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A randomized controlled trial of abdominal massage and prone positioning as a proactive nursing strategy for feeding intolerance among preterm with non-invasive ventilation

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Abstract
Background: Feeding intolerance among preterm infants is a significant contributing factor to their prolonged hospitalization in the neonatal intensive care unit. This condition is further exacerbated by the use of noninvasive ventilation.
The aim of this study is to examines the effectiveness of utilizing abdominal massage and prone positioning on the incidence of feeding intolerance in preterm infants receiving noninvasive ventilation in the neonatal intensive care unit.
The study employed a randomized controlled trial with an equivalent control group pretest and posttest design to investigate the subject matter. The research was conducted in the neonatal intensive care unit affiliated with the Specialized Pediatric Hospital in Benha city, Egypt. The research was carried out on a sample of 75 premature infants, divided into three groups: 25 subjects who received abdominal massage, 25 who were placed in a prone position, and 25 who served as a control group. The study monitored feeding intolerance parameters, including gastric residue, abdominal distension, and vomiting, on both the first (pre) and seventh (post) days.
The findings indicate a statistically significant distinction ($P \leq 0.001$) between the first and seventh day of the trial in both the abdominal massage group and prone positioning group, as compared to the control group, in relation to the feeding intolerance parameter. This was evidenced by an increase in defecation frequency, a reduction in gastric residue, a decrease in vomits and regurgitations, a relief in abdominal distention, an absence of bradycardia, and a decrease in abdominal circumference. Furthermore, a significant positive correlation was observed between the application of abdominal massage and the utilization of prone positioning in relation to the parameter of feeding intolerance.
In conclusion, the study found that the implementation of abdominal massage and prone positioning had a significant impact on the incidence of feeding intolerance in preterm infants receiving noninvasive ventilation. As a result, the author recommends that nursing professionals consider these interventions as proactive measures for addressing feeding intolerance in this preterm.

Keywords: Abdominal massage, prone positioning, feeding intolerance, preterm, noninvasive ventilation

Introduction

The prevalence of preterm birth varies globally, with reported rates ranging from 5% to 18% of all live births. Premature birth is a significant contributor to neonatal mortality rates. Complications arising from preterm birth result in the mortality of one million out of the 15 million preterm neonates annually. According to Albraik *et al*. (2022) [2], preterm birth constitutes a proportion of 5-9% of all births in developing nations.
The majority of premature neonates are typically admitted to the neonatal intensive care unit (NICU) following birth and are fed via a nasal or oral gastric tube, as reported by Hwang *et al*. (2010) [17]. Infants born prematurely may experience difficulties with sucking, swallowing, and breathing, which can increase their risk of aspiration. As a result, these infants may require gavage feeding. Yonesian *et al*. (2011) [30] have identified feeding intolerance and respiratory issues as contributing factors to the extended hospitalization of premature neonates in neonatal intensive care units (NICUs).
Feeding intolerance (FI) is a prevalent occurrence in premature neonates, resulting in disturbances in feeding and gastrointestinal function. Several factors have been identified as potential causes of FI, including reduced intestinal motility, bacterial colonization, hormonal fluctuations, and local immune responses. The clinical manifestations of this condition comprise of abdominal distension, vomiting, bilious gastric residuals, and occult or gross bloody stools. These symptoms have been reported in approximately 29% of neonates affected by this condition, as per the findings of Ghasemi *et al*. (2019) [13].
Indicators of feeding tolerance, such as vomiting, abdominal distention, abdominal circumference, and gastric residual volume (GRV), have been reported in previous studies (Lu *et al*., 2020; Zhu & Gong, 2021. Carter (2012) [22, 32, 8] suggests that nursing interventions for feeding intolerance primarily involve symptom prevention

and monitoring. According to Hockenberry and Wilson (2021) [16], abdominal massage has been demonstrated to be a therapeutic, non-invasive, non-pharmacological nursing intervention that is both safe and recommended. Furthermore, it is considered preferable due to its ease of implementation, lack of pain, and absence of adverse effects.

The application of abdominal massage has been observed to enhance postprandial alertness and activate the vagus nerve, thereby augmenting the functionality of the intestinal peristaltic. This leads to expedited gastric emptying and improved satiety in infants. In addition, according to Hendy *et al*. (2022) [15], Lestari *et al*. (2021) [21], and Seiiedi-Biarag & Mirghafourvand (2020) [26], massage therapy has been found to enhance blood circulation and metabolic rate, as well as reduce vomiting and increase frequency of defecation.

The respiratory instability of a preterm neonate undergoing noninvasive ventilation may potentially impede their ability to tolerate feeding. In addition, it is possible that feeding could have a negative impact on pulmonary function. Ensuring sufficient caloric intake while preventing instances of feeding intolerance presents a primary obstacle in providing nutritional support to these patients, as noted by Bozzetti *et al*. (2017) [7]. A recent study conducted by Barsan *et al*. (2021) [6] found that prone positioning can effectively recruit lung bases and improve arterial and cerebral oxygenation in individuals with mild to moderate respiratory distress who receive nasal non-invasive ventilation. Astuti *et al*. (2018) [5] conducted a study who found that prone sleep positioning for infants following enteral feeding resulted in a decrease in desaturation events, abdominal distension, and vomiting frequency in the intervention group.

