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EFFECT OF ABDOMINAL MASSAGE ON PHYSIOLOGICAL PARAMETERS AND FEEDING OUTCOMES AMONG PRETERM INFANTS

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Abstract

Background: abdominal massage is a beneficial nonpharmacological intervention for enhancing overall health outcomes in preterm infants. **The aim** of the current study was to evaluate the effect of abdominal massage on physiological parameters and feeding outcomes among preterm infants. **Methods:** A single-blinded randomized controlled trial (RCT) design was utilized on a purposive sample of eighty four preterm infants from Neonatal Intensive Care Units at El Manial (Kaser Al Aini) and EL Monira Pediatric Hospitals that are affiliated to Cairo University from June 2023 to July 2024. were simply randomly assigned to two equal groups, namely study (abdominal massage) and control. **Tools:** three tools were utilized: preterm infant's characteristics and medical record data sheet, physiological parameters' record and feeding outcomes recording sheet including feeding tolerance criteria and preterm infants' weight. **Results:** there were no statistically significant differences between the study and control groups regarding their personal characteristics on admission. There were statistically significant differences regarding mean score of heart rate and respiratory rate While there was no statistically significant difference regarding the mean oxygen saturation between both groups. As well as there was a highly statistically significant difference in the mean score of feeding intolerance including abdominal circumference, abdominal distension, GVR, frequency of vomiting and frequency of defecation in the abdominal massage group. Also, the mean preterm infant weight gain in the abdominal massage was a highly statistically significant difference compared to control group. **Conclusion**: abdominal massage can be an effective non-pharmacological intervention to efficiently improve physiological parameters, significantly reduce gastric residual volume, vomiting episodes, and abdominal distention. Additionally, it has been associated with increased defecation frequency and therefore it promotes weight gain in preterm infants. **Recommendation**: Utilizing abdominal massage as a nursing care routine in enterally fed preterm infants.

Keywords: Abdominal Massage, Physiological Parameters, Preterm Infants, Feeding Outcomes.

1. INTRODUCTION

World Health Organization (WHO), defined preterm as neonate had born alive before 37 weeks of pregnancy are completed [1].

Preterm birth is related to 5 to 18% of pregnancies, and also is a major cause of infant morbidity and mortality.

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Despite of improvement in the medical care services, mortality rate is yet remarkable among preterm and very low birth weight infants [2].

In recent years, essential enhancements have been created in the care provided to those infants; however, immaturity continues to be a significant cause of infant morbidity and mortality in developing countries [3].

The establishment of safe oral feeding in preterm infants with regulation of physiological parameters may be delayed because of poor coordination of sucking and swallowing, neurological immaturity and respiratory distress [4].

So, feeding problems and in ability to regulate preterm infants' physiological parameters are of the most significant contributors to growth failure in preterm infants. The inability to sustain enteral feeding also contributes to extended periods of parenteral nutrition, which often requires central venous access, thereby increasing the risk of infection [5].

Competent oral feeding requires the proper integration of physical and neurophysiologic functions that may not necessarily be mature at the time oral feeding is introduced. For preterm infants, such issues are generally identified during their hospitalization in Neonatal Intensive Care Units (NICUs) as attainment of independent oral feeding is a major criterion for hospital discharge [6].

Because these infants usually have not yet developed coordinated sucking and swallowing, they may be vulnerable to develop feeding intolerance and instability of their physiological parameters until they achieve adequate oral feeding skills [7].

Functional immaturity of the gastrointestinal tract and vital organs function in preterm infant can cause several problems. It leads to irregular or abnormal physiological parameters and feeding intolerance which may lead to suboptimal nutrition and subsequent adverse outcomes including reduced brain growth, decreased weight gain, and cognitive delays [8].

Preterm infants have an increased susceptibility to feeding intolerance which is one of the most significant causes of growth failure. The inability to sustain enteral feedings also contributes to extended periods of parenteral nutrition, which often requires central venous access, thereby increasing the risk of infection [9].

