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Effects of Abdominal Massage on Feeding Tolerance in Preterm Infants Hospitalized in Selected Hospitals of Isfahan- Iran

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Abstract

Background

Feeding intolerance is one of the leading causes of weight loss in preterm infants. The present study aimed to evaluate the effects of abdominal massage on feeding tolerance in preterm infants hospitalized in neonatal intensive care units in Isfahan, Iran.

Materials and Methods: In this randomized controlled clinical trial, 64 infants who had the inclusion criteria, were selected and randomly assigned to control and intervention groups. They were fed every two hours. The gastric residual volume, the abdominal circumference, the frequency of defecation, and the frequency of vomiting episodes, were measured before the feeding. One hour after the feeding, abdominal massage in the intervention group (massage), was given by a researcher twice a day for 15 minutes in a 5-day period. The control group received typical unit care. In order to analyze the data, the SPSS version 23.0 software and analytical as well as descriptive statistical methods were used.

Results: The abdominal massage affected the preterm infants' feeding-tolerance criteria and significantly reduced the gastric residual volume, the abdominal circumference, and the frequency of vomiting episodes and significantly increased the frequency of defecation in the intervention group, as compared with the control group ($P < 0.05$).

Conclusion

Abdominal massage could impact preterm infants' feeding-tolerance criteria. Based on the above results, it is apparently essential to carry out more in-depth studies in this field.

Key Words: Abdominal massage, Feeding tolerance, Iran, Preterm infants.

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1- INTRODUCTION

The neonatal period, during which so many physiological adaptations to extrauterine life occur, is a very vulnerable stage for the infant. The mortality rate in the first year of life is not comparable with any rate at other stages up until the seventh decade of life (1). About 14.9 million births are preterm per year across the world (2). Numerous studies presented preterm prevalence of 1.3 to 11.9 % in Iran (3). Preterm birth is related of 5 to 18% of pregnancies, and also is a major cause of infant morbidity and mortality (4). Despite of improvement in the medical care services, mortality rate is yet remarkable among preterm and very low birth weight infants (5). Preterm infants' metabolic functions are compromised by the absent or weak swallow, suck, and gag reflexes; a small stomach capacity; weak abdominal muscles; a limited store of nutrients; a decreased ability to digest proteins and absorb nutrients; and immature enzyme systems (6).

In order for a weight gain and optimum growth, preterm infants ought to have an energy intake through feeding. Furthermore, certain medical conditions such as lack of oxygen, low blood pressure, acidosis, infection, and the need for surgery are more in this group of infants and all of them increase the need for metabolism and energy. One of the methods for feeding preterm infants is gavage, or forcible feeding, which, obviously, could cause feeding intolerance. By consuming and digesting breast milk or formula, preterm infants develop an eating disorder in the form of one or more clinical signs such as increased gastric residuals, nausea and vomiting, abdominal distension, frankly bloody or guaiac-positive stools, diarrhea, apnea, bradycardia, and temperature instability. Its more severe complications include pneumatosis intestinalis (PI), and necrotizing enterocolitis NEC (7). Feeding intolerance is induced by the poor function of the digestive system in preterm infants. As more serious complications such as NEC develop, feeding intolerance causes prolonged hospitalization, increased risk for infections, and complications resulting from the long-term use of parenteral nutrition (8). Feeding intolerance is one of the most important causes of weight loss in preterm infants, which results in the inability to maintain enteral nutrition. This leads to the long-term use of parenteral nutrition through the central venous catheter, which increases the risk of acquiring infections (9). One of the causes of feeding intolerance in preterm infants is slow gastric emptying. In order to treat and control it, medications, massage therapy, and repeated rectal stimulation are recommended (10). Massage therapy can stimulate the parasympathetic activity and induce a more effective response of the digestive system by accelerating peristalsis, decreasing abdominal distension, accelerating the bowel transit time, increasing the frequency of defecation, and decreasing the frequency of vomiting episodes in the daytime (11).

A large number of studies have revealed positive effects of body massage on preterm infants' weight gain and feeding tolerance (8, 10, 11). During a full-body massage, the infant's body is manipulated a lot; moreover, the medical equipment attached to the body makes it difficult to give the infant a full-body massage. In addition, the massage is intended for an improvement in the function of the digestive system as the target organ. Unfortunately, few studies have been conducted on effects of abdominal massage. Therefore, the present study aimed to evaluate the effects of abdominal massage on preterm infants' feeding tolerance.

