The effect of I Love You massage technique on the gastric function, growth parameters, and comfort among hospitalized preterm neonates

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Abstract

Background: One of the most frequent problems that arise in preterm neonates and elevates their morbidity and death rate is feeding intolerance. **Aim:** Determine the effect of the I Love You technique of abdominal massage on gastric function, growth parameters, and comfort among hospitalized preterm neonates**. Methods:** Quasi-experimental research design took place in Kafrelsheikh University Hospital's Neonatal Intensive Care Unit-Egypt. A sample of 60 preterm neonates was randomly divided into two groups, each receiving conventional hospital care. The study group received a 15-minute abdominal massage twice daily, precisely one hour before their meals. **Tools**: The preterm neonates' characteristics assessment record, Neonate Comfort Behavior (COMFORT neo) Scale, and feeding intolerance assessment sheet were the three instruments employed. **Results**: Statistical difference is evident in the mean scores denoting feeding intolerance parameters between the initial day and the fifth day within the massage group such as gastric residual volume, abdominal circumference, vomiting frequency, and defecation frequency. Most of the study group had achieved comfort through the third to fifth day of the study. The difference in mean weight between the massage and control groups on the fifth day exhibited an exceptionally high level of statistical significance. **Conclusion:** This study highlights the efficacy of the I Love You massage of the abdomen as a safe non-pharmacological intervention in preterm neonates receiving enteral nutrition**. Recommendation:** Training initiatives should be implemented for all nurses in the NICU to educate them about the utilization of abdominal massage and its advantageous outcomes for premature neonates.

Keywords: abdominal massage, comfort level, growth parameters, feeding intolerance, preterm neonates.

Introduction

The period of the last trimester of fetal development and the first three months of life is a crucial phase marked by rapid physical and neurological growth for an infant. However, this critical period of accelerated growth can be disrupted when neonates are born prematurely, prior to the end of 37 weeks of gestation **(Lammertink et al., 2020).** Preterm neonates are born before their life-sustaining systems have fully developed, which necessitates their transition to an extra-uterine existence. It is concerning that the prevalence of preterm birth has been on the rise over the past three decades. According to recent statistics, each year 14.9 million preterm births occur across the globe. This highlights the significance and global impact of preterm birth as a significant public health issue **(Morgan et al., 2022)**.

The initial critical period of transitioning from the intra-uterine to the extra-uterine environment is relatively short, typically lasting only a few hours. However, the process of adapting to the extra-uterine life can take several weeks to several months, depending on the degree of prematurity. Preterm neonates require specialized care and support during this extended period of adaptation to ensure their growth, development, and overall well-being. The duration of this adaptation period may vary for each preterm neonate, as their individual needs and developmental progress differ **(Morton & Brodsky, 2016).**

Nutrition plays a crucial role in promoting normal growth, strengthening the immune system, ensuring long-term health, and supporting optimal neurologic and cognitive development in infants. However, prematurity remains a significant challenge in this regard. Providing enteral feeding to preterm neonates in the Neonatal Intensive Care Unit (NICU) safely is one of the obstacles faced by healthcare providers in providing them care. Supplying sufficient nutrition to premature neonates presents a complex challenge due to several issues. These issues encompass underdeveloped bowel function, inability to suck and swallow, heightened susceptibility to feeding intolerance, reduced intestinal motility, and enzymatic activity that can exacerbate gastrointestinal problems **(Thoene & Anderson-Berry, 2021).**

Moreover, premature neonates exhibit poor muscle tone in the lower esophageal (cardiac) sphincter area compared to most full-term neonates. This can lead to milk regurgitation into the esophagus, stimulating chemoreceptors and causing apnea due to vagal stimulation, bradycardia, and increased risk of aspiration. Premature neonates also have limited stomach capacity, making them prone to over-distention, which can compromise respiration. Additionally, the gastrointestinal tract function in premature neonates is impaired due to the early interruption of gestation **(Indrio et al., 2022)**.

In the NICU, gastrointestinal immaturity frequently gives rise to the issue of feeding intolerance **(Ardiansyah et al., 2021).** Feeding Intolerance (FI) is a common issue among premature neonates, often leading to temporary discontinuation or delayed advancement of feedings, so nutrition must be given parenterally which may lead to risks and complications such as sepsis, intestinal atrophy, infection, and thrombus. Suspected FI is typically characterized by signs such as Gastric Residual Volume (GRV) presence, abdominal distention, and vomiting. A high GRV can be associated with an increased incidence of other gastrointestinal complications, including necrotizing enterocolitis, suck-swallow incoordination, and digestive function disorders due to intestinal movement issues. Consequently, when a newborn is unable to suckle and swallow, it may need to be fed intravenously or through an oral or nasogastric tube. **(Seiiedi-Biarag & Mirghafourvand, 2020)**.

Recently, massage has become more common in the NICU. According to research, abdominal massage is a beneficial, secure, non-pharmacological, and non-invasive nursing intervention. The abdominal massage has demonstrated capability in lowering GRV and fostering advantageous effects on the digestive system as shown by **(Ardiansyah et al., 2021)** who discovered that the intervention group displayed a decrease in average scores of GRV and abdominal circumference. The massage technique focuses on enhancing parasympathetic activity, which results in improved stomach motility, decreased vomiting frequency, decreased abdominal distension, and enhanced intestinal peristalsis movement. Due to these advantages, abdomen massage is highlighted as a helpful nursing care strategy in the NICU context **(Lu et al., 2020).** This in turn leads to alleviating abdominal distension as highlighted in a study done by **(Haghshenas et al., 2020),** who reported a substantial change in abdominal circumference within the massage group.

