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Effects of Abdominal Massage and Non-Nutritive Sucking on Physiological Parameters of Preterm Infants: A Randomized Clinical Trial (RCT)

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Abstract

Background: Despite the reduction of infant mortality in the world, complication of preterm birth is a major cause of infant mortality. The present study aimed to evaluate the effect of abdominal massage and non-nutritive sucking on physiological parameters of preterm infants in neonatal intensive care units in Emam Reza Hospital in Kermanshah, Iran.

Materials and Methods: In this randomized controlled clinical trial, 42 infants who had the inclusion criteria, were selected and randomly assigned to three groups of abdominal massage and non-nutritive sucking and control (14 infant for each group). Abdominal massage in the first intervention group with the "I Love You: method and non-nutritive sucking in the second intervention through sucking a pacifier were performed twice in day for 15 minutes. The control group also received typical unit care. In order to analyze the data, the SPSS 22.0 software for analytical as well as descriptive statistical methods was used.

Results: The results of this study showed that the studied groups, at 9 AM and 9 PM of 5 consecutive days, had a significant difference with each other in terms of physiological parameters of the mean scores of respiratory rate, heart rate, and oxygen saturation level ($p<0.05$); as the mean of changes of Respiratory rate , Heart rate and Oxygen saturation level in the abdominal massage group had a significant statistical difference with each of the control and non-nutritive sucking groups ($P<0.05$); but there was no statistically significant difference between non-nutritive group and the control group ($P>0.05$).

Conclusion: Abdominal massage had positive effect on the physiological parameters of preterm infants, but non-nutritive sucking had no effect on these parameters, so abdominal massage may be effective on improvement of physiological indices in preterm infants.

Key Words: Abdominal massage, Non-nutritive sucking, Preterm infants.

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1- INTRODUCTION

Due to an increase in inductive pregnancy over the recent years, the number of preterm births is on the rise around the globe. Preterm infants are account for 10 percent of the overall number of births (1). Preterm infants are those born before 37 weeks of pregnancy (2). Out of 100 live births happening in the world, 3 preterm infants are born. These infants usually weigh less than 2,500 grams (3). In Iran, out of 100 live births, 12.9 infants are reported to be born prematurely (4). Although mortality rate of preterm infants around the world is decreasing (4.4 million deaths in 1990 reduced to 3.1 million in 2010); the effects of preterm birth, still, account for more than one million deaths among infants (5). In order to cope with failure of growth and weight gain and also to prevent neural disorders, long term care is required during the hospitalization periods. Often feeding gets associated with many problems during these long term hospitalizations. Due to the lack of coordination among sucking, swallowing, and breathing, preterm infants are at the risk of aspiration. Therefore, in these infants, feeding must be performed through gavage (6, 7).

Feeding disorders occur to 25 percent of infants. However these disorders in preterm infants are so higher that include 30 to 40 of them. Therefore, comparing to ordinary infants, preterm infants are at higher risk of having feeding disorders (8). Inability to perform intestinal digestion leads to food intolerance which is a common disorder among preterm infants. The pathology of food intolerance is yet to be wholly discovered; that is why the healing process is faced with limitation (9-11). On the other hand, necrotizing enterocolitis is another important cause of death among infants. It is known as the emergency of digestive system and has an association with food intolerance. Despite the significant advancements in infant care, necrotizing enterocolitis related deaths have reached to 40 percent over the past few years (12, 13). In order to prevent these harmful gastrointestinal consequences among infants, various methods have been suggested including kangaroo mother care, massage, and skin contact and touch. Studies have shown that abdominal massage leads to an increase in peristaltic movements, change in intra-abdominal pressure, and digestive system speed-up (14). Also, the investigations indicate that non-nutritive sucking is so effective in infants' nutritional parameters that facilitates infants' sucking and improves food digestion (15, 16).

However, few studies have been carried out to investigate the effects of the interventions (abdominal massage, non-nutritive sucking, and oral massage) on physiological parameters of preterm infants. For instance, the study carried out by Rangey and Sheth in India showed that both massage and kangaroo mother care are effective in adjusting the physiological parameters such as respiratory rate (17). However some other studies have shown the ineffectiveness of the interventions. For example, the study carried out by Valizadeh et al. in Iran, showed that oral massage has no significant association with physiological parameters of respiratory rate, heart rate, and oxygen saturation (18). Therefore, in one hand, considering the limited number of studies carried out to investigate the effect of abdominal massage and non-nutritive sucking on physiological parameters of preterm infants in Iran, and on the other hand, the importance of normality and stability of these parameters in preterm infants' survival, the present study was designed and carried out with the aim of investigating the effect of abdominal massage and non-nutritive sucking on physiological parameters of preterm infants.