2- MATERIALS AND METHODS

2-1. Study design and population

The current study was a randomized controlled clinical trial. It has been registered on the website of the Iranian Registry of Clinical Trials and the registration code is IRCT2016072723216N3. The research population comprised all preterm infants hospitalized in the Neonatal intensive care units (NICU), in the Shahid Beheshti Hospital and the Alzahra Hospital in Isfahan, the Central of Iran.

2-2. Methods

The sample size was calculated on the basis of statistical consulting and the below formula. The number of samples in each group was 32. **Z1** is a confidence coefficient of 95%, i.e. 1.96, **Z2** is a confidence coefficient of 80%, i.e. 0.84, **S** represents an estimate of the standard deviation for each variable (i.e. residual volume, abdominal circumference, and frequency of defecation) in each group, **D** represents the minimum mean difference of each variable between the two groups. It shows a significant difference. **S** is considered to be 7.0. Next, 64 preterm infants, 29-33 weeks old, who met the inclusion criteria entered the study and were randomly assigned to two groups: control group and intervention or massage group.

2-3. Measuring tools: validity and reliability

The data-gathering tool was a questionnaire consisting of demographic information and a checklist for recording daily data. In order to determine its content validity, the questionnaire was submitted to 10 faculty members of Isfahan's Faculty of Nursing and Midwifery. After undergoing necessary modifications, the questionnaire was used in the study. Its reliability was evaluated using the test-retest method and the correlation coefficient was 0.92.

2-4. Intervention

The gastric residual volume, the abdominal circumference, the frequency of defecation, and the frequency of vomiting episodes were regarded as the feeding-tolerance criteria in the preterm infants (12). Before giving a feeding to the two groups, the correct position of the orogastric tube was checked out. Afterwards, the gastric residual volume, the abdominal circumference, the frequency of vomiting episodes, the frequency of defecation, and the infants' weight were recorded at a certain time point. In the control group, the infants received the routine care in the unit. The infants in the intervention group, received the routine care in the unit, too.

Additionally, when these infants were awake and calm and it was one hour after the feeding (13), a researcher gave them abdominal massage twice a day, at 2.00 PM and 8.00 AM, for 15 minutes (14), during a 5-day period (11). After having participated in a training course in Isfahan University of Medical Sciences and having received training from a faculty member, the researcher earned the Certificate in Massage Therapy. The massage was performed in the presence of a doctor. Prior to the massage, in order to reduce friction, the researcher applied a few drops of olive oil onto the hands and performed the massage gently (with pressure a little more than a stroke) following the below instructions:

1. Hold your hand so that the edge of your little finger can move like a paddle across the infant's abdomen. Starting at the base of the rib cage, stroke downward with one hand and make a paddle-wheel-like motion with the other hand.

2. Massage the abdomen with your fingertips in a circular, clockwise motion.

3. Do the "I Love U" stroke as follows: Trace the letter I down the infant's left side. Next, trace an inverted L, stroking across the abdomen along the base of the ribs from the right side to the left side and

then downward. Trace an inverted U, stroking from down the infant's right side upward and around the navel and finally down the left side.

4. Walk your fingers around the navel clockwise.

5. Hold the knees and feet together and gently press the knees up toward the abdomen. Rotate the infant's hips around to the right a few times.

6. Place your hand on the stomach horizontally and rock your hand from side to side a few times. Avoid massaging the stomach if the cord has not healed completely (11).

During the massage, the heart rate, blood pressure, saturation of hemoglobin with oxygen, infants' skin color, and the presence of vomiting, apnea, rapid respiration, and muscle contraction were recorded.

2-5. Ethical consideration

First, the written informed consent was obtained from the infants' parents.

2-6. Inclusion and exclusion criteria

The inclusion criteria included the preterm infants who were in the age range of 28-32 weeks; were 1,000-1,800 grams in weight; received 20 cc/kg of daily feeding minimum according to a doctor's orders; were fed with the mother's milk; had no intestinal obstruction, abdominal surgery, contraindication to abdominal massage, hypoxic injury, respiratory failure with mechanical ventilatory support, previous or current history of NEC, confirmed or suspected sepsis, or cerebral hemorrhage; were fed with the orogastric tube; and suffered from no congenital malformations such as congenital heart disease and digestive anomalies. Excluded were the infants who opted out of the study by their mothers; died or were discharged before the end of the intervention; and grew ill during the intervention.

2-7. Data Analyses

In order to analyze the data, the SPSS software version 23.0 and analytical as well as descriptive statistical methods such as paired t-test, analysis of variance and covariance, t-test, and Chi-square test, Mann-Whitney U, and Wilcoxon were employed. So, all data analysis was carried out according to a pre-established analysis plan. Proportions were compared by using Chi-squared tests with continuity correction or Fisher's exact test when appropriate.

