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Comparing the Effect of Non-nutritive Sucking and Abdominal Massage on Feeding Tolerance in Preterm Newborns

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Abstract

Background: Enteral feeding intolerance is a major problem in the preterm neonates. Non-nutritive sucking and abdominal massage are among the most important nutritional interventions in this regard.

Aim: This study aimed to compare the effect of non-nutritive sucking and abdominal massage on feeding tolerance in the preterm newborns.

Method: This clinical trial was conducted on 52 preterm neonates in the Neonatal Intensive Care Unit of Imam Reza Hospital in Mashhad, Iran. The subjects were randomly divided into three groups, namely abdominal massage (17 newborns), non-nutritive sucking (18 newborns), and control groups (17 newborns). In the abdominal massage group, the intervention was fulfilled for 15 min twice a day, and in the non-nutritive sucking group, the intervention was performed for 10 min three times a day within 7 days. The control group only received tube feeding every two h without any intervention. Feeding tolerance was examined in terms of gastric residuals, vomiting, and abdominal distention. The data were collected through the recording daily information form. The data were analyzed through SPSS version 23, using ANOVA test and marginal models.

Results: The mean gestational age of the abdominal massage group was 32.8±1.0 weeks. This value was 32.5±1.3 weeks in both sucking and control groups. Generalized estimating equation revealed that non-nutritive sucking was effective in the absence of distention (P=0.01) and vomiting (P=0.01). However, abdominal massage was effective only in the absence of vomiting (P=0.01).

Implications for Practice: The use of non-nutritive sucking can increase the feeding tolerance in the preterm newborns.

Keywords: Feeding tolerance, Abdominal massage, Non-nutritive sucking, Preterm infants

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Introduction

The live newborns who are born before the 37th week of gestation after the first day of the last menstrual period are referred to as preterm neonates by the World Health Organization (1). The preterm newborns are one of the groups with the highest rates of neonatal mortality and morbidity so that two-thirds of infant mortality are caused by preterm birth (2). Since the e arly feeding behaviors, such as sucking and swallowing, are prerequisite to secondary behaviors (e.g., speech), any disruption in these actions will have a direct impact on the future development of the verbal and communication skills in the infants (3).

Nutritional care is of vital importance to the preterm neonates that have been deprived of the placental food reserves and are experiencing a rapid ectopic growth. Neonatal nurses can have a better evaluation of the newborn status, feeding control, and feeding methods as well as the prevention of the complications caused by alternative nutritional methods (e.g., parenteral nutrition practices when they are equipped with information about the effects of prematurity on the function of the digestive system and nutritional needs of the preterm and high-risk newborns), (4).

The nutritional problems in the preterm neonates prevent them from reaching independent oral feeding. As a result, the majority of such babies are transferred to the Neonatal Intensive Care Unit (NICU) after birth and fed by tube through the nose or mouth. This type of feeding impairs the act of sucking and its motor development in these newborns and also brings about feeding problems in the long run (3).

Some nutritional problems caused by tube feeding include non-organized sucking pattern, lack of coordination in sucking, swallowing, and breathing, as well as oversensitivity to the touch of areas around or inside the mouth. Furthermore, this type of feeding prevents the proper mother-infant interaction during the feeding process (3). Feeding intolerance is a common phenomenon in the NICUs, which is observed in 16-19% of the preterm neonates. Regarding the relationship between the feeding intolerance and necrotizing enterocolitis (NEC) (i.e., a gastrointestinal emergency and one of the causes of the neonatal mortality), the NICU medical team pays attention to any symptoms of feeding intolerance (5).

The enteral feeding intolerance is a major problem in the preterm newborns, which leads to longer hospitalization, increased infection risk, and prolonged parenteral nutrition (6). The delayed enteral nutrition in the preterm neonates with feeding intolerance leads to the incidence of intestinal problems, such as delayed intestinal growth and calorie deficit. Gastric residuals are common in these newborns, the elevation of this condition is considered as a symptom of feeding intolerance or NEC. In the nursing care program of the preterm neonates, the gastric residueals are considered among the criteria determining the increase of feeding volume or the stoppage of feeding (7).