2- MATERIALS AND METHODS

2-1. Study design and population

In this study, the studied population were premature infants. Premature infants are infants who are not born before 37 weeks of pregnancy (1). The present study was a 3 group randomized controlled clinical trial carried out after obtaining the license from Tabriz University of Medical Sciences' ethic committee with the registration number of IR.TBZMEDREC.1395.158 and being registered in the Iranian center of clinical trial with the registration number of IRCT: 201410275168N9. It had been performed from May 21 to 21 July 2016 in the neonatal ward of Eman Reza hospital in Kermanshah city, Kermanshah province, Iran.

2-2. Methods

The sample size was estimated via G-power 3.1 software, with 95% confidence interval, 95% power, 3 groups, 10 measured response variables, correlation coefficient 0.25 between two consecutive measurements and variance ratio 0.25 between measurements to the error variance; 42 cases were examined and 14 infants were allocated to each group. Then, using random number table, the infants were assigned to 3 groups including 2 intervention groups (abdominal massage and non-nutritive sucking, and a control group. The preparation and completion of the checklist of these groups were performed by a research assistant who had not been informed of neither the randomized allocation of the groups nor the aims the study.

2-3. Inclusion and exclusion criteria

The entrance criteria for the present study were: the age of 28 to 32 gestational weeks defined by the pregnancy ultrasound, oral-gastric tube feeding, weighing 1,000 to 1,750 grams, physiologically being stable (not being under Nasal Continuous positive airway pressure [NCPAP], High flow nasal cannula [HFNC] ventilator), informed consent of the parents, and not being prohibited from either abdominal massage or non-nutritive sucking by physicians. The exit criteria were including central nervous system diseases, sever congenital abnormalities (sever heart disorder, intestinal sepsis and abnormal disorders, sever hemodynamic instability, withdrawal from the study by the parents, necrotizing enterocolitis, congenital anomaly of the abdomen, abdominal surgery, and oral anomalies and lesions.

2-4. Measuring tools: Validity and reliability

The data collection tools consisted of infants' demographic questionnaire and a checklist to record the physiological parameters of respiratory rate, heart rate and oxygen saturation on the daily basis. In this study the validity of the questionnaire was determined through content validity; the questionnaire was given to 10 experts and specialists including 7 members of the Faculty of Nursing and Midwifery as well as 3 Pediatric specialists. Then the necessary modifications were implemented based on their opinions. The first, made sure that the NOVAMETRIX pulse oximeter attached to the infants was calibrated, so that the results would be reliable. Then, to determine the reliability, the test-retest method was employed. In the first 10 infant cases, measuring respiratory rate and gastric residual volume was carried out by two nurses. The correlation coefficient between the two nurses was 0.92.

2-5. Intervention

After presenting the parents with the research objectives and the manner of doing the research, a written informed consent was obtained and those infants who met the entrance criteria were enrolled under the supervision of the specialists. In the abdominal massage group, the researcher after observing the

hand washing protocol, the infants' abdominal circumference was touched and measured to control the distention. Abdominal massage was performed while the researcher's hands were warm and smeared with olive oil. Two times a day for 5 days the massage had been performed at 9 AM and 9 PM before feeding (to reduce the risk of regurgitation) with the "I Love You" method and Vaymal technique (the "I Love U": Trace the letter I down your baby's left side. Then trace an inverted L, stroking across the belly along the base of her ribs from her right side to her left and down. Trace an inverted U, stroking from low on the baby's right side, up and around the navel, and down the left side. During the 15 minute massage, the infant was set in supine position while the head of the bed was elevated 35-40 degrees (19).

The preterm infants in the non-nutritive group were, also received pacifier intervention for 5 days and two times a day at 9 AM and 9 PM by researcher. Pacifier sucking started 5 minutes before the time of gavage and continued for another 10 minutes. It lasted 15 minutes in total. If the infant stopped sucking, his moth would, again, be stimulated be the pacifier. The control group only received routine care (Routine care are not including massage of the abdomen and non-nutritive sucking) of the ward. During the study, the physiological parameters of respiratory rate, heart rate, and oxygen saturation in the 3 groups were repeatedly recorded and measured by researchers.

2-6. Ethical consideration

In order to perform the present study, a license was obtained from Tabriz University of Medical Sciences' ethic committee registered under the ethical number of IR.TBZMEDREC.1395.158. Also, before embarking upon investigation, a written informed consent was obtained from the parents of the infants.