The frequency of defecation, the frequency of defecation, the frequency of vomiting episodes, means of the abdominal circumference and the gastric residual volume before and after the abdominal massage in the intervention and control group were compared by paired t-test, analysis of variance and covariance, t-test or Mann-Whitney U, and Wilcoxon when appropriate.

3- RESULTS

The current study was conducted on 64 preterm infants, who were randomly placed in two groups, namely control and intervention (or massage). There were 32 infants in each group. Out of 64 infants, 24 (37.5 %) were in the Alzahra Hospital and 40 (62.5%) in the Shahid Beheshti Hospital. Among the infants, 26 (40.7%) were female and 38 (59.3 %) male.

In the control group, one subject was excluded from the study due to the diagnosis of NEC. None of the subjects in the intervention group developed abnormal signs during the massage. Based on the statistical results, there was no significant difference between the variables (i.e. gender, oxygen therapy, type of delivery, age at the initial breast-milk feeding, age at the start of the intervention, birth weight, maternal age, the mean Apgar score at the 1st and 5th minutes, and weight at the start

of the study) between the two groups before the intervention (P>0.05) (**Table.1**).

Table.2 shows the measurements and the means of the abdominal circumference, the frequency of defecation, the frequency of vomiting episodes, and the gastric residual volume in the preterm infants before and after the abdominal massage in the two groups. The results demonstrate that there was a statistically significant difference in the means of the abdominal circumference, the frequency of defecation, the frequency of vomiting episodes, and the gastric residual volume before and after the abdominal massage in the intervention group (P<0.05). According to the results, the means of the abdominal circumference, the frequency of vomiting episodes, and the gastric residual volume after the massage in the intervention group were less than those before the massage. Moreover, the mean of the frequency of defecation after the intervention was more than that before the massage.

There was no significant difference in the means of the frequency of defecation, the frequency of vomiting episodes, and the gastric residual volume before and after the study in the control group (P>0.05). However, the mean of the abdominal circumference after the intervention was significantly different from that before the intervention (P<0.05), so that the mean of the abdominal circumference after the study, as compared with that before the study, had increased (24.80±11.01 cm versus 25.81±12.22 cm).

Table 1: The means of baseline characteristics in the preterm infants before the intervention in the two groups

Variables	Sub-groups	Control (Mean ± SD)	Massage (Mean ± SD)	P-value
Apgar score (minute)	1st-min	6±2.00	6.35±1.8	0.562
	5th-min	8.79±2.1	8.48±2.2	0.205
Age at the initial breast-milk feeding (week)		13.80±7.2	14.40±7.8	0.797
Birth weight (gr)		1445.17±500.2	1481.68±505.1	0.064
Weight at the start of the study (gr)		1349.44±495.3	1353±501.1	0.051
Maternal age (year)		29.75±3	29.68±2	0.948
Type of delivery, No. (%)	Caesarean Vaginal	25 (8.39%) 7 (2.10%)	23 (9.36%) 9 (1.13%)	0.281
Oxygen therapy, No. (%)	Yes No	21 (34.6%) 11 (15.4%)	17 (27.9%) 15 (22.1%)	0.300
Gender, No. (%)	Female Male	14 (21.9%) 18 (28.1%)	12 (18.8%) 20 (31.2%)	0.460

P < 0.05 shows that there is a significant difference; SD: Standard deviation.

Table.2: The means of the feeding-tolerance criteria in the preterm infants before and after the intervention in control and Massage groups

Variables	Control	Mean ± SD	P-value	Massage	Mean ± SD	P-value
Abdominal circumference	Before	24.80±11.01	0.004	Before	26.72±11.22	0.031
	After	25.81±12.22		After	25.83±10.05	
Frequency of defecation	Before	1.06±.05	0.155	Before	1.41±0.11	0.023
	After	2.00±.05		After	3.07±1.10	
Frequency of vomiting episodes	Before	0.133±0.01	1.000	Before	0.586±0.05	0.001
	After	0.133±0.01		After	0.00±0.00	
Gastric residual volume	Before	3.85±1.042	0.315	Before	3.75±2.108	0.048
	After	2.08±2.001		After	0.01±0.006	

P < 0.05 shows that there is a significant difference; SD: Standard deviation.

4- DISCUSSION

The present study was aimed at evaluating effects of abdominal massage on preterm infants' feeding tolerance. The results revealed that the means of the abdominal circumference, the frequency of vomiting episodes, and the gastric residual volume in the massage group had decreased significantly after the intervention, as compared with those before the intervention, and the frequency of defecation had increased significantly.