Non-nutritive sucking may stimulate the gastric motor function, and thereby facilitate the digestion of enteral nutrition. This effect occurs through the activity of vagal mechanisms by stimulating the nerve fibers in the oral cavity. The vagus nerve activity affects the levels of digestive hormones, such as gastrin and somatostatin. Gastrin secretion is required for acid secretion, gastric motility, and growth of the intestinal lining. The reduction of somatostatin increases the gastric emptying (8). In an attempt to investigate the impact of non-nutritive sucking on gastric emptying, Vidstrom et al. (2000) measured and recorded the volume of gastric contents three hours after feeding. The results of their study did not show any significant difference between the groups at the time of emptying (9). However, in a study conducted by Zhao (2004), significant results were reported for the impact of non-nutritive sucking on gastric residuals (10).

Sensory stimulation is among the basic needs of humans, especially for their growth and evolution. However, the preterm neonates are deprived of the tactile stimulation due to the limitations arising from the care necessity and sometimes because of the isolation periods (11). Massage leads to an increase in the level of serotonin and vagal activity. It also lowers the stress level and colic hormones. In addition, massage helps regulate sleep and increases the motor development, coordination, balance, and weight in the infants (6).

The feeding intolerance is a serious problem in the preterm neonates, which bears evident negative effects on this population. Various studies has reported different results regarding the effect of the non-nutritive sucking and massage. Nonetheless, these methods have not been still compared with each other in any study, and it is not known which method is more suitable for the clinical application.

With this background in mind, the current study was conducted to determine the effects of abdominal massage and non-nutritive sucking on feeding tolerance (i.e., level of gastric residuals, abdominal distention, and the frequency of vomiting) in the preterm neonates and compare these two methods. This study attempted to obtain an effective and applicable method for the improvement of feeding tolerance in the preterm neonates in order to optimize the neonatal growth and their respective passage of transitional stage.

Methods

This clinical trial was conducted on 52 preterm neonates in the Neonatal Intensive Care Unit (NICU) of Imam Reza Hospital in Mashhad, Iran, within September, 2015-January, 2016. Based on the previous studies (e.g., Assadollah-Pour), the sample size was calculated to be 18 cases for each group with the confidence level of 95% and statistical power of 80%. Considering the drop probability of 10% in each group, the sample size was determined to be 20 subjects in each group.

Out of the 60 neonates participating in the study, eight subjects were excluded from the study. Accordingly, two neonates were excluded in the non-nutritive sucking group due to the parental dissatisfaction with the continuation of the intervention and having nothing by mouth (NPO) for more than 24 h, respectively. Similarly, two newborns were excluded from the abdominal massage group due to the same reasons. In addition, in the control group, three neonate were excluded because of the NEC diagnosis, showing positive blood culture during the study, and having NPO more than 24 h, respectively. Eventually, the study was proceeded with 52 newborns, i.e., 17, 18, and 17 neonates in the abdominal massage, non-nutritive sucking, and control groups, respectively.

The inclusion criteria were: 1) the chronological age of 48 h or less, 2) gestational age of 30-34 weeks, 3) tube-feeding, 4) Apgar score of 7 and above in the fifth minute, 5) absence of acute respiratory distress, 6) no need for mechanical ventilation, 7) mother's non-addiction, 8) birth weight of 1200 g or higher, 9) enjoyment of apparent health and not suffering from major congenital diseases (e.g., severe congenital heart disease, digestive system abnormalities, nervous system abnormalities, and genetic disorders), 10) no signs and symptoms of infection, and 11) the absence of cleft lip and palate.

On the other hand, the exclusion criteria included: 1) grade 3 or 4 intraventricular hemorrhage, 2) NEC, 3) positive blood culture at birth, 4) sepsis, and 5) having NPO for at most 24 h after the onset of enteral nutrition. The data were collected using such instruments as demographic characteristics and recording daily information forms. These tools were confirmed in terms of the content validity, and were then given to the seven members of the Faculty of Nursing and Midwifery of Mashhad, and were finally used in the study after incorporating the necessary amendments.

These forms included clear statements and questions that have been frequently used in other studies, and thereby their reliability has been confirmed. To ensure the reliability of the data, the authenticity of the scale was approved with a fixed 500-gram weight each day before weighing the neonates. After obtaining the approval of the Ethics Committee and the university, the researchers visited the parents of the eligible preterm newborns and informed them about the study objectives, methodology, and procedure.

After obtaining the parental consent, the eligible infants were randomly assigned into one of the three study groups, i.e., non-nutritive sucking, abdominal massage, and control. To this aim, 20 random numbers were selected using the table of random numbers from 0 to 14. The selected numbers 0-4, 5-9, and 10-14 were named ABC, BCA, and CAB, respectively. Then, 20 ABC, BCA, and CAB terms were obtained, which came together as a string and 20 sample units were placed in each group (i.e., A: abdominal massage group, B: non-nutritive sucking and group, and C: control group).