2-7. Data analysis

After data collection, using SPSS 22.0 software, descriptive analysis of the data was carried out, The one way ANOVA, and Chi-square tests were used for the analysis of quantitative and qualitative variables in baseline ;respectively. And also the Repeated Measures ANOVA test was used for the analysis of quantitative variables between groups during the time. The results were considered significant at $P<0.05$ level.

3-RESULTS

The present study was conducted on 42 preterm infants admitted to the NICU of Emam Reza hospital in the city of Kermanshah, Iran. These infants were randomly divided into the three groups of abdominal massage, non-nutritive sucking, and control. The number of the preterm infants in each group was 14.

Table.1 shows the baseline characteristics of the preterm infants before the interventions performed with the division of the groups, as it is shown, there is no significant statistical difference among the three groups in terms of baseline variables of the infant's age, gestational age, birth order, Apgar score at 5 minutes, birth weight, the mother's age, parity, abdominal circumference, gender, and the type of delivery ($P>0510$); the lack of significant difference could be resulted from the exactness of the randomization process (**Table.1**). **Table.2** shows the mean scores of respiratory rate changes at 9 AM of 5 consecutive days among the 3 groups. As it is shown, the mean scores of changes of this variable in the 3 groups had a significant statistical difference with each other ($P=0.02$).

The mean scores of respiratory rate changes in the abdominal massage group had a significant statistical difference between each of the control and non-nutritive sucking groups (with significant

levels of P=0.03 and P=0.05, respectively); however, it did not have any significant difference between the non-nutritive group and the control group (P=0.96). Also, the mean scores of respiratory rate changes of the 3 groups at 9 Pm of 5 consecutive days, had a significant statistical difference with each other (P=0.001); so that, the mean scores of changes in this physiological parameter in the abdominal massage group had a significant difference between the non-nutritive group and the control group (P=0.66) (**Table.2**).

Figures 1 and 2 show the mean scores of respiratory rate changes in 5 consecutive days at 9 AM and 9 PM among the 3 groups. In the present study, the mean scores of heart rate changes among the 3 groups at 9 AM of 5 days did not show any significant statistical difference with each other (P=0.074). However, the mean scores of this physiological parameter among the 3 groups at 9 PM of 5 consecutive days had a significant statistical difference with each other (P<0.001). So that, the mean scores of heart rate changes in the abdominal massage group had a significant statistical difference with each of the non-nutritive sucking and control groups (with significant level of P<0.001). However, it did not have any significant difference between the non-nutritive sucking group and the control group (P=0.08) (**Table.3**). **Figures 3 and 4**, respectively show the mean scores of this parameter in 5 consecutive days at 9 AM and 9 PM among the 3 groups. Considering oxygen saturation level, the results indicated that 3 groups had a significant statistical difference with each other on this parameter as well (P<0.001); so that, this variable in the abdominal massage group had a significant statistical difference with each of the control and non-nutritive sucking groups (with levels of P=0.01 and P<0.001, respectively). However, this variable had no significant difference between the non-nutritive sucking and control groups (P=0.25) (**Table.4**).

Also, the mean scores of changes of this physiological parameter in the three groups at 9 PM of 5 consecutive days had a significant statistical difference with each other (P=0.02); so that, the mean scores of this parameter in the abdominal group had significant statistical difference with each of the non-nutritive and control groups (with a significant level of P<0.001 for both). However it did not have a significant difference in the non-nutritive sucking group with the control group (P=0.32) (**Table.4**) and **Figures 5 and 6**, respectively show the mean scores of this parameter at 9 am and 9 pm of 5 consecutive days in the 3 groups.

Table-1: The baseline characteristics in the preterm infants before the intervention in the three groups

Variables	Sub-groups			P-value
	Abdominal massage	Non-nutritive sucking	Control	
	Mean (SD)	Mean (SD)	Mean (SD)	
Age (day)	3.36 (1.33)	3.14 (1.16)	3.57 (1.22)	0.663
Gestational age (week)	30.64 (1.44)	30.14 (1.61)	31.14 (1.35)	0.212
Birth order	2.57 (1.34)	1.64 (0.74)	2 (1.35)	0.072