The importance of research is noteworthy

The study conducted by Weeks *et al*. (2021) [29] utilized meta-analysis to investigate the prevalence of feeding intolerance (FI) in preterm neonates who exhibit risk factors, such as non-invasive ventilation. The results of the analysis revealed that the prevalence of FI varied between 15% to 30% across one hundred studies, with an overall prevalence of 27% (95% confidence interval 23-31%). The performance of abdominal massage on preterm infants with a gestational age ranging from 28 to 34 weeks has been found to have a significant impact on the prevention of symptoms related to feeding intolerance. The aforementioned statement is rooted in the augmentation of gastrointestinal processes, specifically the escalation of parasympathetic dysfunction, as well as the amplification of gastric and intestinal motility and the heightened secretion of digestive hormones (Shaeri, *et al*., 2017) [27]. A further experiment was conducted to evaluate the efficacy of prone positioning with head elevation, which was supported by prior research to enhance oxygenation and alleviate feeding intolerance. The impact of feeding position on gastric residuals is acknowledged as a significant factor, with the latter frequently being regarded as a straightforward indicator of feeding intolerance (Gözen., *et al*., 2022) [14]. The present trial aimed to investigate the effectiveness of abdominal massage and prone positioning in reducing feeding intolerance symptoms among preterm infants receiving non-invasive ventilation. This trial contributes to the originality and advancement of research in this area, as well as enhancing the existing body of literature.

Operational definitions

Feeding intolerance (FI)

Is a common issue observed in premature infants, which can result in a disturbance of the feeding regimen. Fanaro (2013) [11] defines the condition as the incapacity to properly digest enteral feedings, which is characterized by elevated gastric residuals volume, abdominal distension, and/or frequent emesis.

Abdominal massage

The technique commonly known as "I Love U" involves performing a massage on the abdominal area. The method involved the application of the technique in a clockwise direction on the abdominal wall's intestines, while tracing the letter "I" downwards along the left costal margin of the infant. Subsequently, proceed to trace an inverted "L" pattern across the abdominal region, following the base of the ribs, commencing from the right side and concluding on the left side, before descending downwards. According to Al Qahtani and Ahmed (2021) [1], it is recommended to trace an inverted "U" stroke over and around the umbilical from the infant's right side, followed by tracing under the left side.

Non-Invasive Ventilation (NIV)

Pertains to the provision of respiratory assistance without the use of an invasive synthetic airway, such as an endotracheal tube or tracheostomy tube. The utilization of noninvasive ventilation has experienced a significant surge over the course of the last twenty years, and it has evolved into an indispensable instrument in the management of respiratory conditions (Anne & Murki, 2021) [3].

Objective of study

The objective of this trial is to evaluate the effect of distinct nursing preventive techniques, namely abdominal massage and prone positioning, on the parameter of feeding intolerance in neonatal preterm patients receiving noninvasive ventilation. The trail was compared the outcome of these techniques to a control group that receives standard routine nursing procedures.

Hypothesis

The trial proposes that the implementation of abdominal massage and prone positioning after feeding may result in a positive outcome for feeding intolerance in neonatal preterm patients who were receiving noninvasive

ventilation. This intervention was compared to a control group who was received standard routine nursing intervention.

Methodology
Technical design
Research design
Involves a randomized controlled trial with an equivalent control group pretest and posttest design, which was conducted in the neonatal NICU.

Setting
The location of interest is the Neonatal Intensive Care Unit situated within the premises of a specialized pediatric hospital in Benha city, Egypt.

The sampling
Method employed in this trial involved the use of a convenience sample, which was selected through a computer-generated randomization scheme. Seventy-five preterm were divided into three equivalent groups based on predetermined inclusion criteria. The groups were randomly assigned to receive either abdominal massage, prone positioning, and serve as a control group for a period of six months.