In the non-nutritive sucking group, the researcher put his little finger gently into the baby mouth after light stimulation of the lower lip 5 min before feeding, and stimulated the newborn’s sucking reflexes by moving the finger in the neonate’s mouth. Then, the sucking was started and continued in the first 5 min of feeding, and the newborn feeding was performed simultaneously through catheter.

When the newborn’s sucking was stopped during the intervention, the gentle shaking of the finger encouraged him/her to continue sucking. This intervention was performed three times a day (i.e., at 8, 12, and 16 o'clock). It should be noted that the neonates were routinely fed every two hours (at even hours) in the study environment.

The abdominal massage group received massage twice a day (i.e., at 9 and 15), each time for 15 min at least one hour after feeding. The massage was performed clockwise; accordingly, the hand was put in a position with the little finger laying on the abdomen which was tapped downwards from below the chest. The abdomen and the area around the navel received massage clockwise with fingertips in circular forms. It continued on the right side of the neonate's body upwards, and then on the left side of the body downwards.

In the end, the newborn's knees and legs were taken by the hand and the knees were slowly pushed up towards his/her abdomen. Additionally, the neonate's thigh was rotated several times to the right. On the other hand, the newborns in the control group received no intervention and were fed normally every 2 h by nasogastric tube.

The number of times each neonates had experienced vomiting was recoded using nurses' reports or the researcher's observations. In addition, in case of the occurrence of distention (i.e., hard abdomen) or gastric residual (i.e., the remaining of more than 50% of the milk volume of the previous meal in the stomach), the presence of that variable was considered positive during the previous 24 h and recorded in the relevant checklist.

The acceptance criteria of feeding tolerance included the presence of the gastric residuals of less than half of the previous meal, no vomiting, and lack of distention. The intervention was performed within the first 48 h of birth. Upon the admission of the newborns to the NICU, the stabilization of the newborns' conditions began and continued for seven days.

The data analysis was performed using the ANOVA, Chi-square, and Kruskal-Wallis tests as well as the design of marginal models through the SPSS version 23. The dependent variables of this study were measured over time. Considering the type of the collected data, the repeated measures analysis was employed. In case the response variable does not meet the assumptions of the repeated measures design, other methods of statistical analysis, such as marginal modeling, random-effects model, etc. can be used.

Results

In this study, the results of the one-way ANOVA test revealed no significant difference between the three groups in terms of the demographic variables of height, weight, head circumference at birth, gestational age, first and fifth minute Apgar score, as well as maternal age. Consequently, the three groups were homogeneous in terms of these variables (Table 1).

The generalized estimating equation and marginal modeling approach with logit link were used for the analysis of the intervention effect on the distention and vomiting. Since this study aimed to compare three groups, the group variable enters the model as the predictor, and the control group was selected as the reference group.

According to Table 2, the abdominal massage had no significant effect on distention. However, the intervention in the non-nutritive sucking group was significant so that the chance of elimination of distention in this group was five times as much as that in the control group (P=0.001). As indicated in

Table 1. Comparison of demographic characteristics between the three groups

Groups Variables	Abdominal massage Mean±SD	Non-nutritive sucking Mean±SD	Control Mean±SD	ANOVA test results
Gestational age (week)	32.8±1.0	32.5±1.3	32.5±1.3	P=0.73
Birth weight (gram)	1853.5±353.1	1836.3±322.0	1821.7±390.7	P=0.96
Height (centimeter)	43.5±3.1	43.3±2.5	42.4±3.0	P=0.51
Head circumference (centimeter)	30.6±1.9	30.6±1.8	30.7±1.9	P=0.96
First minute Apgar	7.9±0.8	7.7±0.9	7.7±0.9	P=0.82
Fifth minute Apgar	9±0.9	8.7±0.8	8.8±0.8	P=0.64
Maternal age (year)	30±7.4	27.5±6.9	26.8±6.2	P=0.37

Table 2. Coefficients of distention in the logistic model with generalized estimating equation method

Parameters	Parameter estimate	SD	Wald test statistic	P-value
Intercept	1.8	0.9	3.3	0.06
Abdominal massage group	0.6	0.3	2.8	0.09
Non-nutritive sucking group	1.8	0.5	11.9	0.001

Table 3. Coefficients of vomiting in the logistic model with generalized estimating equation method