Apgar score (5th-min)	7.21 (1.18)	7.43 (0.85)	7.86 (0.86)	0.223
Birth weight (gr)	1389 (234)	1346 (290)	1490 (213)	0.300
Maternal age (year)	31.6 (7.5)	28.2 (5.1)	29.9 (5)	0.345
Parity	1.21 (1.05)	0.74 (0.64)	0.93 (0.82)	0.244
Abdominal circumference (cm)	24.73 (1.13)	24.40 (1.55)	25.15 (1.11)	0.304
Gender, No. (%) Girl Boy	 9 (64.3) 5 (35.7)	 11 (78.6) 3 (21.4)	 8 (57.1) 6 (42.9)	0.472
Type of delivery, No. (%) Normal vaginal delivery (NVD) Caesarean section(CS)	 3 (21.4) 11 (78.6)	 5 (35.7) 9 (64.3)	 5 (35.7) 9 (64.3)	0.640

Table-2: Mean scores of respiratory rate at 9 AM and 9 PM of 5 consecutive days among the 3 groups (Repeated Measures ANOVA)

Respiratory rate at 9 AM of 5 consecutive days	Abdominal massage	Non-nutritive sucking	Control	P-value
	Mean (SD)	Mean (SD)	Mean (SD)	
The first day (B.I)	60.14 (1.16)	61(1.88)	60.71 (1.13)	0.02
The first day (A.I)	61.43 (1.28)	61.07(1.94)	60.43 (1.91)	
The second day (B.I)	57.86(1.35)	57.14 (2.17)	58.07(1.26)	
The second day (A.I)	58.29 (1.32)	57.07(1.94)	58 (2.0)	
The third day (B.I)	54.57 (2.13)	54.07 (2.86)	54.50 (2.5)	
The third day (A.I)	54.14 (2.53)	52.93 (2.97)	53.07(3.02)	
The fourth (B.I)	49.79 (3.19)	50.29 (3.93)	49.93(3.24)	
The fourth (A.I)	49.64 (3.41)	49.21 (3.66)	48.79 (3.98)	
The fifth (B.I)	48.14 (2.24)	48.64(3.03)	48.50(2.62)	
The fifth (A.I)	48.07(2.43)	47.71(3.36)	47.93(3.31)	
Respiratory rate at 9 PM of 5 consecutive days	Abdominal massage	Non-nutritive sucking	Control	P-value
	Mean (SD)	Mean (SD)	Mean (SD)	
The first night (B.I)	59.86 (1.83)	59.14(1.95)	58.93(2.01)	
The first night (A.I)	153.79 (9.68)	147 (8.35)	147.93 (7.74)	
The second night (B.I)	56.93(1.81)	55.71 (2.33)	56.71 (2.01)	
The second night (A.I)	56.5 (2.31)	55.14 (3.48)	56.36 (2.02)	

The third night (B.I)	52 (3.44)	52.5 (3.18)	51.71 (2.33)	0.001
The third night (A.I)	51.07 (3.71)	51.71 (3.66)	51.86(3.41)	
The fourth night (B.I)	48.86(2.95)	49.57 (3.85)	48.93(2.49)	
The fourth night (A.I)	48.07(3.05)	49 (3.35)	48.79(2.94)	
The fifth night (B.I)	47.93(1.85)	48.5 (2.84)	47.93 (2.61)	
The fifth night (A.I)	47.07(1.81)	47.57 (2.70)	47.43(2.40)	
B.I : Before the Intervention; A.I : After the Intervention.				

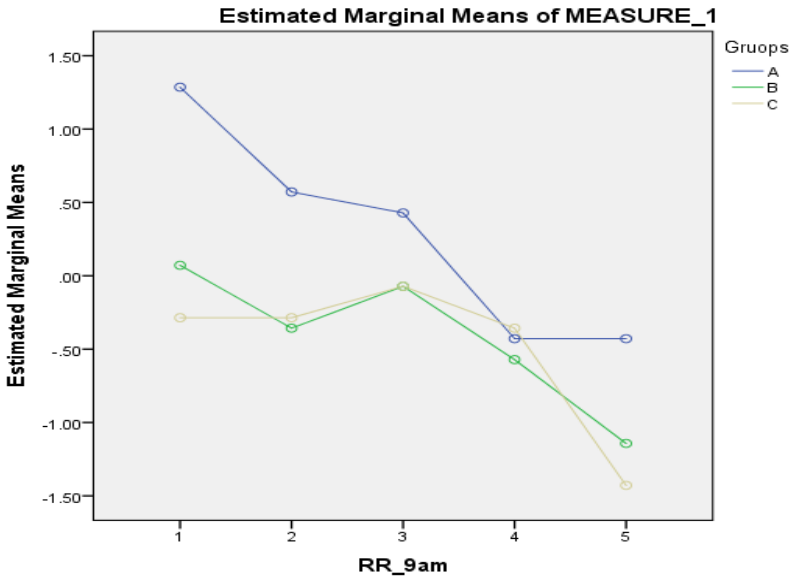

Fig.1: Respiratory rate changes at 9 AM of 5 consecutive days among the 3 groups.