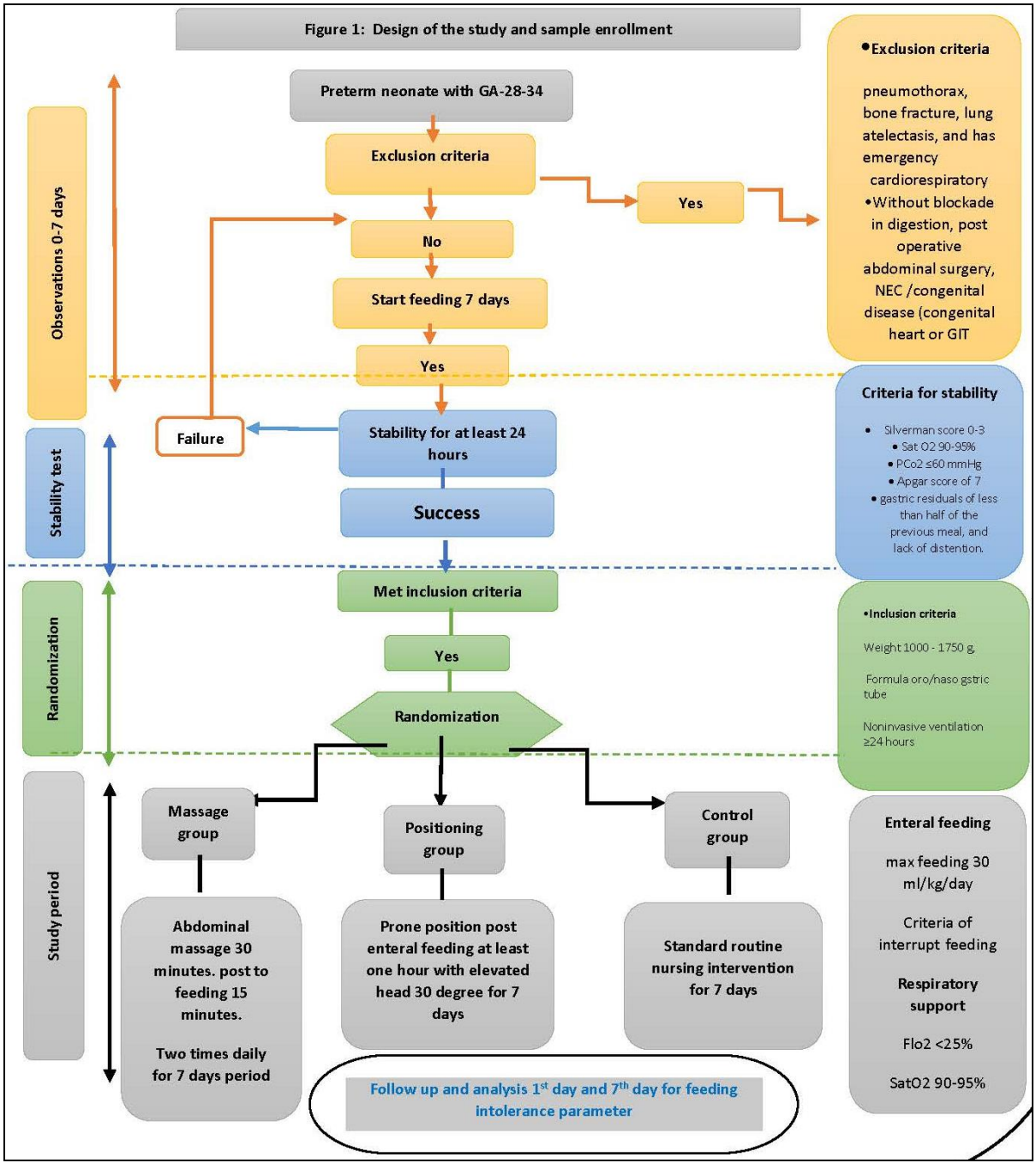

Fig 1: Design of the study and sample enrollment

Data collection instruments: Structured form to collect the following
Instruments
The tools utilized for gathering data: A structured form is required to gather the following information: One of the instruments being utilized is Instrument 1.

Section A
Characteristics of Neonatal Preterm Infants Based on Gestational Age and Gender. Auxological parameters, including weight in grams, length in centimeters, and head circumference in centimeters, are commonly used in clinical assessments.

Section B
Neonatal Record Data
The variables of interest in this study include the diagnosis, duration of hospitalization, enteral nutrition intake measured in milliliters per kilogram per day, total caloric intake measured in kilocalories per kilogram per day, and the type of milk provided, either human milk or formula.

Section C
Pertains to respiratory parameters
Including the Apgar score, respiratory rate measured in acts per minute, transcutaneous oxygen blood saturation expressed as a percentage (SatO2 TC %), capillary/arterial blood gas test, and the Silverman score calculator.

Section D
The Feeding Intolerance Parameter Score
As utilized by Naberhuis *et al*. (2016) [24], is denoted during the first and seventh day of the trial, the subjects were monitored for various physiological indicators including defecation, Gastric residual volume (GRV), vomits and/or regurgitations, abdominal distention, bradycardia, and abdominal circumference.

Measurement
The primary outcomes
Of the study were the mean gastric residual volume (GRV) and the number of gastric residuals. These were measured by aspirating residual gastric fluid using a 5 cc syringe in either a nasogastric tube (NGT) or an orogastric tube (OGT) that had previously been given 0.5-1 cc of air, and by checking with a stethoscope on the gastric section. The process of gastric fluid withdrawal involves a slow and repetitive approach to ensure complete emptying of the gastric contents.

Secondary outcomes
Were evaluated in the study. The arithmetic average of the abdominal circumference, ascertained by employing a tape measure that spans from the umbilical region around the abdominal area and back to the umbilical region.

Tertiary outcome
Measures the frequency of vomits and/or regurgitations observed per day. The parameters being measured in this study include the mean score per day for abdominal distention, the number of episodes per day for hypothermia and bradycardia, and the occurrence of an episode of defecation.

A pilot study
Was conducted on a sample of preterm infants in the neonatal intensive care unit (NICU) to assess the clarity and completeness of the study tools, as well as to determine the time required to complete each tool. The participants in the pilot study were subsequently included in the larger study sample.

Validity and reliability
Were taken into consideration during the research process. Prior to the commencement of the actual study, it was ensured that the final form had been established based on the outcomes of the pilot. The content validity and reliability of the instruments were evaluated by a panel of three experts in the fields of pediatric nursing and pediatrics. The Cronbach's alpha coefficient method yielded an internal consistency value of 0.82.

Ethical guidelines
The study adhered to the outlined in the Declaration of Helsinki and was granted approval by the Ethics Committee of the specialized children hospital in 2021. The study obtained informed consent from all parents of neonates who were included in the research. The purpose of the study and its potential benefits to the neonate are elucidated by the researcher. The participants in the study were guaranteed confidentiality and anonymity, and were informed of their right to withdraw from the study at any point. These measures were implemented in accordance with scientific research standards.

Operational design

Fieldwork and administrative design

A formal agreement was obtained from the administration of the aforementioned establishment. The research was carried out between the months of January and June in the year 2021. The occurrence of pre and post feeding intolerance is ascertained by the manifestation of one or more symptoms, including augmented gastric residue, abdominal distension, and frequency of vomiting, which are observed during the initial (pre) and subsequent seven (post) days. Abdominal massage is typically performed on a weekly basis, specifically every seventh day. The data exhibits variation between the initial and final days. The incidence of feeding intolerance was assessed by the researcher as a pre-test on the initial day. Abdominal massage is administered twice daily at 8:00 AM and 2:00 PM, respectively. A postprandial abdominal massage is conducted half an hour after administering a formula, with the infant positioned in a head-up inclination of 30-45 degrees during the massage to mitigate the likelihood of emesis. During the abdominal massage, the participants in the intervention group underwent hemodynamic monitoring. The practice of abdominal massage is conducted within an incubator, where the temperature is regulated to range between 36-38 degrees Celsius. At 7th day, posttest monitoring the occurrence of feeding intolerance.