In addition, massage has an advantage in decreasing vomiting episodes in preterm neonates undergoing eternal feeding as illustrated in a study done by **(Seiiedi-Biarag & Mirghafourvand, 2020)** who found that following the abdominal massage intervention, the incidence of vomits decreased significantly more in the experimental group than in the control group. Furthermore, massage enhances gastric peristalsis which in turn improves defecation in preterm neonates as shown in a study done by **(Moghadam et al., 2021)**. The researchers in that study reported that stimulation of GIT-related massage enhanced the regularity of gastric activity which decreased the occurrence of constipation.

Nursing strategies for addressing feeding intolerance typically focus on symptom prevention and monitoring. Kangaroo care and neonatal massage therapy, both non-pharmacological interventions, are preferred due to their ease of implementation for neonates

(Carter, 2012). So, this study aims to determine the effect of the I Love You massage technique on gastric function, growth parameters, and comfort among hospitalized preterm neonates.

Significance of the study:

One of the main factors contributing to preterm newborns' weight loss is feeding intolerance, which makes it impossible for them to continue receiving enteral nutrition. This results in the continuous use of central venous catheter-based parenteral feeding hence raises the risk of infection. Slow stomach emptying is one of the reasons preterm neonates develop feeding resistance. Massage therapy is advised as a means of treatment and control. Through the acceleration of peristalsis, reduction of abdominal circumference and thus abdominal distension occurred. In addition, by accelerating the bowel transit time, increasing the frequency of defecation, and reducing the frequency of diurnal vomiting episodes, massage therapy can activate the parasympathetic nervous system and trigger a more efficient response of the digestive system. Therefore, the present study aimed to evaluate the effect of the I Love You technique of abdominal massage on gastric function, growth parameters, and comfort among hospitalized preterm neonates. **(Carter, 2012)**.

Aim of the study:

The primary objective of this study was to examine the impact of the "I Love You" massage technique on gastric function, growth parameters, and comfort among hospitalized preterm neonates.

Operational definitions:

I Love U technique for abdominal massage: This technique entailed massaging the neonate's abdomen wall in a clockwise motion, starting at the left costal border and moving downward in the shape of the letter "I". Next, go from right to left and downward, tracing an inverted "L" around the base of the ribs. Finally, begin on the right side of the neonate and delineate an inverted "U" shape under the left side and over and around the umbilical area **(Zhang et al., 2023)**.

Feeding intolerance: This happens when a premature neonate cannot properly swallow and digest food, as seen by symptoms such as vomiting, increase in abdominal circumference, constipation, and elevated gastric residual volume greater than 50% of the food amount given in the preceding meal. **(Seiiedi-Biarag & Mirghafourvand, 2020)**.

Growth parameters: Measuring weight in kilograms, and height in centimeters. The assessment was longitudinal where serial measurements of the same neonate are recorded over different periods.

Research hypotheses:

- Abdominal massage improved the gastric function of preterm neonates compared to those who did not receive it.
- Abdominal massage improved the preterm neonates' weight compared to those who did not receive it.
- Abdominal massage improved the preterm neonates' length compared to those who did not receive it.
- The comfort level of preterm neonates who receive abdominal massage is higher than that of those who do not.

Subjects and Methods

Research Design: A quasi-experimental research methodology was used to accomplish this study. Quasi-experiments are studies that aim to evaluate interventions which include a wide range of nonrandomized or partially randomized pre/post-intervention studies. It aims to demonstrate causality between an intervention and an outcome and to identify how specific conditions affect others. An independent variable is a condition in a research study that causes an effect on a dependent variable manipulation **(Handley et al., 2018; Hudson et al., 2019).**

In this research, an independent variable is "I Love You" massage technique which has an impact on gastric function parameters, growth parameters, and comfort, which are considered dependent variables.

Setting:

The study was conducted in the Neonatal Intensive Care Unit situated on the fourth floor at Kafrelsheikh University Hospital, Egypt.

Which introduces medical facilities to preterm and full-term neonates for all the nearby areas in Kafrelsheikh governorate. The unit is divided into two partitions and contains about 12 incubators and 3 ventilators. The unit receives nearly 3 cases per day.

Study subjects:

A convenient sample of 60 preterm neonates was chosen from the previously mentioned setting. A randomized allocation - One subject for the control group (I) then the other for the study group (II), and so on- distributed the participants into two equivalent groups, as illustrated in Figure 1.

- **Control group:** Consisted of (30) preterm neonates who received the customary, standard care provided within the hospital setting, without any additional interventions or treatments.

- **Study group:** Consisted of (30) preterm neonates who underwent a regimen of 15-minute abdominal massage, scheduled one hour prior to each feeding, with a frequency of twice daily over the course of five consecutive days in addition to the routine hospital care.

Selection criteria for samples:

Preterm neonates with gestational ages between 30 and 37 weeks and nasogastric tube feedings during the first 48 hours of life were eligible for inclusion providing their birth weight was greater than or equal to 1500 gm. Additionally, preterm neonates who had any of the following conditions were disqualified from participating in the study: significant congenital abnormalities, intestinal obstruction, GIT anomalies, ventilator support, congenital heart disease, sepsis, necrotizing enterocolitis, or any abdominal surgery.