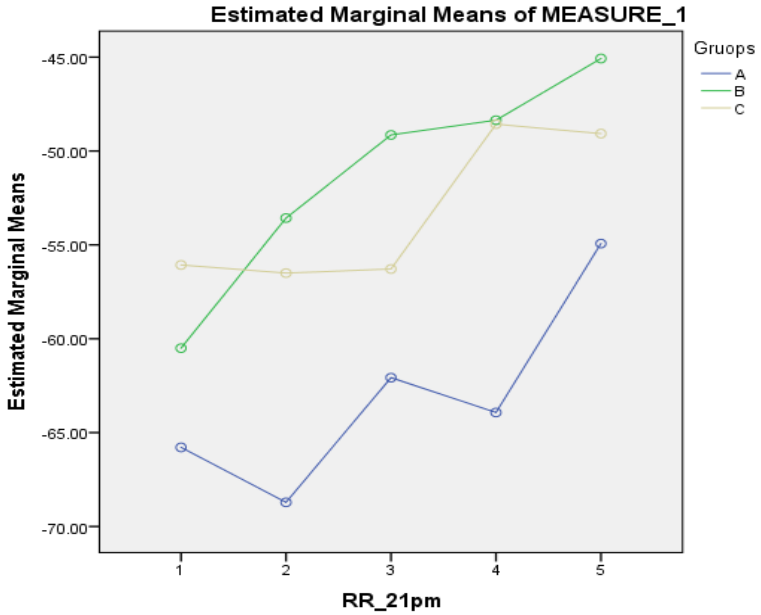

Fig.2: Respiratory rate changes at 9 PM of 5 consecutive days among the 3 groups.

Table-3: Mean scores of heart rate at 9 AM and 9 PM of 5 consecutive days among the 3 groups (Repeated Measures ANOVA)

Heart rate at 9 AM of 5 consecutive days	Abdominal massage	Non-nutritive sucking	Control	P-value
	Mean (SD)	Mean (SD)	Mean (SD)	
The first day (B.I)	149.86 (5.12)	149.50 (8.68)	147.93(4.25)	0.074
The first day (A.I)	157.86 (7.71)	152 (5.6)	147.64(3.60)	
The second day (B.I)	151.43 (9.75)	144.93 (6.24)	148.07(5.90)	
The second day (A.I)	154.29 (10.88)	141.57 (8.60)	148.29(8.78)	
The third day (B.I)	147 (6.88)	142.07 (5.41)	141.07(6.05)	
The third day (A.I)	148.21(9.90)	137.29(5.79)	141.43(6.18)	
The fourth (B.I)	139.57 (3.56)	138.36 (4.58)	141.50 (5.12)	
The fourth (A.I)	414.14(5.08)	137.57(4.89)	138.64(6.38)	
The fifth (B.I)	136.29(3.70)	137.86(5.36)	140.21(6.53)	
The fifth (A.I)	136.29 (3.70)	137.86(5.36)	140.21(6.53)	
Heart rate at 9 PM of 5 consecutive nights	Abdominal massage	Non-nutritive sucking	Control	P-value
	Mean (SD)	Mean (SD)	Mean (SD)	
The first night (B.I)	59.86(1.83)	59.14(1.95)	58.93(2.01)	<0.001
The first night (A.I)	153.79 (9.68)	147(8.35)	147.93(7.74)	
The second night (B.I)	150.14(9.12)	143.12(7.44)	144.36(3.57)	
The second night (A.I)	156.36(8.77)	141.07(8.39)	141.07 (5.97)	
The third night (B.I)	141.71(4.48)	139(6.99)	141.57(6.04)	
The third night (A.I)	141.71(8.38)	139.86(6.31)	141(9.08)	
The fourth night (B.I)	137.79(5.57)	138.14(5.14)	141(4.77)	
The fourth night (A.I)	139(7.67)	137.29(4.79)	138.86(9.12)	
The fifth night (B.I)	47.07(1.81)	47.57(2.70)	47.43(2.40)	
The fifth night (A.I)	137.79(3.30)	128.21(33.40)	136.79(4.98)	

B.I : Before the Intervention; A.I : After the Intervention.