Procedure

Abdominal massage

The researcher underwent specialized training in abdominal massage for infants and had previously published research in this area, thereby qualifying them to perform abdominal massage for neonates. All massages for preterm neonates were conducted in the presence of a neonatology nurse and doctor during the morning shift. The technique of abdominal massage was derived from prior scholarly works. The abdominal massage was performed in a clockwise direction, applying moderate pressure to the area above the abdominal wall and intestines. It is recommended to position a preterm neonate in a supine posture with the head elevated at an angle of 30°- 45°. Apply nourishing baby oil and use the edge of your hand's pinkie finger to gently stroke the neonate's belly in a paddling motion. Commencing at the inferior margin of the thorax, apply a downward stroke with each hand successively in a manner resembling the motion of a paddlewheel. The recommended technique for performing a massage involves using the fingertips to apply circular clockwise pressure. The individual suggests a method of arranging the phrase "I Love U" through a specific pattern of movements. This involves tracing the letters I, L, and U on different sides of the abdomen while moving the fingers clockwise around the umbilicus. Additionally, the technique involves holding the knees together and pressing them up towards the abdomen, causing the neonate's hips to rotate to the right a few times. Place your hand vertically on the abdomen, above the belly button, and gently rock it from side to side a few times. Abdominal massage is typically not administered if the umbilical cord has not yet detached.

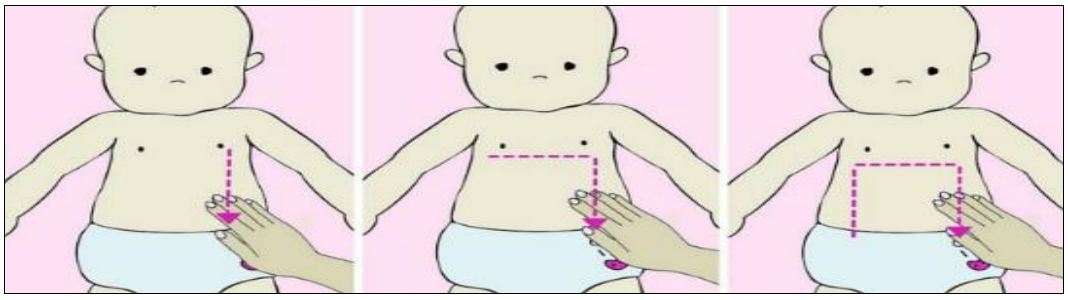

Fig 2: Massage technique

Prone positioning

The practice of prone positioning involves placing a patient in a prone position for a minimum of one hour after the initiation of enteral feeding, and this positioning is maintained from the first day up to the seventh day. The head of the bed was inclined at an angle of 30 degrees while administering enteral nutrition.

Control

The feeding intolerance parameter was evaluated from the first to the seventh day after the regular routine nursing procedure was administered.

The statistical design

Employed in this study involved the verification and coding of data by the researcher, followed by analysis using IBM-SPSS 21.0. The study employed descriptive statistics to calculate means, standard deviations, and percentages. The One-Way ANOVA statistical test is utilized to establish significant differences between categorical groups. The correlation coefficient is a statistical measure that quantifies the degree and direction of a linear association between two variables. A p-value of 0.05 or less was deemed significant.

Results

Table 1: The frequency distribution of preterm characteristics on the first day of the trial.

Variable	N =25 (%) Abdominal massage group	N=25 (%) Positioning group	N =25 (%) Control group	P-Value
GA				
28-30 w	10 (40)	7(28)	11(44)	*p*> .05
30-34 w	15 (60)	18(72)	14(56)	*p*> .05
Mean± SD	31.80±2.3	32.70±2.4	30.90±2.1	
Weight (g)	1561.0±161.5	1548.2±140.7	1521.06±165.46	*p*> .05
Length (cm)	42.3±2.5	41.4±2.2	41.4±2.2	*p*> .05
Head circumference (cm).	29.2±1.5	28.9±1.7	29.1±1.8	*p*> .05
Gender				
Male	12(48)	17(68)	15(60)	*p*> .05
Female	13(52)	8(32)	10(40)	*p*> .05

Table 1: demonstrates that there was no statistically significant difference observed among the characteristics of the three preterm groups, with a p-value greater than.05. Moreover, a significant proportion of preterm infants, accounting for 72% of the sample, had a gestational age falling within the range of 30-34 weeks, with a mean of 32.70±2.4. Additionally, a substantial percentage of these infants, comprising 68%, were male and were classified under the positioning group. The study revealed that the abdominal massage group had a high mean weight of 1561.0±161.5, a length of 42.3±2.5, and a head circumference of 29.2±1.5, with a female gender distribution of 52%.

Table 2: The feeding attributes of preterm data as recorded on the first day of the trial.

Variable	Abdominal massage	Positioning group	Control group	P-value
Enteral nutrition intake (ml/kg/day)	196.1±2.1	193.4±2.3	195.5±2.8	*p*>.05
Total caloric intake (Kcal/kg/day)	120±3.5	121±3.8	122±3.7	*p*>.05
Breast milk only	5(20%)	3(12%)	4(16%)	*p*>.05
Formula only	12(48%)	9(36%)	11(44%)	*p*>.05
Breast and formula	8(32%)	12(48%)	10(40%)	*p*>.05

Table 2: According to Table 2, the abdominal massage group had the highest mean of enteral nutrition intake at 196.1±2.1, with a percentage of 20% for breast milk only. The positioning group exhibited a significantly elevated proportion of 48% for infants who were fed with breast milk and formula. Moreover, the highest mean value was observed in relation to the overall caloric consumption (122±3.7), with a significant proportion (44%) attributed to the formula intake exclusively reported in the control group.