Nursing interventions in dealing with research-based feeding intolerance were still focused on prevention and monitoring of symptoms caused [10]. Research on abdominal massage aimed at the problem of feeding intolerance was first carried out by [11].

The results showed that abdominal massage performed on premature infants with a gestational age of 28–34 weeks significantly influence the prevention of symptoms of intolerance feeding. This is based on an increase in gastrointestinal function such as increased parasympathetic dysfunction, gastric and intestinal motility and increased production of digestive hormones [12].

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Abdominal massage is a useful way to relax the abdominal muscles of infants to the greatest extent, which could effectively relieve their gastrointestinal discomfort. Studies have shown that massage could not only promote the early growth and development of premature infants, but also greatly increase the levels of gastrin and insulin in premature infants, thus increasing the digestion and absorption of their nutrients [13].

Meanwhile, during abdominal massage therapeutic signals could be transmitted directly to brain by means of skin contact and pressure, stimulating the vagus nerve, thus promoting intestinal peristalsis [14].

However, little research showed the connection between intervention of abdominal massage and feeding outcomes in premature infants.

1.2 Operational definitions

For the purpose of the current study the following operational definitions will be addressed: -

Abdominal massage: is a group of consecutive interventions which include paddling massage technique, I Love U stroke, sun and moon massage technique, fulling massage technique and knees up maneuver.

Physiological parameters: it includes (heart rate, respiratory rate and oxygen saturation).

Feeding outcomes: it includes the following:

- Feeding tolerance criteria (gastric residual volume, abdominal circumference, absence of abdominal distension, frequency of defecation, and frequency of vomiting episodes) and weight of preterm infant.

2. METHODS

2.1 Aim

The aim of the current study was to evaluate the effect of abdominal massage on physiological parameters and feeding outcomes among preterm infants. To achieve the aim of the current study the following research hypotheses were postulated:

H1: Preterm infants who are receiving abdominal massage will exhibit stable physiological parameters than those who don't.

H2: Preterm infants who are receiving abdominal massage will have better feeding outcomes than those who don't.

2.2 Design

A single-blinded randomized controlled trial (RCT) design was utilized.