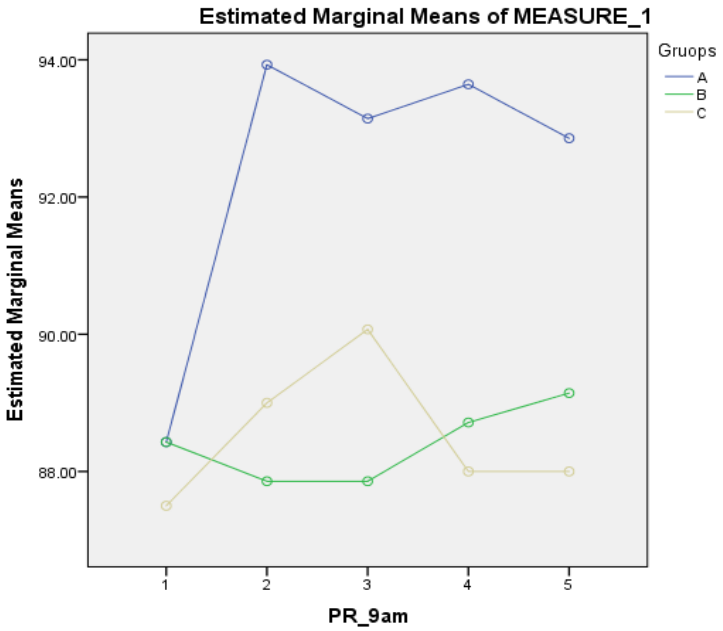

Fig.3: Heart rate changes at 9 AM of 5 consecutive days among the 3 groups

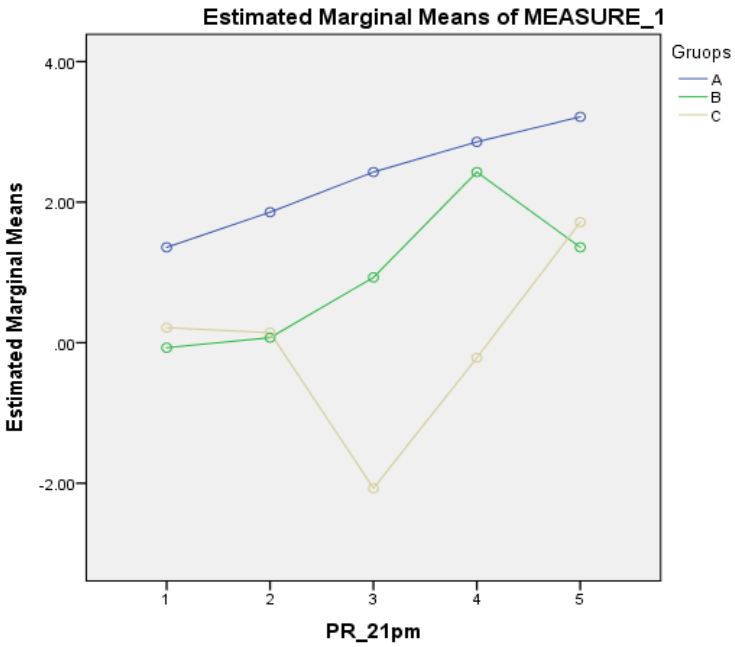

Fig.4: Heart rate changes at 9 AM of 5 consecutive days among the 3 groups

Table-4: Mean scores of oxygen saturation level at 9 AM and 9 PM of 5 consecutive days among the 3 groups (Repeated Measures ANOVA)

Oxygen saturation level at 9 PM of 5 consecutive days	Abdominal massage	Non-nutritive sucking	Control	P-value
	Mean (SD)	Mean (SD)	Mean (SD)	
The first day (B.I)	92.07 (0.61)	91.50(0.94)	91.57 (1.08)	<0.001
The first day (A.I)	93.43(1.69)	91.43 (1.74)	91.97 (1.96)	
The second day (B.I)	92.21 (1.05)	92.43 (1.55)	92 (1.30)	
The second day (A.I)	94.64 (1.27)	93.36 (1.86)	89.93 (8.99)	
The third day (B.I)	93.29 (1.13)	92.21(1.42)	92.36 (1.64)	
The third day (A.I)	96.5(1.09)	93.57 (2.76)	94.07 (2.99)	
The fourth (B.I)	87.43 (22.62)	92.57 (1.60)	93 (1.71)	
The fourth (A.I)	95.07 (2.30)	94.50 (2.37)	94.21(3.44)	
The fifth (B.I)	93.57 (2.17)	93.57 (2.34)	93.5 (1.6)	
The fifth (A.I)	96.26 (1.72)	95.86 (1.61)	95.14 (2.50)	
Oxygen saturation level at 9 PM of 5 consecutive night	Abdominal massage	Non-nutritive sucking	Control	P-value
	Mean (SD)	Mean (SD)	Mean (SD)	
The first night (B.I)	92.57 (1.34)	92.21 (1.12)	91.93 (0.91)	0.02
The first night (A.I)	94.43 (1.86)	92.29 (1.93)	92.07 (2.16)	
The second night (B.I)	92.43 (1.15)	92.71 (1.32)	92.50 (1.60)	
The second night (A.I)	95.29 (1.89)	95.14 (2.34)	92.29 (2.26)	
The third night (B.I)	92.86 (1.46)	93.29 (1.32)	93 (1.75)	
The third night (A.I)	95 (2.57)	94.43 (2.95)	92.86 (2.56)	
The fourth night (B.I)	93.64 (1.78)	93.21 (1.76)	93.57 (1.55)	
The fourth night (A.I)	96.14 (2.28)	95 (2.48)	93.36 (2.76)	
The fifth night (B.I)	93.79 (1.52)	93.29 (2.01)	94.43 (1.82)	
The fifth night (A.I)	96.71 (2.49)	96.57 (1.78)	95.86 (1.74)	