Table 3: The respiratory parameter of preterm infants on the first day of the trial.

Variable	Abdominal massage group	Positioning group	Control group	P-value
Apgar score	8.23±0.1	8.41±0.3	7.9±0.4	*p*>.05
Respiratory rate (acts/min)	44.12±4.02	43.45±4.31	44.71±4.09	*p*>.05
Transcutaneous O2 blood saturation (SatO2 TC %)	95%	96%	94%	*p*>.05
Capillary/arterial blood gas test				
pH	7.23±0.02	7.25±0.03	7.24±0.05	*p*>.05
SaO2 (%)	79.9±6.5	79.8±6.4	76.7±6.3	*p*>.05
PaCO2 (mmHg)	47.3±2.5	48.2±2.6	47.9±2.4	*p*>.05
PaO2 (mmHg)	44.8±2	44.3±2.1	44.2±2.3	*p*>.05
The Silverman score calculator.	3.20±1.02	3.34±1.32	3.54±1.76	*p*>.05

Table 3: presents the results indicating that the Positioning group had the highest mean values for Apgar score, O2 saturation, pH, and PaCO2. On the other hand, the abdominal massage group had the highest mean values for SaO2, PaO2, and the Silverman score. The control group exhibited the highest mean respiratory rate, as observed through differentiation.

Table 4: A comparison of feeding intolerance parameters among preterm on the first and seventh day of the trial.

Variable	1st day trial					7th day trial				
	Abdominal massage group	Positioning group	Control group	ANOVA F-value	P-Value	Abdominal massage group	Positioning group	Control group	ANOVA F-value	P-Value
Defecation	0.48±0.1	0.70±0.1	0.73±0.1	8.43	0.057	3.23±0.2	3.50±0.3	0.60±0.1	4.87	≤ 0.001
Gastric residual volume (GRV)	3.65±1.057	4.78±2.2	4.00±2.8	8.54	0.349	0.00±0.00	0.38±0.1	5.38±2.9	3.71	≤ 0.001
Vomits and/or regurgitations	1.12±0.332	1.15±0.312	1.53±0.514	6.01	0.308	0.00±0.000	0.00±0.000	2.35±0.493	3.03	≤ 0.001
Abdominal	22.76±2.016	21.13±1.72	23.35±1.115	7.91	0.301	20.59±2.033	19.15±1.21	25.24±1.821	4.16	≤

distention										0.001
Bradycardia	0.24±0.19	0.23±0.13	0.46±0.91	7.23	0.043	0.00±0.000	0.00±0.000	1.45±0.17	3.81	≤ 0.001
Abdominal circumference	26.13±1.5	25.23±1.6	25.50±5.6	7.98	0.317	23.70±1.3	22.60±1.2	27.87±4.7	3.90	≤ 0.001

Table 4: displays a statistically significant difference (P=≤ 0.001) between the abdominal massage group and the Positioning group compared to the control group with regards to an increase in defecation frequency, a reduction in gastric residual volume, a decrease in vomits and regurgitations, relief from abdominal distention, the absence of bradycardia, and a decrease in abdominal circumference on the 1st and 7th day of the trial.

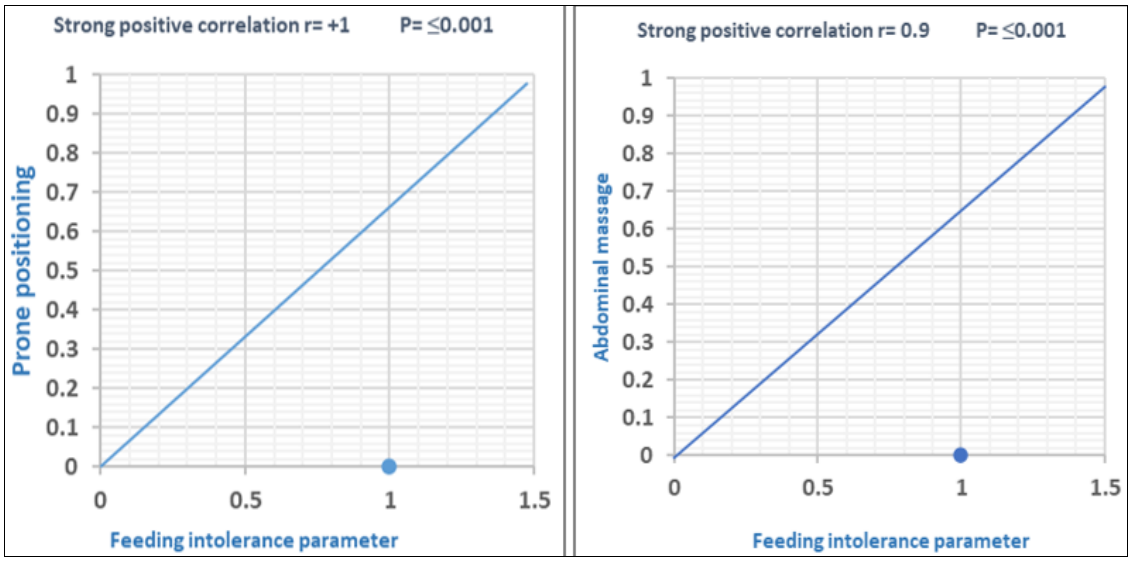

Fig 2: The correlation among abdominal massage, prone positioning at 7th of trial, and feeding intolerance parameter of preterm infants

Figure 2: The results presented in Figure 2 indicate a statistically significant positive correlation between the feeding intolerance parameter and prone position, with a correlation coefficient of r=+1 and a p-value of ≤0.001. A noteworthy observation is the robust and affirmative correlation between the feeding intolerance parameter and abdominal massage, with a correlation coefficient of r=0.9 and a p-value of ≤0.00. This finding suggests that the implementation of proactive nursing strategies, such as the prone position and abdominal massage, can be beneficial.