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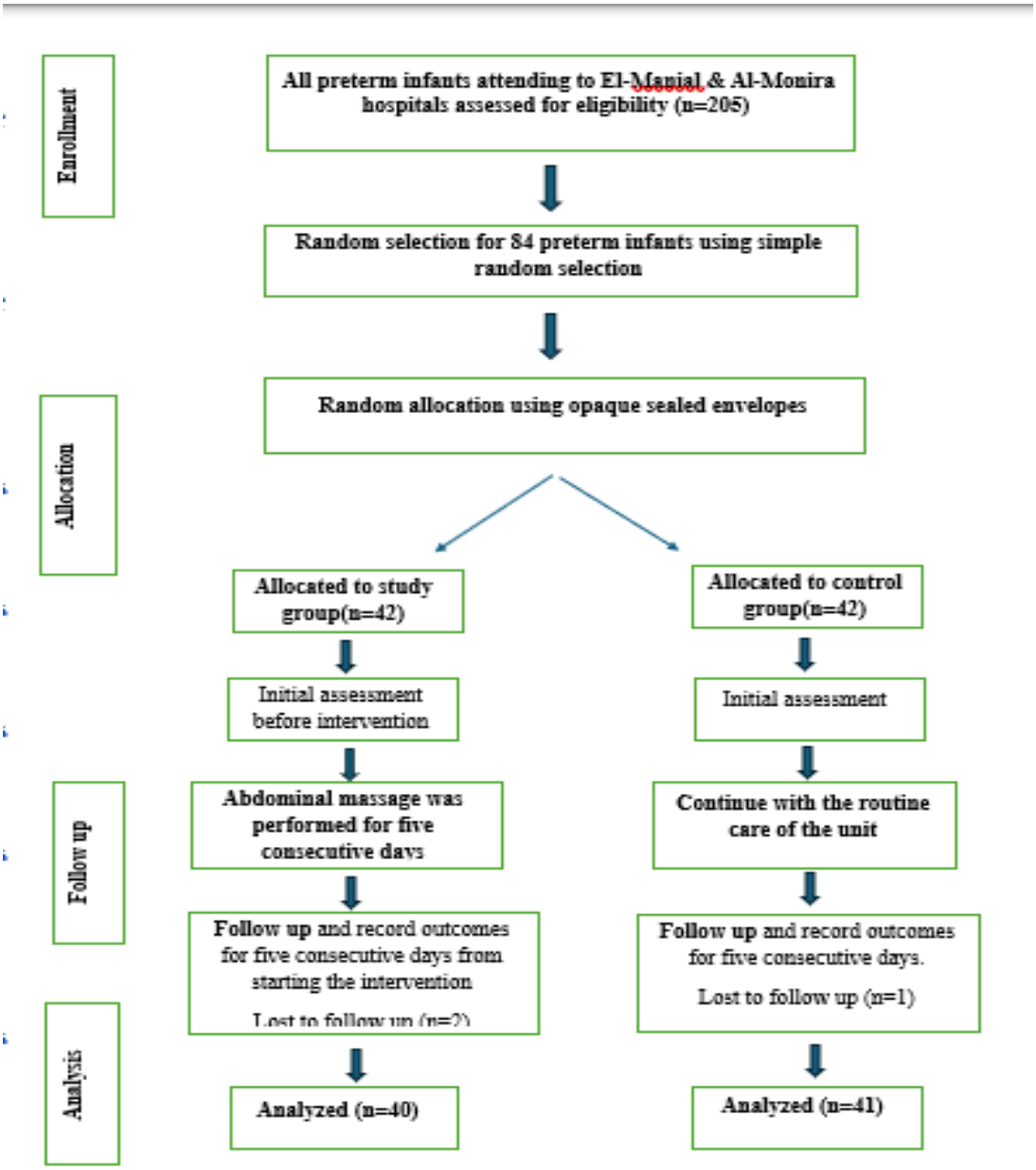

2.3 Setting

The study was conducted at the NICUs of both El Manial (Kaser Al Aini) and EL Monira Pediatric Hospitals that are affiliated to Cairo University. Capacity of the NICU at El Manial (Kaser Al Aini) hospital is about 64 incubators and the NICU of EL Monira Pediatric hospital is about 56 incubators. Both units provide the same protocol of care for neonates.

2.4 Participants

A purposive sample of 84 preterm infants who met the inclusion criteria were simply randomly assigned to two equal groups, namely study (abdominal massage) and control.

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2.5 Data Collection Tools

Three tools were developed by the researchers after extensive review of related literature: preterm infant's characteristics and medical record data sheet, physiological parameters' record and feeding outcomes recording sheet including feeding tolerance criteria and preterm infants' weight.

2.6 Procedure

The study was carried out in three phases: the preparatory, the implementation, and the evaluation phase.

Preparatory phase: Official permission was obtained from the director of NICU administrator of the study setting. The researcher introduced herself to the preterm infants' parents. Written informed consent was obtained from each parent after a complete description of the purpose, nature, and benefits of the study.

Randomization of Sample: The researcher started the enrollment process by assessing preterm infants of both NICUs at El Manial University Hospital and Cairo University Children Hospital at Al-Monira for eligibility criteria of the trial. After that, a list of preterm infants who met the criteria was done by the researcher.

Thereafter, preterm infants were randomly allocated into study group or control group by using opaque sealed envelopes reflecting the type of each group and assigned doctor or nurse was asked to choose an envelope to determine to which group the preterm infant was assigned. This technique was utilized to maintain allocation concealment in order to decrease bias and ensure homogeneity between the groups.

Implementation phase: Data collection was done for five consecutive days per week at day shift twice a day for all preterm infants of both groups. The researcher recorded preterm infants' characteristics and relevant medical history was obtained from medical record using Tool I for all preterm infants in the two groups at enrollment.