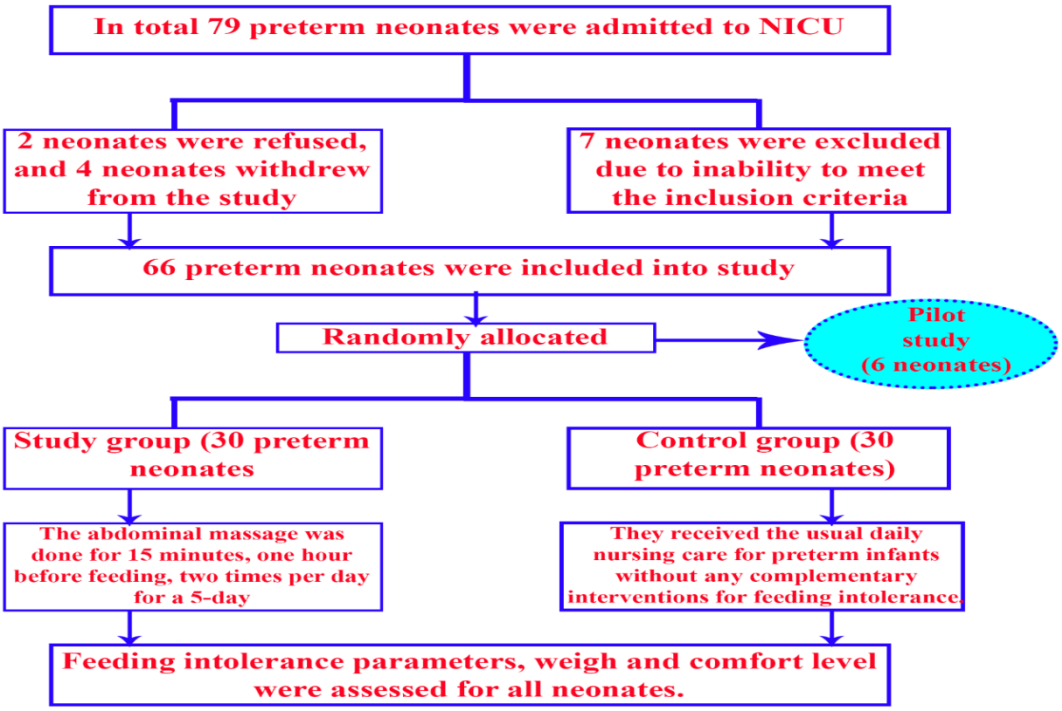

Figure 1 Study subject distribution.

Sample Size Calculation

Based on data from the literature **(Mohamed & Ahmed, 2018)**, considering the level of significance of 5%, and power of study of 80%, the sample size was calculated using the following formula **(Charan & Biswas, 2013):**

$$n = \frac{(Z\alpha/2 + Z\beta)^2 \times 2(SD)^2}{d^2}$$

where, SD = standard deviation obtained from the previous study; $Z_{\alpha/2}$, for 5% this is 1.96; Z_{β}, for 80% this is 0.84 and d, for the expected difference. Therefore,

$$n = \frac{(1.96 + 0.84)^2 \times 2(2.4)^2}{(1.74)^2} = 29.8$$

According to the mentioned equations, the sample size is 30 per group.

Tools of data collection:

In order to gather the requisite data for this research investigation, three tools were employed.

Tool I: Assessment Record of Premature Neonatal Characteristics. This instrument was custom-developed by the research team following a comprehensive review of contemporary, pertinent literature **(Abouheiba et al., 2022)**. Its primary purpose is to identify and document the pertinent characteristics of preterm neonates. It includes 9 questions about, gestational age (weeks), gender, birth weight /growth measurements, APGAR score in 1 and 5 minutes, diagnosis, time of starting feeding, medication, and type of feeding. Cronbach's coefficient was used to assess the tool's reliability to estimate how closely the tool's items were related to one another, Alpha reliability test was (a=0.83).

Tool II: Feeding Intolerance Assessment Sheet: This tool was adopted from **(Tekgündüz et al., 2014)** to monitor the gastric function appropriateness of the preterm neonates in both groups. It comprised six items, to cover the daily weight and length of preterm neonates, abdominal circumference, vomiting frequency, defecation frequency, and gastric residual volume. The reliability was evaluated using Cronbach's Alpha (r=0.901).

Tool III: Neonate Comfort Behavior (COMFORT neo) Scale. To assess the distress levels experienced by neonates in the pediatric intensive care unit, **(Ambuel et al., 1992)**. This scale specifically focuses on neonates monitored in Neonatal Intensive Care Units (NICUs), aiming to measure their discomfort, distress, and the need for sedation and comfort. The scale encompasses six behavioral subcategories: alertness, calmness-aggression, respiratory response (for ventilated neonates) or crying (for non-ventilated neonates), physical movement, muscle tone, and facial tension.

Responses to each category on the scale are recorded using a 5-point Likert scale, with distinct behavioral descriptions ranging from 1 to 5. The total score ranges from 6 to 30, and a score of ≥17 is indicative of anxiety and discomfort, requiring intervention. The overall score is interpreted as follows:

- 6 to 16 → Comfort
- 17 to 21 → Mild level of distress and discomfort
- 22 to 26 → Moderate level of distress and discomfort
- 27 to 30 → Severe level of distress and discomfort (the highest possible pain).

Content Validity

Five experts in the field of pediatric nursing assessed the content validity of the research instruments, and all necessary revisions were implemented.

Ethical considerations:

The researchers obtained ethical approval from the Committee of Research Ethics of Kafrelsheikh University to conduct the study with code MKSU 23-3-13. In addition, written consent was sought and gained from the relevant authorities governing the aforementioned setting. This was done subsequent to a comprehensive explanation of the research's objectives and purpose. Furthermore, after describing the study's purpose, its advantages, and the procedures for their participation, the parents of the preterm newborns gave the researchers their informed consent.

Participants were explicitly informed that they had the option to withdraw from the study at any point without any obligation. Anonymity and the confidentiality of data were rigorously maintained and employed exclusively for research purposes.

Pilot Study:

It was carried out on six premature neonates representing 10% of the study sample to test the feasibility and applicability of the study tools, the time required to fill it, and its clarity and validity. The subjects included in the pilot study weren't involved in the study sample. The necessary modifications were done by adding or omitting unneeded or repeated items prior to data collection.

Fieldwork

The study spanned six months, commencing in June 2022 and concluding in December 2022, encompassing four distinct phases as follows:

Preparatory phase:

The researchers introduced themselves to the nurses at the units mentioned previously and went over the goals of the study and the procedures for gathering data.