Discussion

Feeding intolerance is a significant challenge encountered by preterm in the NICU. It is characterized by the incapacity to effectively absorb enteral nutrition in preterm infants who are undergoing noninvasive ventilation. Thus, the present trail aimed to determine the incidence of feeding intolerance based on specific parameters, including gastric residual volume (GRV), abdominal distention, and emesis. The study conducted by Post determined that there was a significant difference between the abdominal massage group and the prone sleeping position group in reducing symptoms of feeding intolerance when compared to the control group.

The present trial demonstrated that the preterm group exhibited certain characteristics. Specifically, a significant proportion of preterm infants, accounting for seventy two percent, had a gestational age ranging from 30 to 34 weeks, with a mean gestational age of 32.70±2.4. Moreover, a substantial proportion of preterm infants, comprising sixty eight percent, were male and were positioned in a localized manner. The trial revealed that the abdominal massage group had a high mean weight of 1561.0±161.5, a length of 42.3±2.5, and a head circumference of 29.2±1.5, with a gender distribution of 52% female. In contrast to the aforementioned study, Cresi *et al*. (2019) [10] conducted a protocol study in Italy on preterm infants to assess their tolerance to enteral nutrition. The study found that all preterm infants with a gestational age of 25-29 weeks required non-invasive respiratory support and were suitable to begin enteral feeding. Furthermore, a study conducted in Iran by Ghasemi *et al*. (2019) [13] examined a total of 28 infants, comprising 15 boys and 13 girls. The infants had a mean gestational age of 32.43±1.16 weeks in the intervention group and 33±0.88 weeks in the control group, with no significant difference observed between the two groups (p=0.15). The mean weight of the infants was 1830±330 gr in the intervention group and 1870±370 gr in the control group, with no significant difference observed between the two groups (p=0.82).

In terms of homogeneity among the preterm groups, the researcher carefully selected samples that satisfied the predetermined criteria. The findings indicate that there was no statistically significant distinction between the two experimental groups and the control group in terms of demographic characteristics such as gestational age, gender, birth weight, length, and head circumference. Furthermore, the nutritional aspect pertains to the manner of feeding, caloric content, and quantity of food intake. Furthermore, the respiratory parameters such as Apgar

score, Silverman score, respiratory rate (breaths per minute), transcutaneous oxygen blood saturation (SatO2 TC %), and capillary/arterial blood gas test (p>.05) were evaluated. The study conducted by Mojaveri *et al*. (2020) [23] revealed that there were no significant differences between the massage and control groups with respect to gender, birth weight, age, feeding mode, and gestational age (P = 0.711, 0.076, 0.082, 0.612, and 0.629, respectively).

The present trial reveals a statistically significant difference (P=≤ 0.001) between the abdominal massage group and the Positioning group, as compared to the control group, with respect to an increase in defecation frequency, a reduction in gastric residual volume, a decrease in the frequency of vomiting and regurgitation, relief from abdominal distention, absence of bradycardia, and a decrease in abdominal circumference, as observed on the 1st and 7th day of the trial. The findings presented here bear resemblance to those reported in a prior investigation conducted by Hendy, *et al*., (2022) [15], who examined the effects of abdominal massage on the ability of low-birth-weight infants to tolerate feeding prior to gavage feeding in Egypt. The study group exhibited an abdominal circumference of 23.18±2.99 cm after feeding, while the control group displayed an abdominal circumference of 24.79±2.99 cm. The study group exhibited a gastric residual volume of 0.8±0.10 ml, while the control group demonstrated a gastric residual volume of 3.86±1.03 ml. The application of abdominal massage was observed to have a gradual impact on the postprandial condition of feeding tolerance.

Mojaveri *et al*. (2020) [23] conducted a study in Iran who demonstrated that premature infants who received massage exhibited a significant decrease in gastric residual volume, vomiting frequency, and abdominal circumference, as well as a significant increase in defecation frequency and reduced abdominal distension.

In a recent experimental study conducted by Ardiansyah *et al*. (2021) [4] in Indonesia, the effects of abdominal massage on feeding intolerance were investigated among two nonequivalent groups. The results indicated that the incidence of feeding intolerance did not increase (0%) in the intervention group, whereas the control group experienced an increase of 9 (52.9%). The type of mechanical ventilation had a notable impact on the confounding factor of gastric residue levels following the intervention, with a p-value of 0.02.

Furthermore, a study conducted by Jin *et al*. (2020) [19] at Jinan University investigated the efficacy of abdominal massage in improving feeding intolerance in premature infants. The study concluded that post-intervention abdominal massage was effective in enhancing weight gain and improving feeding tolerance in these babies.

Pourazar *et al*. (2018) [25] conducted a study in Iran to investigate the effectiveness of abdominal touch in improving nutritional tolerance in premature infants. The authors opinion that proper positioning after feeding and noninvasive touch were effective in enhancing nutritional tolerance in preterm infants.

Astuti *et al*. (2018) [5] conducted a study in Indonesia to investigate the effects of prone position sleep following enteral feeding on feeding intolerance. The study found a statistically significant decrease in desaturation events (p = 0.011), abdominal distension (p = 0.017), and frequency of vomiting (p = 0.035) following the implementation of prone position sleep in premature infants.