Each preterm infant of all two groups was connected to a calibrated monitor and pulse oximeter to monitor and record the physiological parameters (heart rate, respiratory rate, and oxygen saturation level), as a baseline at enrollment and for five consecutive days before any interventions using tool II.

Weight was measured daily using the same scale at the same time for all two groups before the intervention using (Tool III, second part).

Abdominal massage technique:

The abdominal massage technique is adopted from [11] and [15]. Abdominal massage used moderate pressure massage techniques that were carried out in the abdomen area, following the procedure: Abdominal massage was applied in a clockwise direction over the intestines on the abdominal wall. Preterm infants were placed directly in front of researcher in supine position with head elevated 30°- 45°, while these infants are awake and calm.

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Prior to the massage, in order to reduce friction, 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- **Paddling massage technique:** for this technique, hold hand so that the edge of the 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 paddlewheel-like motion with the other hand.

2- The researcher should always be creating clockwise motion when the left hand began, the right hand followed. massage the preterm infant's abdomen with the fingertips in a circular clockwise motion.

3- **I Love U" stroke as follows:** trace the letter I down the preterm infant's left side. Next, traced an inverted L, stroked across the abdomen along the base of the ribs from the right side to the left side and then downward. trace an inverted U, stroked from down the preterm infant's right side upward and around the umbilicus and finally down the left side. Then walk the fingers around the navel clockwise.

4- **Sun and moon massage technique,** look at preterm infant's abdomen as if it is a clock (with 12 o'clock at the top and 6 o'clock at the bottom) and begin at 6 o'clock by using the left hand. Then gently press and slide a hand in a clockwise motion around the baby's bowel. After that, the right hand began at 12 o'clock, gently pressed and slide hand in a clockwise motion in a half moon shape until reaching 6 o'clock.

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. Then place a hand on the stomach horizontally and rock the hand from side to side a few times. Avoid massaging the stomach if the cord has not healed completely.

6- **Fulling massage technique:** lay two thumbs flat across preterm infant's abdomen. Then, gently press in; slide the thumbs away from each other. The "fulling" sequence was done in this order: - Two strokes just above the navel. - One stroke on each side moving out.

Note: they should always be creating clockwise motion when the left hand began, the right hand followed.

For the control group, the pre-term infants received routine care in the units with no massage technique applied.

Dropout Analysis

Out of the 84 preterm infants initially enrolled in the study, 81 completed the trial. The drop rate was 3.57% (3 infants).

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The reasons for the dropouts and their timing are detailed below:

- **Abdominal Massage Group:**
  - Dropouts: 2 infants
  - Timing: Both dropouts occurred within the first and third days of the intervention.
  - Reason: Medical complications as the pre-term infants developed conditions requiring intensive care, making it unsafe to continue the massage intervention.
- **Control Group:**
  - Dropouts: 1 infant
  - Timing: One dropout occurred on the third day of measurement.
  - Reason: one pre-term infant developed severe respiratory complications which ended with death.

Evaluation phase: Physiological parameters, signs of feeding intolerance and weight were measured daily for each preterm infant in both groups before intervention for five consecutive days by using tools II, and tool III (first & second part).

2.7 Statistical Analysis

A Statistical Package for the Social Science (SPSS) program version 21 was used [15]. The collected data was tabulated, and summarized. Data was computerized and analyzed using appropriate descriptive statistics were utilized such as frequencies, mean and standard deviation. Inferential statistical tests to test the research hypotheses as the significance in standard statistical books included Student t-test, chi-square, (ANOVA) test, Post Hoc Tests, Kruskal–Wallis, Mann-Whitney U tests and Spearman test for correlation. Level of significance was set at $P < 0.05$.

3. RESULTS

3.1 Description of Participants

Table 1 and Figure 1demonstrated that there are no statistical significance differences among study groups in relation to their table (1) that there were no statistically significant differences between study and control groups regarding their gender, diagnosis and age ($p = 0.51, 0.19, 0.52$ & 0.20). respectively.