These results are consistent with the results of a study by Tekgündüz et al., their study aimed to investigate the effectiveness of abdominal massage in preventing feeding intolerance in preterm infants. They conducted it on 27 preterm infants in the neonatal intensive care unit in a university hospital in Turkey. In this study, before the feeding in the massage group, the weight, the gastric residual volume, the abdominal circumference, the amount of abdominal distension (palpation), the frequency of defecation, the frequency of vomiting episodes, and arterial blood oxygen saturation were measured and recorded. Afterwards, abdominal massage was performed for 15 minutes at both 9.00 AM and 9.00 PM in the 5-day study period. The results indicated a decrease in the abdominal circumference, which confirms the results of the present study (11). Contrary to the results of the present study, Roozbehani and Narenji carried out a study in 2008 on effects of massage with sesame oil on sleep patterns and anthropometric measurements of term infants. Randomly assigned to three groups were 150 healthy two-month infants. The first group received no massage at all, the second was the group of massage alone, and the third was the group of massage with sesame oil. In the third group, the mother gave the infant a full-body massage with sesame oil twice a day for 10 minutes in a 4-week period.

The second group received a full-body massage without oil. The control group received typical care. According to the results of the study, the increase in the abdominal circumference was more in the massage groups than in the control group ($p < 0.05$) (15). The reason for the difference in the results must have been

the nature of selecting healthy, as opposed to preterm, infants in the present study. In the study by Roozbehani and Narenji (15), the infants' weight gain could have caused the increase in the abdominal circumference. In the current study, which was done on preterm infants, the decrease in the abdominal circumference following the abdominal massage could be justified in association with the increase in the number of defecation. The other result of the present study was that the abdominal massage decreased the frequency of vomiting episodes and the gastric residual volume and also increased the frequency of defecation. In a clinical trial in 2005, Diego et al., conducted a study in the Jackson Memorial Hospital in Miami and explored effects of massage on the vagal activity, gastric motility, and weight gain of preterm infants. The results showed that the massage increased vagal activity, which in turn led to an increased weight gain and increased gastric mobility during and right after the intervention. Moreover, this increased gastric mobility accelerated gastric emptying (16).

Furthermore, in a study by Bayomi and El-Nagger in 2015, 64 preterm infants were selected and received a full-body massage for 15 minutes twice a day for 3 months. The heart rate, respiratory rate, body temperature, occurrence of apnea, weeping and sleeping conditions, feeding patterns, feeding amount, frequency of vomiting episodes and defecation, level of pain, and body weight were measured before and after the intervention. According to the results, the frequency of vomiting episodes decreased significantly and the frequency of defecation increased significantly after the massage therapy. These results are in line with those of the present study (17). This is justifiable since abdominal massage stimulates the vagus nerve, increases gastric and intestinal mobility, and promotes the blood circulation to the massaged area (16). In addition, the increased frequency of defecation has a direct relationship with the decreased abdominal circumference and gastric residual volume. In other words, as the frequency of defecation increases, the abdominal circumference and distension decrease. Moreover, the results of the present study are consistent with the results of the study by Tekgündüz et al. (11). Apparently, abdominal massage is one of the traditional non-invasive and non-pharmacological interventions for tackling the problem of feeding intolerance in infants. Stimulating the digestive system and increasing intestinal mobility, massage therapy helps infants release gas trapped in the bowels and alleviates the pain and moreover, by increasing the secretion of melatonin, soothes infants and improves their sleep (8).

Obviously, the infant's body is manipulated a lot during a full-body massage. Additionally, the medical equipment attached to the body makes it difficult to give the infant this massage. Moreover, the goal of the massage is an improvement in the function of the digestive system. Furthermore, the results of the present research revealed the effects of abdominal massage on preterm infants' feeding tolerance. It is therefore possibly appropriate to use this method for preventing, reducing, or eliminating preterm infants' feeding intolerance.

4-1. Limitations of the study

The limitations of the study were the short intervention period and the low number of abdominal massages. Hence, it is recommended that more studies with a larger number of subjects be conducted in this field.

5- CONCLUSION

Overall, abdominal massage impacts on preterm infants' feeding-tolerance criteria and has the potential to decrease the abdominal circumference, gastric residual volume, and frequency of vomiting

episodes, and increase the frequency of defecation in preterm infants. Based on the above results, it is apparently essential to carry out more in-depth studies in this field.

6- CONFLICT OF INTEREST: None.

7- ACKNOWLEDGMENTS

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