Assessment Phase

- Medical records of the preterm newborns were reviewed, and their mothers were consulted to collect pertinent medical history.
- Following the insertion of the nasogastric tube, the gastric residual volume was measured, and the measurement of GRV was taken by drawing out via a 5 ml syringe immediately prior to each feeding session.

A. If the GRV of the previous feeding was less than 25% of the feeding volume, the residual was re-fed, and the feeding schedule would be resumed as planned.

B. If the GRV was between 25% to 50 %, without any ominous abdominal signs, the residual would be re-fed, in the continuous gastric feeding group, two bolus feeds were deferred, or an equivalent volume was incorporated into the ongoing feeding regimen, and subsequently, the feeding schedule was resumed as originally intended.

C. If GRV was more than 50 %, or repeatedly between 25% to 50%, feeds were held for 12 hours and resumed according to the feeding schedule.

- Other clinical parameters were evaluated including abdominal circumference, frequency of defecation, episodes of vomiting, and the neonate's weight.
- The recorded measurements were diligently documented on a daily basis within the designated "Feeding Intolerance Assessment Sheet " throughout the five-day study period.

Implementation phase

For study group

Technique of I Love You Massage of Abdomen

- A gentle and rhythmic abdominal massage was administered by the researcher without inducing any tickling sensations. The massage was conducted with minimal pressure on the neonate's skin, and if the neonate displayed discomfort, the massage was immediately discontinued.
- Over the course of five consecutive days, the abdominal massage was administered as follows: a 15-minute session, scheduled one hour prior to each feeding, and performed twice daily, specifically at 9 am and 9 pm:

A. Supine the newborn and raise the head by 30 to 45 degrees.

B. Apply Baby lotion (Johnson & Johnson) and use the pinkie finger's edge to paddle it around the neonate's abdomen.

C. Use fingertips to rub the abdomen in a clockwise, circular manner.

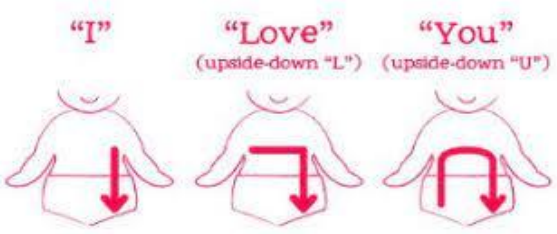

Figure 2: Abdominal massage in the I Love You method (McClure, 2000)

A. Trace the letter I along the neonate's left side to perform the "I Love U" stroke. Next, make an inverted L motion by gently tracing a line from right side to left, and finally downward, at ribcage, over a tummy. Make an inverted U motion with strokes, starting from the neonate's right side and moving up and around the navel to the left.

B. Rotate fingers clockwise around the navel.

C. Press the knees gently up towards the abdomen while keeping the feet together.

D. The neonate's hips rotated a couple of times to the right.

E. After that, the neonates were placed in the incubator in a prone position under supervision.

For Control Group

- The neonates got routine daily nursing care that was customized for preterm neonates; no supplemental interventions were used to modify the feeding schedules.

Evaluation phase

- During the five days of massage therapy, a daily assessment of various aspects of gastric function (GRV, abdominal circumference, frequency of defecation, vomiting). In addition to the weight and length of the premature neonates.
- Neonates' comfort level was assessed for all neonates in this study during the feeding session.
- Collecting data in the control group who fed similarly to the newborns in the massage group.

Statistical data analysis:

Statistical analysis was conducted by employing SPSS for Windows ver. 25.0 (SPSS, Chicago, IL). Continuous data, which exhibited a normal distribution, were presented as mean ± standard deviation (SD). Categorical data were represented by numbers and percentages. An independent sample t-test was used for the comparison of two variables with continuous data. The Chi-square test was utilized for comparing variables with categorical data. Statistical significance was established at $p \leq 0.05$.

Results

Table 1 illustrates that almost half of the premature neonates (50%& 53.3%) in both massage and control groups had a gestational age ranging from 30 to less than 32, respectively with a mean of age (32.5 ±2.2 &32.1 ±2.1), respectively. In addition, more than half of them were males (53.3% & 66.7 %), respectively. Moreover, half of the preterm neonates (50%& 56.7%) in the study & control groups, respectively had birth weights ranging from 1500 gm to less than 1600 gm with a mean of weight (1634.6 ±94.1 &1620.1 ±109.2), respectively. It is also observed from the same table that more than two-thirds of the preterm neonates (66.7%& 73.3%) in the study & control groups, respectively had respiratory distress. Furthermore, more than two-thirds of the preterm neonates (63.3%& 73.3%) respectively in the study & control groups began their feeding before the 5^{th} day of birth. Additionally, all premature neonates in both groups received preterm formula milk (100% for each) with non-statistically significant differences between both groups regarding all the characteristics of the neonates.

Table 2 analyses the five consecutive days' average GRV scores between the studied groups. Between the third and fifth days of the trial, the GRV scores in the massage group exhibited a decrease when compared to the control group, as the table shows. The study group's mean scores were 0.17 ±0.07 &0.07±0.03 in the morning and afternoon shifts on the fifth day, while the control group's mean scores for the morning and afternoon shifts on the fifth day of the research were (8.13 ±2.69 & 10.10 ±2.29), respectively. There was a substantial statistical difference ($P < 0.001$) between the two groups from the third to the fifth day of the intervention regarding GRV mean scores. While there was no statistically significant difference between both groups on the first and second day of the intervention which illustrates that the massage intervention had a significant impact on GRV relative to the control group.

Table 3 shows a comparative analysis of feeding tolerance criteria concerning abdominal circumference between the study groups throughout the five-day intervention period**.** On the fifth study day, the mean scores of the massage group regarding abdominal circumference were markedly decreased (26.68 ± 0.66&26.64 ± 0.52) compared to the control group (28.85±0.70&28.87±0.72) in the morning and

afternoon shifts respectively. The distinction between the control group and the study group was found to be highly statistically significant ($P < 0.000$) from the third to fifth days of the study. In contrast, there was no statistically significant difference between both groups on the first day of the intervention.