3.2 Tests of Hypotheses

Table (2) shows that there are statistically significant differences among total mean scores of heart rate and respiratory rate in the study group (153.6 ± 4.6 & 57.2 ± 2.5) as compared to (157.3 ± 5.5 & 58.7 ± 3.0) ($P=0.001^*$ & 0.01^*) respectively. while there is no statistically significant difference related to oxygen starvation in the study group compared to control group ($p=0.09$). Table (3) demonstrates that there are a highly statistically significant differences in the study compared to control group for weight gain over five days of measurements ($p= 0.03^*, 0.03^*, 0.001^*, 0.001^*$ & 0.001^*) respectively. Table (4)

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indicates that there are a highly statistically significant differences for the mean score of signs of feeding intolerance including abdominal distension, GRV, frequency of vomiting and defecation in the study group (0.3±0.7, 4.8±2.9, 5.4±2.8, 4.9±3.8 & 5.5±3.4) compared to (1.1±1.2, 6.9±2.6, 7.0±2.4, 10.1±4.1 & 4.1±2.6) in the control groups (p <0.001*, 0.001*, <0.001* & 0.04*) Respectively. Table (5) reveals that there was a highly significant negative correlation between abdominal circumference, distension and the first trial of oral feeding and APGAR score in the study group. While there was a highly significant negative correlation between abdominal distension and gestational age in the control group. The milk volume correlates negatively with the first trial of oral feeding in the study group and correlate negatively with a highly statistically significant differences with the first trial of oral feeding in the control group.

Table 1: Comparison of Preterm Infants' Characteristics among the Study control Groups

Items	Group				p-value
	Study (n=42)		Control (n=42)		
	No.	%	No.	%	
Age (days):					
<7	25	59.5	18	42.9	
7+	17	40.5	24	57.1	0.13
Mean±SD	6.3±3.1		7.2±3.2		0.19
Gestational age:					
<32	11	26.2	10	23.8	
32+	31	73.8	32	76.2	0.80
Mean±SD	32.7±2.1		33.0±2.0		0.52
Diagnosis:					
LBW, PT, RDS	40.2	95.2	35	83.3	
Meconium aspiration	1	2.4	1	2.4	
Mild RDS	1	2.4	0	0.0	0.20
Multiple	0	0.0	6	14.3	

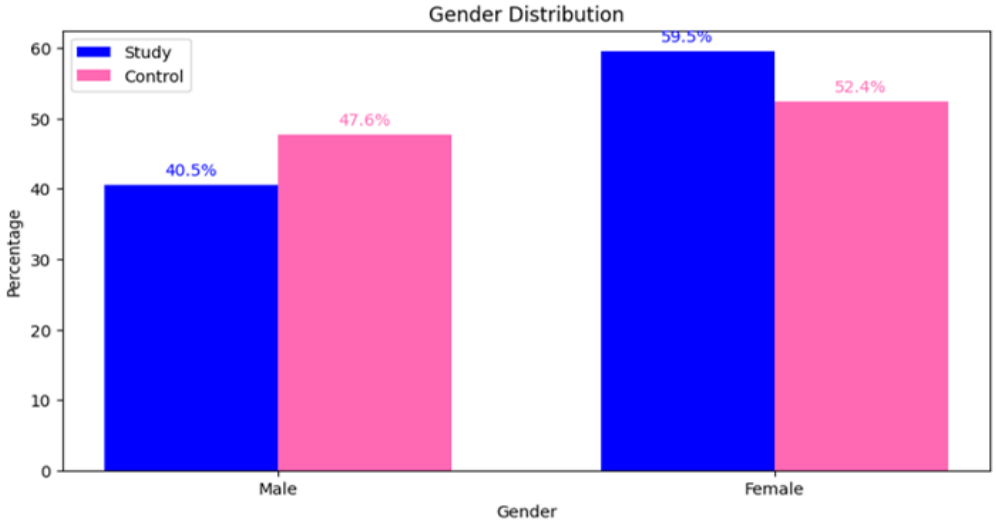

Figure 1: Gender of preterm infants among study and control groups (N=84)