Parameters	Parameter estimate	SD	Wald test statistic	P-value
Intercept	-2.3	1	5.5	0.01
Abdominal massage group	-1.1	0.4	6.6	0.01
Non-nutritive sucking group	-1.4	0.6	5.5	0.01

Table 4. Comparison of the incidence of the number of residues during the intervention days for each group

Groups Variables	Abdominal massage Mean±SD	Non-nutritive sucking Mean±SD	Control Mean±SD	ANOVA test results
The number of gastric residuals (times per week)	0.4±0.7	0.1±0.5	0.4±0.6	P=0.25

eliminating vomiting (P<0.05). Therefore, according to the outputs, the probability of the elimination of vomiting in the abdominal massage group was 3.3 times as much as that in the control group. Furthermore, this chance in the-nutritive sucking group was almost 4 times higher than that in the control group.

Since significant changes were not observed in the number of gastric residuals during the study period, the total number of residuals in each subject during the seven days of the study was added together, and the mean scores of the three groups were then compared with each other. The results of the ANOVA test demonstrated no significant difference between the groups in terms of the mean score of the number of gastric residuals occurring during the research days (P=0.25).

The mean values of the days that feeding tolerance (i.e., no vomiting, residues, and distention) existed in the studied groups were also compared. Based on the results of the Kruskal-Wallis test, the mean value of feeding tolerance in the non-nutritive sucking group was significantly higher than that in the control group (6.6±0.5 and 5.7±0.9, respectively; P=0.004). However, there was no significant difference between the abdominal massage group (6±0.7) and the control group in this regard (P=0.05).

Discussion

The results of this study supported the hypothesis that while the non-nutritive sucking is not effective in the gastric residual, it reduces the frequency of distention and vomiting occurrence, and ultimately leads to the enhancement of feeding tolerance in the preterm neonates. Yue et al. (2003) found that such complications as vomiting and abdominal distention were lower in the non-nutritive sucking group. They indicated no statistically significant differences between the two groups. In addition, they reported the gastric residuals to be significantly lower in the non-nutritive sucking group (13).

Although the present study did not show any statistically significant difference between the intervention groups in terms of gastric residuals, the feeding tolerance was generally higher in the newborns of the non-nutritive sucking group than those in the other groups. Mohagheghi et al. (2012) pefromed oral motor sensory stimulation and non-nutritive sucking for 5 min started 15 min before gavage for seven days in the experimental group. No intervention was performed in the control group. They demonstrated that the rate of oral feeding tolerance in the intervention group was higher than that in the control group (14). The results of the mentioned study are consistent with those of the present study. Similar to the present study, in a study conducted by Zabo (2000), the non-nutritive sucking was found to be ineffective in the gastric residual (9).

The results of the present study showed that the abdominal massage was not effective in the gastric residuals and distention. Furthermore, the degree of feeding tolerance was not significantly different between the abdominal massage and control groups. Neverhteless, the abdominal massage significantly decreased the frequency of vomiting. Uysal et al. (2010) examined the effect of abdominal massage on the gastric residuals in adults. The results of their study showed that the gastric residuals in the abdominal massage group was significantly lower than that in the control group. However, vomiting and abdominal distention in the abdominal massage group were not significantly different from those in the control group (15).

The discrepancy between the results of the mentioned study and our findings can be attributed to the difference between the age ranges of the research population in the two studies. Tekgunduz et al. (2014) conducted a study on 27 neonates (i.e., 14 and 13 newborns in the abdominal massage and

control groups, respectively). They reported no statistical difference between the abdominal massage and control groups in terms of the defecation frequency.
However, there was a statistically significant difference between the two groups in terms of the frequency of vomiting and abdominal distention as well as gastric residuals volume. According to the findings of the mentioned study, the use of abdominal massage improved the feeding tolerance in the preterm neonates (6). The results of the mentioned study are inconsistent with our findings. The mentioned study was conducted on the newborns with the gestational age of 28-32 weeks and there are some debates and controversies over the safeness of massage for this group of neonates. In addition, this study was perfomed on a limited number of neonates. Therefore, it is necessary to carry out further studies with higher sample size to confirm the obtained results. Karbandi et al. (2013) reported that the incidence of feeding intolerance in the newborns of the control group was almost nine times higher than that in the massage group; this difference was reported to be statistically significant (16).
In the present study, no significant difference was observed between the abdominal massage and the control groups regarding the mean value of vomiting frequency and feeding tolerance. This diffrence can be due to the employment of different types of massage. In the current study, massage has been limited to the abdomen area, while in the aforementioned study, the intervention was administered in the form of massage using the field method, which does not basically cover the abdominal area.
In this study, there were some confounding variables and limitations. For example, such variables as the type and amount of care the neonates received as well as the person who checked the feeding tolerance were all considered to be the same. Another limitation of this study was that the non-nutritive sucking was also possible to be performed by mother or nurse for many hospitalized neonates and the infants under study were not excluded. Furthermore, the use of newborns' records in the data collection can be considered as another limitaion of this study.