B.I : Before the Intervention ; A.I : After the Intervention.

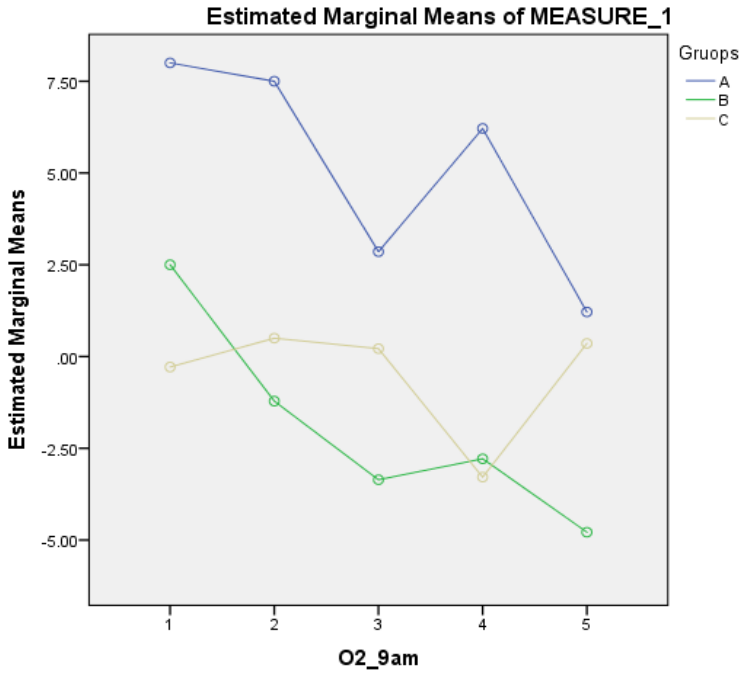

Fig.5: Oxygen saturation level changes at 9 AM of 5 consecutive days among the 3 groups

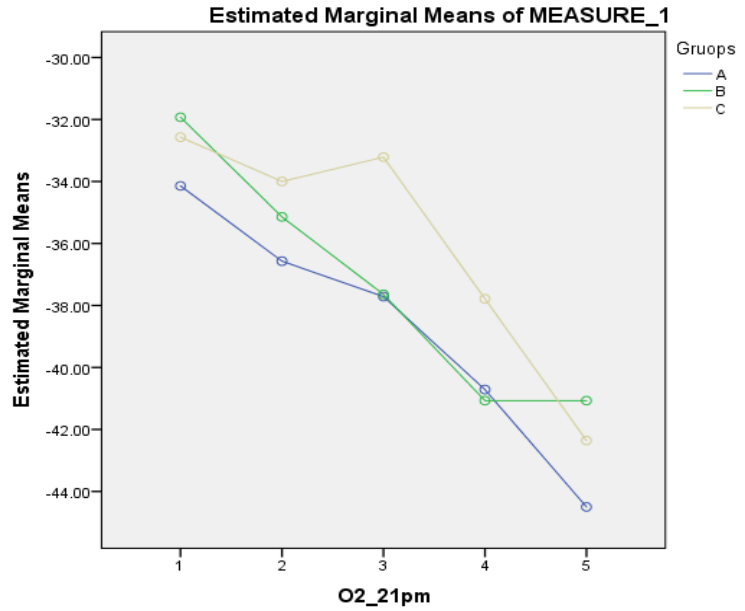

Fig.6: Oxygen saturation level changes at 9 AM of 5 consecutive days among the 3 groups

4- DISCUSSION

The present study was a randomized clinical trial with the aim of comparing the effect of abdominal massage and non-nutritive sucking on clinical consequences in preterm infants. The study was designed and carried out on 42 preterm infants divided into the 3 groups of abdominal massage, non-nutritive sucking, and control. The results of the study showed that the studied groups, at 9 AM and 9 PM of 5 consecutive days, had a significant difference with each other ($P<0.05$) in terms of physiological parameters of the mean scores of respiratory rate, heart rate, and oxygen saturation; so that, the mean scores of changes in each of these parameters had a significant difference with each of the non-nutritive sucking and control groups ($P<0.05$). However, it did not have any significant difference between non-nutritive group with the control group ($P>0.05$).