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Table 2: Comparison of the preterm infants' physiological parameters' mean score in study and control groups during the five days of measurement

Physiological parameters	Group		p-value
	Study (n=42)	Control (n=42)	
	Mean±SD	Mean±SD	
Heart rate			
Day 1	155.2±7.7	158.7±8.1	0.04*
Day 2	154.9±6.8	157.7±6.0	0.053
Day 3	154.4±5.2	158.2±6.5	0.004*
Day 4	153.0±4.4	155.9±5.9	0.01*
Day 5	150.5±5.1	156.0±5.0	<0.001*
Average	153.6±4.6	157.3±5.5	0.001*
Respiratory rate			
Day 1	58.9±4.7	60.1±4.6	0.22
Day 2	58.1±3.9	59.4±4.2	0.15
Day 3	57.3±3.9	59.4±3.6	0.01*
Day 4	56.3±3.0	57.5±3.7	0.10
Day 5	55.3±2.8	57.2±3.9	0.02*
Average	57.2±2.5	58.7±3.0	0.01*
Oxygen saturation			
Day 1	96.5±0.8	96.3±1.0	0.20
Day 2	96.6±0.9	96.4±1.0	0.33
Day 3	96.8±1.0	96.5±1.0	0.24
Day 4	97.2±0.9	96.8±1.1	0.11
Day 5	97.3±0.9	96.8±0.9	0.01*
Average	96.9±0.8	96.6±0.9	0.09

Table 3: comparison of body weight gain mean score among pre-term infants in the study and control groups at five days of measurement

Body weight change	Group		H-Test	p-value
	Study (n=42)	Control (n=42)		
	Mean±SD	Mean±SD		
Day 2-1	5.5±16.8	-2.9±18.2	2.18	0.03*
Day 3-2	11.0±12.9	3.8±16.1	2.24	0.03*
Day 4-3	9.2±10.2	-2.0±14.3	4.13	<0.001*
Day 5-4	15.2±9.2	2.7±14.4	4.74	<0.001*
Day 5 – enrollment (gm)	47.5±56.0	-2.6±45.0	4.52	<0.001*
Day 5 – birth (gm)	33.5±104.2	-8.2±115.2	1.74	0.09
Day 5 – birth (%)	2.2±6.4	0.2±8.3	1.28	0.20
Day 5 – enrollment (%)	3.0±3.9	-0.3±3.4	4.11	<0.001*

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Table 4: comparison of Feeding intolerance average time mean score of pre-term infants in the study and control groups at five days of measurement

Average times (5 days):	Group		p-value
	Study (n=42)	Control (n=42)	
	Mean±SD	Mean±SD	
Abdominal distension	0.3±0.7	1.1±1.2	<0.001*
Gastric residual <50%	4.8±2.9	6.9±2.6	0.001*
Days to start oral feeding	4.3±2.9	6.9±3.0	<0.001*
Times (5 days):			
Gastric residual:			
Milky	5.4±2.8	7.0±2.4	0.008*
Cheesy white	2.4±1.8	1.8±1.8	0.12
Bilious	0.2±0.9	0.4±0.7	0.25
Bloody	0.0±0.0	0.0±0.0	
Greenish	0.0±0.0	0.0±0.0	
Others	0.0±0.0	0.0±0.0	
Vomiting	4.9±3.8	10.1±4.1	<0.001*
Defecation	5.5±3.4	4.1±2.6	0.04*

Table 5: Correlation between abdominal massage and preterm infants' characteristics