Table 4 shows a comparison of each studied group's mean scores for the frequency of vomiting episodes over five days. The table shows that the mean frequency of vomiting in the massage group dropped to (1.20 ± 0.48) (1.07 ±0.25) (1.01 ±0.07) accordingly on the third, fourth, and fifth days of the intervention in afternoon shifts. During the same days in the afternoon shifts, the control group showed mean frequencies of (2.47 ± 0.61) (2.37 ± 0.58) (2.35 ± 0.85), respectively. This shows that the massage group functioned significantly better than the control group after the intervention. ($P \leq 0.001$). In contrast, there was no statistically significant difference between both groups on the first and second day of the intervention.

Table 5 compares the mean scores for the frequency of defecation over a five-day intervention period between the studied groups. The table shows a notable rise in the intervention group's mean frequency of defecation after massage therapy in the afternoon shift (1.37 ± 0.61, 3.93 ±0.25) on the first and fifth day of the study, respectively. In contrast, the control group's mean frequency of defecation ranged from (1.43 ± 0.63) on the first day to (1.90 ±0.80) on day five of the study in the afternoon shift. Significantly, on the fourth and fifth day of the intervention, there was a clear and statistically significant difference, with a P-value of <0.001, in the mean score for the rate of defecation between the intervention group and the control group. In contrast, there was no statistically significant difference between both groups on the first and second day of the intervention.

Table (6) illustrates that the massage group's mean weight varied from (1589.4 ±77.5) on the first day to (1822.4± 83.9) on the fifth day of the intervention, while it varied from (1629.6 ±99.5) on the first day to (1594.1± 82.6) on the fifth day in the control group. The difference in mean weight between the massage and control groups on the fifth day exhibited an exceptionally high level of statistical significance. ($P < 0.001$). In contrast, no statistically significant differences were observed among the studied groups' length on the first and fifth days of the study.

Table (7) shows a comparison of preterm neonates' comfort levels between the study and control groups. It was noticed that most of the intervention group's preterm newborns had achieved comfort behavior through the third, fourth, and fifth day of study (76.7%, 70% & 80%), respectively compared to (20%, 13.3% & 16.7%) of preterm neonates in the control group. A statistically significant difference was found between the control group and study group on the third, fourth, and fifth days ($P< 0.001$). In contrast, there was no statistically significant difference between both groups on the first day of the intervention.

Table (8) illustrates a comparison of the control and massage groups' mean scores for the feeding intolerance measures on the first and fifth days of the intervention. Regarding the massage group, a remarkably substantial statistical distinction was apparent in the mean scores associated with feeding intolerance on the first- and fifth days including parameters like GRV (4.47 ±1.81 Vs. 0.07 ±0.03), abdominal circumferences (28.88 ±0.94 Vs 26.68 ± 0.66), frequency of vomiting (2.47 ±0.68 Vs. 1.01 ±0.07), and frequency of defecation (1.40 ±0.67 Vs. 3.93 ±0.25) with p-value <0.001. The control group neonates exhibited a significant increase in the GRV, with a non-significant change in the abdominal circumference scores, vomiting frequency, and frequency of defecation on the first and fifth days of the study.

Table 9 displays the mean changes related to feeding intolerance between massage and control groups in the first and fifth days of the study. The table unequivocally shows a statistical significance variance between these two groups concerning the mean change in GRV, abdominal circumference, frequency of vomiting, frequency of bowel movements, and daily weight.

Table 1. Characteristics of the premature neonates between the study and the control group

	Study (n=30)		Control (n=30)		Chi-Square	
	N	%	N	%	X^2	P
Gestational age (weeks)						
30 – <32	15	50.0	16	53.3		
32 – <34	7	23.3	7	23.3		
34 – <36	3	10.0	4	13.3		
36 – <37	5	16.7	3	10.0	0.675	0.879
Mean ±SD	32.5 ±2.2		32.1 ±2.1		0.830*	0.410
Gender						
Male	16	53.3	20	66.7		
Female	14	46.7	10	33.3	1.111	0.292
Birth weight/gm.						
1500 ≤ 1600	15	50.0	17	56.7		
1600 ≤ 1700	8	26.7	6	20.0		
1700 ≤ 1800	6	20.0	5	16.7		
1800 ≤ 1900	1	3.3	2	6.7	0.835	0.841
Mean ±SD	1634.6 ±94.1		1620.1 ±109.2		0.552*	0.583
Apgar scored in 1 minute						
4 – 6	11	36.7	8	26.7		
7 – 10	19	63.3	22	73.3	0.693	0.405
Apgar scored in 5 minutes						
4 – 6	2	6.7	0	0.0		
7 – 10	28	93.3	30	100.0	2.069	0.150
Diagnosis						
Respiratory distress	20	66.7	22	73.3		
Jaundice	9	30.0	5	16.7		
Neonatal sepsis	1	3.3	3	10.0	2.238	0.327
Time of start feeding						
Before 5th day of birth	19	63.3	22	73.3		
On 5th day of birth or after	11	36.7	8	26.7	0.693	0.405
Medication used						
Antibiotic	8	26.7	9	30.0		
Zantac	6	20.0	6	20.0		
Primperan	3	10.0	2	6.7		
Bronchodilators	13	43.3	13	43.3	0.259	0.968
Type of feeding						
preterm formula milk	30	100	100	100		
Expressed breast milk	0	0	0	0		

*: t value of student t-test

Table 2. Comparison of the Feeding tolerance criteria of premature neonates regarding Gastric residual volume between the study and control group in morning and afternoon shifts