The finding of this study shows the overall effectiveness of abdominal massage on the mean scores of changes in physiological parameters of respiratory rate, heart rate, and oxygen saturation in preterm infants with comparison to non-nutritive and control groups. This finding is not consistent with some of the studies carried out in this filed. For instance, in the study performed by Valizadeh et al., with the aim of investigating the effect of oral massage on physiological and behavioral parameters, frequency, and duration of independent oral feeding in preterm infants in Iran, it was suggested that oral massage does not have a significant effect on the physiological parameters of respiratory rate, heart rate, and oxygen saturation (20). Also, the results of the study performed by Hwang et al. indicated that during feeding, heart rate and oxygen saturation levels do not have a significant difference between the two groups of massage and control (21).

Also, Picker et al. suggested that heart rate does not have a significant difference between the massage and control groups; while, oxygen saturation level has a significant difference between the two groups; so that, the infants in the massage group showed a higher oxygen saturation level with comparison to the control group (22). The results of the present study, however is consistent with a large number of studies carried out in this field. For instance, in the study done by Rangey et al. in India with the aim of investigating the comparative effect massage therapy versus Kangaroo mother care on body weight and length of hospital stay in low birth weight preterm infants, the results showed that both massage and Kangaroo mother care are effective in reducing and adjusting physiological parameters of respiratory rate, heart rate, and body temperature of the preterm Infants (17).

In the other study carried out by Jebreili et al. that with the aim of the effect of skin massage on physiological parameters of preterm infants, the results showed that there is a significant statistical difference between the mean scores of respiratory rate changes between the skin massage with olive oil group and the control group; so that the mean score at the 10th day after intervention were 50.24 ± 7.8 and $41.41.47\pm5.22$, respectively, for the massage with olive oil and control groups. The study concluded that infant massage has no negative impact on physiological parameters (23). The study done by Whit-Traut et al., did not show any significant statistical difference between heart and respiratory rates, before and after the intervention of massage, among the preterm infants (24). Although some results of the studies suggest that infant massage has no impact on physiological parameters, most of the studies carried out in this field imply that touching infants is not stress provoking and improves growth, maturity, sleep-wake cycle and

development of infant-mother interactions (25-30). Preterm infant massage, in fact, improves the normal responses of preterm Infant. It helps keeping the infant calm and leads to stable heart rate and slow breathing with reduction of need for supplemental oxygen (10). The studies have shown that preterm Infant massage could contribute to preterm Infants cardiorespiratory stability. Cardiorespiratory stability refers to infant's ability to adjust heart rate, respiratory rates, and oxygen saturation during feeding process. It requires neurological physiological and behavioral development of the infant; without this stability and consistency, the infant is at higher risk of many complications. Diagnosing and minimizing the oxygen saturation decline during feeding process is a very important goal for preterm infants' nurses. Oxygen depletion results in loss of coordinated nutritional behavior and could lead to apnea or heart rhythm changes. This physiological instability could, in turn, create a pattern of stress and food refusal behavior which, by massage, could be prevented to a considerable extent (18, 30, 31).

4-1. Limitations of the study

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

5- CONCLUSION

The finding of this study showed that the overall effectiveness of abdominal massage on the mean scores of changes in physiological parameters of respiratory rate, heart rate, and oxygen saturation in preterm infants with comparison to non-nutritive and control groups. Hence, the obtained results of this study suggest that massage does not have a negative impact on infants; on the contrary, due to the changes made by massage in preterm infants natural or the so-called physiological responses, endocrine system increases the secretion of endorphins and serotonin leading to comfort and relaxation changes in physiological responses and optimal level of respiratory rate, heart rate, and arterial oxygen saturation percent (11, 32, 33). Therefore, considering the results of this study and according to the results of the various studies performed in this field, nurses and mothers should no longer be worried about the negative effects of massage on physiological parameters in preterm infants. They could, without the slightest fear of adverse effects, massage infants and witness the beneficial effects on these parameters.

6- CONFLICT OF INTEREST: None.

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