Items	Spearman's rank correlation coefficient								
	Study group (n=42)			Control group (n=42)			Total sample (n=84)		
	AC	AD	START	AC	AD	START	AC	AD	START
Abd. Circumference (AC)	1.000	.033	-.165	1.000	-.179	-.153	1.000	-.173	-.258*
Abd. Distension (AD)	.033	1.000	.293	-.179	1.000	.534**	-.173	1.000	.549**
Trial start	-.165	.293	1.000	-.153	.534**	1.000	-.258*	.549**	1.000
Age	.090	.172	.178	-.236	.408**	.167	-.118	.354**	.231*
Gestation weeks	.267	.003	-.058	.387*	-.421**	-.282	.319**	-.215*	-.142
APGAR score:									
1	-.436**	-.156	-.056	.136	-.390*	-.336*	-.138	-.258*	-.177
5	-.510**	-.102	.029	.251	-.464**	-.335*	-.116	-.274*	-.125
10	-.438**	-.203	.082	-.014	-.410**	-.209	-.177	-.350**	-.112
Milk vol.(Ml)	-.029	-.144	-.346*	.114	-.153	-.402**	.074	-.203	-.389**

4. DISCUSSION

In relation to preterm infant's characteristics. The current study revealed that more than half of the preterm infants were females in the study group, and control group with no statistically significant difference. This finding goes in the same line with [14], who reported that shows that 65% and 55% of the participants in the study group and the control group were male and female, respectively, without any significant difference between the studied groups.

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The current study identified that in the study group, the correlation between abdominal circumference (AC) and abdominal distension (AD) is weak (0.033), while in the control group, it is negative (-0.179). This suggests variability in abdominal measurements between the groups. The strong positive correlation between AD and trial start day in the control group (0.534**) and total sample (0.549**) indicates that abdominal distension increases as the trial progresses. These findings are consistent with [16] that have reported similar trends in abdominal measurements in preterm infants. However, some studies have found no significant correlation between abdominal measurements and clinical outcomes.

The correlations between age and abdominal measurements are generally weak, with some significant positive correlations in the control group (e.g., age and AD: 0.408**). This suggests that older preterm infants in the control group tend to have higher abdominal distension. The positive correlations between gestation weeks and AC in both groups (e.g., gestation weeks and AC: 0.387*) align with the understanding that longer gestation periods are associated with better growth outcomes [17]. However, the negative correlations between gestation weeks and AD in the control group (-0.421**) indicate that longer gestation may be associated with lower abdominal distension, which contradicts some findings that suggest increased abdominal distension with longer gestation.

The correlations between milk volume and abdominal measurements are generally weak, with some significant negative correlations in the control group (e.g., milk volume and trial start day: -0.402**). This suggests that higher milk volumes are associated with earlier trial start days. These findings are consistent with [14] that have reported similar trends in nutritional intake and clinical outcomes in preterm infants. However, some research has shown no significant correlation between milk volume and abdominal measurements.

The current study revealed that all infants are preterm with more than three quarters of preterm infants were diagnosed with RDS, The current study findings were paralleled with the study of [18], about Effect of Abdominal Massage on Gastric Residual Volume and Weight Gain of Premature Infants Admitted in NICU, which found that more than two thirds of preterm infants in both intervention and control groups had RDS.

Regarding physiological parameters of preterm infants, the results of the current study illustrated that there were statistically significant differences between the mean heart rate and respiratory rate of the study and control groups, while there was no statistically significant difference between both groups for mean of oxygen saturation.

This finding was in agreement with [19] who studied effects of abdominal massage and non-nutritive sucking on physiological parameters of preterm infants and reported that the mean scores of heart rate and respiratory rate changes in the abdominal massage group had a significant statistical difference with each of the intervention and control groups (with significant level of $P<0.001$). On the other hand, [20] disagreed with the finding of the current results and concluded that there was a high statistically significant difference regarding oxygen saturation (χ 2 =29.18 at P value ≤ .00) pre and post application of massage therapy.