	Study (n=30)	Control (n=30)	Student's T–Test	
	Mean ±SD	Mean ±SD	T	P
Day 1				
Morning	4.47 ±1.81	4.07 ±1.75	0.870	0.387
Afternoon	5.70 ±2.18	5.53 ±2.45	0.283	0.777
Day 2				
Morning	4.73 ±1.70	5.57 ±2.77	1.415	0.162
Afternoon	4.50 ±2.00	5.80 ±2.89	2.026	0.047*
Day 3				
Morning	1.17 ±0.53	7.20 ±2.21	14.532	<0.001**
Afternoon	0.87 ±0.38	7.60 ±2.07	17.514	<0.001**
Day 4				
Morning	0.63 ±0.23	6.57 ±2.22	14.577	<0.001**
Afternoon	0.42 ±0.10	6.97 ±2.19	16.364	<0.001**
Day 5				
Morning	0.17 ±0.07	8.13 ±2.69	16.202	<0.001**
Afternoon	0.07 ±0.03	10.10 ±2.29	23.987	<0.001**

Table 3. Comparison of the Feeding tolerance criteria of premature neonates regarding Abdominal circumference between the study and control group in morning and afternoon shifts

	Study (n=30)	Control (n=30)	Student's T–Test	
	Mean ±SD	Mean ±SD	T	P
Day 1				
Morning	28.88 ±0.94	28.86 ±0.97	0.067	0.947
Afternoon	28.86±0.95	28.85 ±0.97	0. .000	1.000
Day 2				
Morning	28.17±0.93	28.81 ± 1.016	-2.563	.013
Afternoon	27.99 ± 0.77	28.56 ±2.39	-1.256	0.214
Day 3				
Morning	27.68 ± 2.67	28.92 ±0.72	-4.831	000*
Afternoon	27.65 ± 2.67	28.89 ±0.72	-4.621	000*
Day 4				
Morning	26.70±0.79	28.72±0. 78	-9.893	000*
Afternoon	26.69 ± 0.66	28.80±0.68	-9.356	000*
Day 5				
Morning	26.68 ± 0.66	28.85±0.70	-12.229	000*
Afternoon	26.64 ± 0.52	28.87±0.72	-12.218	000*

Table 4. Comparison of the Feeding tolerance criteria of premature neonates regarding Frequency of Vomiting between study and control groups in morning and afternoon shifts

	Study (n=30)	Control (n=30)	Student's T–Test	
	Mean ±SD	Mean ±SD	T	P
Day 1				
Morning	2.47 ±0.68	2.23 ±0.97	1.109	0.271
Afternoon	2.33 ±0.61	2.50 ±0.90	0.856	0.395
Day 2				
Morning	2.13 ±0.68	2.50 ±1.04	1.630	0.108
Afternoon	1.92 ±0.61	2.57 ±1.01	3.017	0.003*
Day 3				
Morning	1.30 ±0.53	2.53 ±0.73	7.468	<0.001**
Afternoon	1.20 ±0.48	2.47 ±0.61	8.961	<0.001**
Day 4				
Morning	1.13 ±0.35	2.43 ±0.43	12.842	<0.001**
Afternoon	1.07 ±0.25	2.37 ±0.58	11.273	<0.001**
Day 5				
Morning	1.03 ±0.18	2.40 ±0.92	8.004	<0.001**
Afternoon	1.01 ±0.07	2.35 ±0.85	8.605	<0.001**

Table 5. Comparison of the Feeding tolerance criteria of premature neonates regarding Frequency of defecation between the study and control group in morning and afternoon shifts

	Study (n=30)	Control (n=30)	Student's T–Test	
	Mean ±SD	Mean ±SD	T	P
Day 1				
Morning	1.40 ±0.67	1.37 ±0.61	0.200	0.842
Afternoon	1.37 ±0.61	1.43 ±0.63	0.416	0.679
Day 2				
Morning	1.53 ±0.68	1.47 ±0.63	0.394	0.695
Afternoon	1.47 ±0.57	1.53 ±0.68	0.411	0.683
Day 3				
Morning	2.23 ±0.97	1.57 ±0.73	3.008	0.004*
Afternoon	2.20 ±1.03	1.57 ±0.73	2.749	0.008*
Day 4				
Morning	3.57 ±0.50	1.63 ±0.72	12.067	<0.001**
Afternoon	3.57 ±0.50	1.73 ±0.78	10.765	<0.001**
Day 5				
Morning	3.87 ±0.35	1.83 ±0.75	13.535	<0.001**
Afternoon	3.93 ±0.25	1.90 ±0.80	13.225	<0.001**

Table 6. Comparison of the Feeding tolerance criteria of premature neonates regarding growth parameters of preterm neonates between the study and control group in morning and afternoon shifts

	Study (n=30)	Control (n=30)	Student's T–Test	
	Mean ±SD	Mean ±SD	T	P
Weight				
Day 1	1589.4 ±77.5	1629.6 ±99.5	1.743	0.087
Day 5	1822.4 ±83.9	1594.1 ±82.6	10.622	<0.001**
Length				
Day 1	39.9±2.6	39.6±2.5	0.379	0.706
Day 5	40.4±2.6	40 ±2.5	0.495	0.622

Table 7. Comparison of the Newborn Comfort Behavior between the control and study groups

	Study (n=30)						Control (n=30)							
	Comfort		Mild distress		Moderate distress		Comfort		Mild distress		Moderate distress		Chi-Square	
	N	%	n	%	n	%	N	%	n	%	n	%	X^2	P
Day 1	13	43.3	14	46.7	3	10.0	12	40.0	16	53.3	2	6.7	0.373	0.830
Day 2	15	50.0	14	46.7	1	3.3	8	26.7	15	50.0	7	23.3	6.665	0.036*
Day 3	23	76.7	6	20.0	1	3.3	6	20.0	17	56.7	7	23.3	19.726	<0.001**
Day 4	21	70.0	9	30.0	0	0.0	4	13.3	14	46.7	12	40.0	24.647	<0.001**
Day 5	24	80.0	6	20.0	0	0.0	5	16.7	11	36.7	14	46.7	27.919	<0.001**

