss, can affect the clinical condition of premature infants (12). Other studies have also confirmed the effectiveness of the finger feeding method in infants' weight gain. Moreira et al. showed that the weight gain was higher in the finger feeding group than in the cup feeding group (12). Buldur et al. showed that weight gain was significantly higher in finger-fed infants than in syringe-fed infants (14). The present study compared finger feeding and cup feeding techniques, and the results showed that the finger feeding method significantly improved the weight gain of infants. However, some studies have suggested that cup feeding plays a more effective role in controlling infection than syringe feeding in developing countries because it is easier to clean the cup (16). Dehghani et al. also compared the effects of finger feeding and cup feeding techniques on feeding tolerance and weight gain of premature infants admitted to the NICU and reported no significant difference in the weight changes of infants before and after the intervention (22). This inconsistency could be due to the start time of the interventions in the 2 studies. In Dehghani et al. study (22), the intervention started from the first week of the birth of the infants, and naturally, the infants experienced weight loss during this period, while in the present study, the interventions were performed after the first week when the condition of the infants started to stabilize, which could cause the infants to gain more weight. Contrary to the present study, Nunes et al. reported more weight gain in the cup feeding method compared to the finger feeding method (16). One of the reasons for this conflicting finding was the longer hospital stay of infants in the cup feeding group. Furthermore, the infants in the finger feeding group had a shorter hospital stay.

Although a few studies have described and compared the use of finger feeding and cup feeding techniques, they have shown that finger feeding is a feeding transition method that is useful for premature infants.

Considering the limitations of the present study, in future studies, an interventionist can perform the interventions. Moreover, other feeding techniques should be examined in term and preterm infants. Most of

the previous studies have mostly compared 2 feeding techniques. Thus, to find out the best possible method for feeding premature infants, further studies can compare several feeding interventions.

In line with the findings of the present study, both cup feeding and finger feeding techniques are effective in helping infants achieve independent oral feeding. However, the number of infants who achieved independent oral feeding was higher in the finger feeding group than in the cup feeding group. One of the limitations of the present study is that the volume of milk for each infant was different. Furthermore, when the mother of the infant did not have enough milk, dry milk was used, or sufficient fresh milk was provided for the infants from the milk bank based on a neonatologist's instructions. Besides, some primiparous mothers are not familiar with breastfeeding techniques. Thus, they need to receive breastfeeding training. According to the results, it can be concluded that finger feeding is an effective method for feeding premature infants, and cup feeding can also be considered a supportive oral feeding method.

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Footnotes

Authors' Contribution: All authors equally contributed to conducting this research project.

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