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In relation to weight gain, the current findings demonstrated that there is a highly statistically significant difference in weight gain for all preterm infants in the study and control group through the five days of measurements, as preterm infants in the study gain more weight than those in the control group with mean of daily weight change in the study group (5.5±16.8, 11.0±12.9, 9.2±10.2, 15.2±9.2 & 47.5±56.0) respectively compared to mean of daily weight change in the control group (-2.9±18.2, 3.8±16.1, -2.0±14.3, 2.7±14.4 & -2.6±45.0) respectively. The mean weight gain by the fifth day of measurement in study group increased to 47.5±56.0 as compared to that of the control group 47.5±56.0 with a highly statistically significant difference ($p<0.001$*).

On the same context, [21] in the study of " Effect of Massage on treatment of preterm feeding intolerance: Study protocol for a randomized controlled trial" concluded that there was significant effect of abdominal massage on PT's weight and other indicators of physical development. In the same line, [22] mentioned that the results showed that the changes of body mass and development state of the premature infants in the experimental group were significantly higher than those in the control group, with statistical significance ($P < 0.05$), indicating that abdominal acupoint massage therapy can promote growth and development in preterm infants.

Concerning feeding tolerance criteria, highly statistically significant differences were found between the means of the first day and 5th day related to feeding tolerance measurements parameters of the abdominal massage group ($P<0.001$*). the current study reports that the mean score of the abdominal circumference, abdominal distension, GRV and frequency of vomiting were low in the study group than this in the control group with statistically significant difference and there was increase in frequency of defecations in the study group as compared to control group ($p<0.001$*, 0.001, <0.001* & 0.04) respectively.

This was consistent with [23] who found that abdominal massage had a positive impact on feeding tolerance, The abdominal circumference after feeding in the study group was 23.18 ± 2.99 cm, whereas that in the control group was 24.79 ± 2.99 cm. The gastric residual volume in the study group was 0.8 ± 0.10 ml, whereas that in the control group was 3.86 ± 1.03 ml with significant differences. In agreement with this finding, [24] stated that highly statistically significant differences were found between the first day and 5th day related to feeding intolerance measurements parameters of the massage group ($P=0.001$)

The overall dropout rate in this study was relatively low at 3.57%. The primary reasons for dropout included developing conditions requiring intensive care and respiratory complications ended with death. These factors were not related to the intervention itself and are unlikely to have biased the study results.

5. CONCLUSION AND RECOMMENDATIONS

Abdominal massage can be an effective non-pharmacological intervention to efficiently improve physiological parameters, significantly reduce gastric residual volume, vomiting

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episodes, and abdominal distention. Additionally, it has been associated with increased defecation frequency and therefore it promotes weight gain in preterm infants. Utilizing abdominal massage as a nursing care routine in enterally fed preterm infants is recommended. Neonatal intensive care unit nurses should attend training courses regarding massage therapy to gain knowledge about the importance of massage and how to practice it effectively is recommended also.

6. LIMITATIONS

There were no limitations in the current study.

7. ABBREVIATIONS

WHO	World Health Organization
NICU	Neonatal Intensive Care Unit
AM	Abdominal massage
IASP	International Association for the Study of Pain
FI	Feeding Intolerance
GRV	Gastric residual volume
RDS	Respiratory Distress Syndrome
SPSS	Statistical Package for the Social Science
AC	Abdominal Circumference
AD	Abdominal Distension

8. DECLARATIONS

8.1 Ethical Considerations

This study was part of a Doctorate thesis; primary approval was attained from the research ethical committee in the Faculty of Nursing, Cairo University. All preterm infants' parents who participated in the study were informed about the aim, procedure, benefits, and nature of the study and the written consent was obtained by the researcher from parents. The researcher emphasized that participation in the study was voluntary, and parents can refuse to participate in the study without any reason and obtained data was only used for the research purpose. The confidentiality of information was assured, and the parents had the right to withdraw from the study at any time during the study without any effect on the care provided to their neonates.

8.2 Availability of data and materials

The data that support the findings of this trial are available from the corresponding author upon reasonable request.

8.3 Competing Interests

The authors declare that they have no competing interests.

8.4 Funding

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