Table 8. Comparison of feeding intolerance measures' means between the studied groups on the first and fifth days

	Study (n=30)			Control (n=30)		
	Day 1	**Day 5**	P – Value	**Day 1**	**Day 5**	P – Value
Gestational residual volume	4.47 ±1.81	0.07 ±0.03	<0.001**	4.07 ±1.75	10.10 ±2.29	<0.001**
Abdominal circumference	28.88 ±0.94	26.68 ± 0.66	0.000**	28.86 ±0.97	28.85±0.70	0.968
Vomiting Frequency	2.47 ±0.68	1.01 ±0.07	<0.001**	2.23 ±0.97	2.35 ±0.85	0.612
Defecation frequency	1.40 ±0.67	3.93 ±0.25	<0.001**	1.37 ±0.61	1.90 ±0.80	0.006

Table 9. Comparison of means changes related to feeding intolerance between groups on 1st and 5th day

	Study (n=30)	Control (n=30)	P
	Mean ±SD	Mean ±SD	
Gestational residual volume	4.40 ±1.78	-6.03 ±0.54	<0.001**
Abdominal circumference	2.20 ±0.28	0.01 ±0.27	<0.001**
Frequency of Vomiting	1.46 ±0.61	-0.12 ±0.06	<0.001**
Frequency of defecation	-2.53 ±0.42	-0.53 ±0.19	<0.001**
Daily Weight of Preterm Neonate	-233.0 ±6.4	35.5 ±16.9	<0.001**

Discussion

Despite advancements in medical care services, the mortality rate remains significant among preterm and very low birth weight neonates. Preterm neonates experience compromised metabolic functions due to the absence or weakness of swallow, suck, and gag reflexes, limited stomach capacity, weak abdominal muscles, restricted nutrient reservoir, diminished protein digestion and nutrient absorption capabilities, and underdeveloped enzyme systems **(Heidarzadeh et al., 2016)**.

Neonates' gastrointestinal distress can be reduced by abdominal massage by fully relaxing their abdominal muscles. In addition to promoting early growth and development in premature newborns, abdominal massage has been shown to considerably raise gastrin and insulin levels, which enhance digestion and food absorption **(Xin et al., 2020).** Therefore, this study aimed to evaluate the effect of the I Love You technique of abdominal massage on gastric function, growth parameters, and comfort level among hospitalized preterm neonates.

Gastric residual volume GRV represents the volume of material aspirated from the stomach during nasogastric enteral feeding **(Lämås et al., 2012)**. Effectively reducing and managing GRV can be a noteworthy benchmark for enhancing nutritional status **(Fritz, 2016)**. With regard to comparing the average GRV scores over the duration of the five-day study between the intervention and control groups, the present research ascertained a notable reduction in the mean GRV within the massage group in comparison to the control group. These distinctions in GRV were highly statistically significant. From the researchers' point of view, this observation could be attributed to the stimulation of the parasympathetic branch of the autonomic nervous system during massage therapy. This stimulation encourages rectal loading by enhancing muscular activity and relaxing the gut's sphincter. Consequently, it increases intra-abdominal pressure, promotes peristalsis movement, and augments bowel sensation. These effects collectively contribute to an improved gastric emptying process, resulting in a reduction in gastric residual volume **(Kosasih et al., 2019)**.

This observation remained in alignment with the findings of research about the impact of abdominal massage on feeding intolerance in premature neonates receiving mechanical ventilation in an Indonesian neonatal intensive care unit, done by **(Ardiansyah et al., 2021)** who discovered that the intervention group displayed a decrease in average GRV scores and abdominal circumference. Additionally, this is in agreement with **(Tekgündüz et al., 2014)** study titled "Effect of abdomen massage for prevention of feeding intolerance in preterm infants", which mentioned that gastric residual volume had decreased on the last day of the intervention. On the contrary, the study results of **(Dehghan et al., 2018)** suggest that there is a minimal disparity between the control and massage groups concerning GRV subsequent to abdominal massage. This difference between the current study and the cited studies may be attributed to the variations in the duration of the

massage sessions (15 minutes) or the number of days of intervention.

Abdominal distension refers to a perception of elevated abdominal pressure that encompasses a quantifiable alteration in the patient's abdominal circumference. **(Seiiedi-Biarag & Mirghafourvand, 2020; Shaeri et al., 2017)**. The current study reports that on the fifth day of the trial, there was a highly significant statistical variance in the mean abdominal circumference scores between the study group and the control group during the morning and afternoon shifts. In comparison to the control group, the study group exhibited significantly lower scores in terms of abdominal circumference.

This observation was in alignment with the findings of the study entitled" Effect of Abdominal Massage on Gastric Residual Volume and Weight Gain of Premature Infants Admitted in NICU" by **(Ghasemi et al., 2019)** who stated that **"**the intervention group's mean abdominal circumference was noticeably and statistically significantly lower than the control group on the fifth day of the study**"**. This also aligns with the findings of **(Haghshenas et al., 2020),** who reported a substantial change in abdominal circumference within the massage group in their study about the impact of abdominal massage on neonates with very low birth weights' feeding tolerance. This could be explained by the ability of abdominal massage to stimulate parasympathetic activity. Thus, promotes improved peristalsis movement, lessens the distension of the abdomen, and decreases belly circumference in the massage group.

Furthermore, vomiting stands as a significant and potentially dangerous side effect of nasogastric feeding that could increase the chance of aspiration pneumonia. According to the current study, the mean frequency of vomiting in the massage group decreased, particularly on the third to fifth days of the intervention compared to the control group which showed high mean frequencies regarding vomiting episodes during the same days. This demonstrates that following the intervention, the massage group performed noticeably better than the control group. According to the researchers, I Love You abdominal massage activates the parasympathetic nervous system, which in turn causes the stomach and intestines to become active. This effect promotes efficient digestion of food within the stomach **(Altun Ugras et al., 2022).** Similar findings can be seen in the study conducted by **(Fareed & Elsayad, 2021).** These findings are reinforced by **(Seiiedi-Biarag & Mirghafourvand, 2020)** who found that following the abdominal massage intervention, the incidence of vomits decreased significantly more in the experimental group than in the control group in a systematic review and meta-analysis study about the effect of massage on feeding intolerance in preterm infants.