Kim and Bang (2018) [20] conducted a study in China to investigate the impact of massage on enteral feeding improvement for premature infants. The study found that massage resulted in earlier attainment of full enteral feeding, increased superior mesentery artery, and faster growth. The aforementioned result aligns with the research conducted by Choi *et al*. (2016) [33], who posited that massage therapy may have the potential to enhance premature infants' physical growth and gastrointestinal function.

The study conducted by Tekgündüz *et al*. (2014) [28] in Turkey examined the efficacy of abdominal massage in improving feeding tolerance among preterm infants receiving minimal enteral nutrition. The results indicated a statistically significant difference between the first and last day of the study in terms of preventing excessive gastric residual volume and abdominal distension in the massage group.

A systematic review and meta-analysis conducted by Issac (2021) [18] demonstrated that preterm infants placed in the right lateral and prone positions exhibit reduced gastric residual volume when compared to those placed in the supine and left lateral positions. The study conducted by Fazli *et al*. (2017) [12] aimed to compare the impact of non-nutritive sucking and abdominal massage on feeding tolerance in preterm infants across three groups. The study was conducted in Iran and the results indicated that abdominal massage was only effective in improving feeding tolerance in the absence of vomiting (P=0.01). The study found that the application of abdominal massage did not yield any statistically significant impact on the level of distention experienced by the participants.

The author suggested that the implementation of abdominal massage and prone sleeping position as a nursing intervention is a cost-effective measure that yields positive outcomes in preventing exaggerated feeding intolerance among neonatal preterm patients who are undergoing noninvasive ventilation. The author recommends the adoption of this intervention as a preventive measure.

The current trial demonstrated a robust and statistically significant positive correlation between the feeding intolerance parameter and the prone position, with a correlation coefficient of r= +1 and a p-value of ≤0.001. A noteworthy finding of the trial was the robust and statistically significant positive correlation observed between the feeding intolerance parameter and abdominal massage, with a correlation coefficient of r=0.9 and a p-value of ≤0.001. This finding suggests that the implementation of preventive nursing strategies such as the use of prone position and abdominal massage may be beneficial in managing feeding intolerance. The author's perspective is that there exists a robust positive correlation between feeding intolerance and prone positioning. This is supported by prior research that has demonstrated the efficacy of prone positioning in enhancing oxygenation, particularly in neonatal preterm infants receiving noninvasive ventilation.

Chen *et al*. (2013) [9] conducted a study in Taiwan who revealed that positioning preterm infants in the prone position for the initial 30 minutes following feeding is associated with improved gastric residual outcomes. The author's perspective, subsequent to the implementation of the trial, aligns with previous research that has demonstrated the efficacy of abdominal massage in the context of preterm enteral feeding, thereby affirming its clinical value. Moreover, research has demonstrated that assuming a prone sleeping position can effectively alleviate symptoms of feeding intolerance, particularly in preterm infants undergoing noninvasive ventilation. Furthermore, the implementation of abdominal massage and prone positioning as a therapeutic nursing intervention has been shown to elicit parasympathetic activity and yield favorable outcomes on the digestive system. This practice is regarded as a crucial aspect of caregiving and a matter of parental concern.

In conclusion

The current trials have demonstrated significant differences in the effectiveness of abdominal massage and prone sleeping position as preventive nursing strategies for reducing parameters of feeding intolerance in noninvasive ventilated neonatal preterm.

The utilization of the abdominal massage and prone sleeping position as nursing interventions is highly valued due to their ease of use and noninvasive nature. It is feasible to assert the clinical implementation of interventions aimed at improving outcomes related to feeding intolerance in preterm infants, while minimizing time and cost.

Recommendation

It is recommended that nurses incorporate abdominal massage and prone positioning interventions as routine nursing protocols for preterm infants who are at risk of enteral feeding intolerance, as well as for preventive measures. In order to establish the efficacy of abdominal massage and prone positioning in reducing feeding intolerance among premature infants, it is necessary to conduct clinical trials that incorporate precise protocols, longer intervention periods, and larger sample sizes. Moreover, it is suggested that the impact of this trial be examined with regards to feeding intolerance across different countries.

Further research

Is required to determine the necessity of providing mandatory training to all neonatal nurses in order to optimize the potential advantages of abdominal massage for neonates in NICU.

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Conflicts of interest

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References

1. Al Qahtani AM, Ahmed HM. The effect of educational program for new mothers about infant abdominal massage and foot reflexology for decreasing colic at Najran City. Comprehensive Child and Adolescent Nursing,2021;44(1):63-78.
2. Albraik RK, Shatla E, Abdulla YM, Ahmed EH. Neonatal Feeding Intolerance and Its Characteristics: A Descriptive Study. Cureus; c2022, 14(9).
3. Anne RP, Murki S. Noninvasive respiratory support in neonates: a review of current evidence and practices. Indian Journal of Pediatrics. 2021;88(7):670-678.
4. Ardiansyah D, Nurhidayah I, Trisyany Y, Apriany D, Setiasih Y. Effect of abdominal massage on feeding intolerance among premature baby with mechanical ventilation in neonatal intensive care unit in indonesia. Journal of Neonatal Nursing. 2021;27(4):280-284.
5. Astuti DD, Rustina Y, Waluyanti FT. Sleep Positioning in Low Birth Weight Infants to Reduce Enteral Feeding Intolerance. NURSCOPE: Jurnal Penelitian dan Pemikiran Ilmiah Keperawatan. 2018;4(1):10-17.
6. Barsan Kaya T, Aydemir O, Tekin AN. Prone versus supine position for regional cerebral tissue oxygenation in preterm neonates receiving noninvasive ventilation. The journal of maternal-fetal & neonatal medicine. 2021;34(19):3127-3132.
7. Bozzetti V, De Angelis C, Tagliabue PE. Nutritional approach to preterm infants on noninvasive ventilation: An update. Nutrition. 2017;37:14-17.
8. Carter BM. Feeding intolerance in preterm infants and standard of care guidelines for nursing assessments. Newborn and Infant Nursing Reviews. 2012;12(4):187-201.