Implications for Practice

The results of the present study showed that the feeding tolerance was significantly higher in the non-nutritive sucking group than that in the other groups. According to the findings of this study, the non-nutritive sucking can be an effective way to enhance the feeding tolerance in the preterm neonates and be used as an effective and easy procedure. It is suggested that the abdominal massage be performed on a higher number of samples in the future studies. Future resreachers are also recommended to assess the amount of gastric secretion and residuals via other methods, including the measurement of pH in the abdominal secretions and sonography.

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Conflicts of Interest

The authors declare no conflict of interest.

References

1. Velayaty A, Nourozye E, Falah R, Eady M. Nelson textbook of pediatrics. Tehran: Andisheh Rafee Publication; 2011.
2. Newnhama CA, Milgroma J, Shouteris H. Effectiveness of a modified mother-infant transaction programe on outcom for preterm infant from 3 to 24 months of age. Infant Behav Dev. 2009;32(1):17-26.

3. Yonesian S, Yadegari F, Soleimani F, Karimlou M. Effect of beckman oral stimulation program on time to attainment of independent oral feeding in preterm infants in NICU. Arch Rehabilit. 2011;11(5):65-73. (Persian)
4. Najafi Anari HR, Rassouli M, Atashzadeh Shourideh F, Namdari M. Auditing preterm neonatal nutrition nursing care. Quart J Nurs Manage. 2014;2(4):29-37. (Persian)
5. Valizadeh S, Hosseini MB, Asghari-Jafarabadi M, Mohebbi L. The effect of kangaroo mother care on feeding tolerance in pereterm infants. J Babol Univ Med Sci. 2014;16(12):16-22. (Persian)
6. Tekgunduz KS, Gurol A, Apay SE, Caner I. Effect of abdomen massage for prevention of feeding intolerance in preterm infants. Ital J Pediatr. 2014;40:89.
7. Chen SS, Tzeng YL, Gau BS, Kuo PC, Chen JY. Effects of prone and supine positioning on gastric residuals in preterm infants: a time series with cross-over study. Int J Nurs Stud. 2013;50(11):1459-67.
8. Sheykh Bahaadin Zadeh E. Preterm infant feeding. 1st ed. Tehran: Boshra Publication; 2011.
9. Premji SS, Paes B. Gastrointestinal function and growth in preterm infants: is non-nutritive sucking vital. J Perinatol. 2000;20(1):46-53.
10. Zhao C, Yue X, Lu H, Xue XD. Effects of nonnutritive sucking on gastric emptying and gastroesophageal reflux in premature infants. Zhonghua Er Ke Za Zhi. 2004;42(10):772-6.
11. Modrcin-Talbott MA, Harrison LL, Geroer MW, Yanger MS. The biobehavioral effects of gentle human touch on preterm infants. Nurs Sci Q. 2003;16(1):60-7.
12. Assadollah-Pour F, Soleymani-Far F, Yadegari F, Younesian S. The effect of nonnutritive sucking on achievement of full oral feeding in preterm infants. J Rehabilit. 2013;13:121-7.
13. Yue XH, Zhao CX, Lu H, Xue XD. Effects of intermittent nasogastric feeding with nonnutritive sucking on nutrient and gastrointestinal tract transit time in premature infants. Zhonghua Er Ke Za Zhi. 2003;41(2):91-4.
14. Mohagheghi P, Mahmoodi N, Zareii K, Imani M, Haghani H. Evaluation of the effect of the oral motor interventions and non nutritive sucking on feeding tolerance in premature born infants. Tehran: Tehran University of Medical Science; 2012. (Persian)
15. Uysal N, Eser I, Akpinar H. The effect of abdominal massage on gastric residual volume. Gastroenterol Nurs. 2012;35(2):117-23.
16. Karbandi S, Kalateh Molaee M, Boskabadi H, Esmaeily H. The effects of massage on complication of hospitalized preterm infants in NICU. Evid Based Care. 2013;3(7):49-54. (Persian)