This study reveals a significant rise in the mean scores of defecations within the intervention group that received massage therapy when compared to the control group. These findings may be explained by the ability of abdominal massage to restore homeostasis by a differential action of suppressing hyper-function, encouraging hypo-function, and regulating disrupted function, which helps preterm neonates with low initial stomach motility to develop gastric peristalsis **(Fazli et al., 2017)**. The finding of the present study is in agreement with a study titled "Effect of Abdominal Massage (I Love You method) on the gastric function of Preterm infants hospitalized in the Neonatal Intensive Care units" **(Moghadam et al., 2021)** which reported that stimulation of GIT-related massage enhanced the regularity of gastric activity which decreased the occurrence of constipation. It is also in line with **(Altun Ugras et al., 2022)** who reported that the risk of constipation is high in NICU patients, and abdominal massage is an effective nursing intervention to shorten the time of return of bowel sounds and the time of the first defecation.

In addition, on the fifth day, there was an incredibly statistically significant difference in mean weight between the massage and control groups. According to the researchers, massage increases vagal activity, which in turn causes two mechanisms: first, it increases gastric motility and vagal activity, which in turn increases food absorption and weight gain; second, it causes the release of insulin and

insulin-like growth factor, which in turn causes an increase in weight. This study's findings are comparable to those of **(Diego et al., 2014),** who found that both massage and exercise boosted weight gain. Exercise was linked to an increase in caloric intake, while massage was linked to an increase in vagal activity. The results are also in line with those of **(Abed Elataief et al., 2017),** who noted that massage therapy improves premature neonates' weight and shortens their hospital stay in a study done in Sohag City's neonatal intensive care units regarding the impact of massage therapy on the weight and length of stay of premature neonates.

Neonatal Intensive Care Units inherently create a stressful environment for preterm neonates. This stress is attributable to factors such as separation from parents, intense lighting, ambient noise, iatrogenic procedures, and exposure to various artificial stimuli, all of which can contribute to extended hospitalization durations **(Mirnia et al., 2017).** Hence, ensuring the comfortable survival of preterm neonates during their critical phase of growth and development is of paramount importance. For this reason, the present study sought to investigate an initial finding related to the daily assessment of estimated comfort and distress levels in preterm neonates throughout the five-day feeding period. It was noted that these measurements exhibited significant variations within the study group, in stark contrast to the control group. According to **(Alinejad-Naeini et al., 2023)** massage can improve behavioral status in preterm neonates while studying the effect of M technique massage on behavioral state and weight gain in preterm neonates**.**

Regarding a comparison of the control and massage groups' mean scores for the feeding intolerance measures on the first and fifth days of the intervention. The results of the current study showed that the massage group's mean feeding intolerance scores on the first and fifth days, including, abdominal circumferences, vomiting frequency, GVR, and frequency of defecation," differed in a highly statistically significant way. The control group neonates exhibited a significant increase in the GRV, with a non-significant change in other gastric function parameters on the first and fifth days of the study. These outcomes agreed with **(Abouheiba et al., 2022).** According to their findings, there was a highly statistically significant difference in all feeding intolerance parameters between the control and massage groups, and for daily weight growth, there was an increase in the massage group.

These results were also in line with those of **(Abd Elrazek et al., 2022)** who reported that abdominal massage led to enhanced feeding tolerance indicators, including increased frequency of defecation, decreased occurrences of vomiting, reduction in abdominal circumference, and gastric residual volume. In addition, a study titled " Effect of applying massage therapy on physical, physiological and behavioral states of premature neonates" conducted by **(Bayomi & El-Nagger, 2015)** revealed that post-massage therapy, there was a substantial increase in the number of defecation events, while the frequency of vomiting episodes decreased significantly. This is a justifiable outcome, given that abdominal massage stimulates the vagus nerve, augments gastric and intestinal motility, and enhances blood circulation to the massaged region. Additionally, there is a clear correlation between the increased frequency of bowel movements and decreased abdomen circumference and stomach residual volume. Put another way, there is a corresponding decrease in both belly circumference and distension with an increase in the frequency of defecation.

Conclusion and Recommendations

This research highlights the effectiveness of the I Love You abdominal massage technique as a non-pharmacological intervention which considered non-invasive, and secure for premature neonates. It has the potential to diminish gastric residual volume, decrease the frequency of vomiting episodes, and alleviate abdominal distension by decreasing abdominal circumference. While concurrently fostering enhanced weight gain and a heightened frequency of defecation in premature neonates receiving naso or orogastric feeding. Consequently, it could be considered a viable strategy for preventing, mitigating, or managing feeding intolerance in premature neonates.

Recommendations:

According to the current study findings, the following recommendations are suggested:

1.Extensive assessments should be carried out to evaluate the symptoms associated with feeding intolerance that may appear in preterm neonates. Early detection of this issue can have a substantial positive impact on the outcomes for these neonates.

2.Training initiatives should be implemented to instruct all nurses in NICUs on the utilization of massage therapy and its advantages for preterm neonates.

3.Mothers should be actively encouraged to engage in abdominal massage therapy before their neonate's discharge. This encouragement can be complemented by instructional sessions and the provision of informative booklets featuring color illustrations. Furthermore, it can offer added advantages if parents or caregivers continue the practice at home after the neonate's discharge.

4.Pertinent clinical factors associated with feeding intolerance should be identified, allowing nursing staff to conduct evaluations.

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