9. 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. International journal of nursing studies. 2013;50(11):1459-1467.
10. Cresi F, Maggiora E, Borgione SM, Spada E, Coscia A, Bertino E, *et al*. Enteral Nutrition Tolerance and REspiratory Support (ENTARES) Study in preterm infants: study protocol for a randomized controlled trial. Trials. 2019;20(1):1-8.
11. Fanaro S. Feeding intolerance in the preterm infant. Early human development. 2013;89:S13-S20.
12. Fazli SM, Mohamadzadeh A, Salari M, Karbandi S. Comparing the effect of non-nutritive sucking and abdominal massage on feeding tolerance in preterm newborns. Evidence Based Care. 2017;7(1):53-59.
13. Ghasemi M, Najafian B, Khosravi MH, Nekavand M. Effect of abdominal massage on gastric residual volume and weight gain of premature infants admitted in NICU. Canon Journal of Medicine. 2019;1(2):49-54.
14. Gözen D, Erkut Z, Uslubaş R, Bilgin L. Effect of different positions on gastric residuals in preterm infants initiating full enteral feeding. Nutrition in Clinical Practice. 2022;37(4):945-954.
15. Hendy A, El-Nagger NS, Abozeid A, Reshia FA, Salih SA, Alruwaili MF, *et al*. Outcome of abdominal massage before gavage feeding on tolerated feeding for low-birth-weight infants. Nursing Open. 2022;9(2):1060-1065.
16. Hockenberry JM, Wilson D. Wong's essential of pediatric nursing. 11 ed. St. Louis, Missouri: Elsevier Health Sciences. 2021;14:188-197.
17. Hwang YS, Vergara E, Lin CH, Coster WJ, Bigsby R, Tsai WH. Effects of prefeeding oral stimulation on feeding performance of preterm infants. The Indian Journal of Pediatrics. 2010;77:869-873.
18. Issac KHA. Efficacy of body position on gastric residual in preterm infant: a systematic review and meta-analysis (Doctoral dissertation, College of Nursing, Sanjay Gandhi Post Graduate Institute of Medical Sciences); c2021.
19. Jin X, He L, Zhang S, Zhu C. Effect of abdominal massage on feeding intolerance of premature infants. American Journal of Nursing Science. 2020;9(4):201.
20. Kim HY, Bang KS. The effects of enteral feeding improvement massage on premature infants: A randomised controlled trial. Journal of clinical nursing. 2018;27(1-2):92-101.
21. Lestari KP, Nurbadlina FR, Wagiyo, Jauhar M. The effectiveness of baby massage in increasing infant's body weight. Journal of Public Health Research; c2021, 10(1).
22. Lu LC, Lan SH, Hsieh YP, Lin LY, Chen JC, Lan SJ. Massage therapy for trials. Complementary Therapies in Clinical Practice. 2020;39:101168.
23. Mojaveri MH, Amiri SRJ, Dalili H, Khafri S, Hamed F. The effect of abdominal massage on the feeding tolerance of neonates with very low birth weight. Iranian Journal of Pediatrics; c2020, 30(2).
24. Naberhuis J, Wetzel C, Tappenden KA, Dowling D. A Novel Neonatal Feeding Intolerance and Necrotizing Enterocolitis Risk–Scoring Tool Is Easy to Use and Valued by Nursing Staff. Advances in Neonatal Care. 2016;16(3):239-244.
25. Pourazar SB, Farahani AS, Sarabi AG, Pourhoseingholi MA, Dehghan K. The effect of abdominal touch on nutritional tolerance in premature infants: a randomized controlled clinical trial. International Journal of Pediatrics. 2018;6(8):56.
26. Seiiedi-Biarag L, Mirghafourvand M. The effect of massage on feeding intolerance in preterm infants: a systematic review and meta-analysis study. Italian journal of pediatrics. 2020;46:1-10.
27. Shaeri M, Ghadami A, Valiani M, Armanian AM, Amini Rarani S. Effects of Abdominal Massage on Feeding Tolerance in Preterm Infants Hospitalized in Selected Hospitals of Isfahan-Iran. International Journal of Pediatrics. 2017;5(3):4503-4510. http://eprints.mums.ac.ir/3166/
28. Tekgündüz KŞ, Gürol A, Apay SE, Caner İ. Effect of abdomen massage for prevention of feeding intolerance in preterm infants. Italian journal of pediatrics. 2014;40(1):1-6.
29. Weeks CL, Marino LV, Johnson MJ. A systematic review of the definitions and prevalence of feeding intolerance in preterm infants. Clinical nutrition. 2021;40(11):5576-5586.
30. 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. Archives of Rehabilitation. 2011;11:65-72.
31. Zhang W, Zhou W, Kong Y, Li Q, Huang X, Zhao B, *et al*. The effect of abdominal massage on enteral nutrition tolerance in patients on mechanical ventilation: A Randomized Controlled Study. Intensive and Critical Care Nursing,2023;75:103371.
32. Zhu L, Gong Y. Analysis on the Application Effect of Abdominal Acupoint Massage on Feeding Intolerance in Premature Infants. Journal of Healthcare Engineering; c2021.
33. Choi TM, Chiu CH, Chan HK. Risk management of logistics systems. Transportation Research Part E: Logistics and Transportation Review. 2016 Jun 1;90:1-6.