Effect of Developmentally Supportive Post Feeding Positions on Gastrointestinal Feeding Tolerance Among Preterm Neonates

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Abstract

Background: Feeding intolerance is extremely common in premature neonates. Cessation or delays in enteral feeding may result in poor neurodevelopmental and growth outcomes in preterm infants. So proper developmentally supportive post feeding positions is considered one of the key measures that are carried out by neonatal nurses. **Aim**: determine the effect of developmentally supportive post feeding positions on gastrointestinal feeding tolerance among preterm neonates. **Design:** A cross-over experimental research design was used to accomplish this study. **Setting**: The study was conducted at the Neonatal Intensive Care Unit at El-Shatby Maternity University Hospital in Alexandria. **Subjects**: A purposive sample of 30 preterm neonates comprised the study subjects. **Tools**: Three tools were used to collect the data: Tool I: Preterm neonates' characteristics and clinical data assessment sheet. Tool II: Feeding pattern of preterm neonates assessment sheet. Tool III: Preterm neonates' gastrointestinal post feeding tolerance assessment sheet. **Results:** The majority of preterm neonates (96.7% and 96.3% respectively) had no gastric residual after positioning on developmentally supportive semi recumbent position after feeding either after 69 or 120 minuts. There were statistically significant differences between the developmentally supportive post feeding positions. Moreover, there were statistically significant differences found between developmentally supportive post feeding positions at 60 minutes after feeding regarding abdominal distention, vomiting and regurgitation. **Conclusion**: The results of this study concluded that placing preterm neonates on developmentally supportive right lateral, left lateral and semi recumbent post feeding positions reduce gastric residual volume and improve signs of gastrointestinal feeding tolerance. **Recommendations:** Continuous training in neonatal intensive care units for nurses should be performed for caring and placing preterm neonate in developmentally supportive right lateral, left lateral and semi recumbent post feeding positions.

Keywords: developmentally supportive post feeding positions, gastrointestinal feeding tolerance, preterm neonates.

Introduction

Prematurity is considered one of the problems that interfere with adequate adaptation of neonates to extra- uterine life. The reason behind the difficulties in adaptation is prematurity (**Alireza et al., 2019)**. Globally, it was estimated that 15 million neonates are born premature. More than one million of them died as a result of their prematurity. Most of the low-birth weight neonates are also preterm; consequently, they may confront serious health problems and are at increased risk of long-term complications **(WHO, 2018)**.

Preterm neonates have weak sucking and swallowing reflex, and have delayed gastric emptying. Hence, gavage feeding with tube is the suitable method for obtaining adequate nutrition for those neonates. Moreover, preterm neonates have immature body organs especially of the digestive systems and need to be admitted to neonatal intensive care units (NICUs) (**Sangers et al .,2017; Jebraieli, 2018**)

Beginning enteral feeding as early as possible enables preterm neonates to better tolerate feeding and ensures that they experience fewer possible complications of parenteral feeding. Preterm neonates are exposed to many feeding problems such as gastroesophageal reflux and feeding intolerance (**Mora et al., 2017**). Feeding intolerance is extremely common in premature neonates. The most frequent signs of a suspect feeding intolerance include the presence of gastric residuals, vomiting, abdominal distension visible bowel loops, diarrhea, or

bloody stool and the onset of crises of apnea or bradycardia (**Parker et al .,2019**).

One of the important nursing care practices for preterm neonates in neonatal intensive care units is the positioning of those neonates **(Halemani et al ., 2021)**. Nurses usually change the neonates' positions and observe them. Doing regular changes in neonates' positions usually prevent the complications which may occur when neonates remain in the same position. Positioning the preterm neonates may positively or negatively influence their body systems. Inappropriate positioning of preterm neonates causes motor and behavioral deteriorations, irregular sleep-wake cycles, chronic pain and long-term complications **(Chen et al ., 2015)**. Optimum nursing position in neonates receiving enteral nutrition is unknown. Nursing positions are applied in NICU including; supine position, left lateral, right lateral and prone positions. There are limited studies which have compared these positions **(Pourazar et al ., 2018)**. Such different positions have an effect on the preterm neonates such as prone position which increases arterial O2 saturation, progresses breath and rib cage movements, reduces apnea in neonates with a history of apnea, improves sleeping, and constricts regurgitation (**Larkin et al.,2019**) However, this position increases orthopedic disorders and delays muscles development. On the other hand, preterm neonates are inclined to sudden infants' death syndrome. Hence, the preterm neonates situated in prone position must be under cardiopulmonary and arterial O2 saturation monitoring. Among all nursing positions, supine position is associated with increased gastric residuals and gastro-esophageal reflux. The right lateral position is preferred as it is associated with less gastric residuals and faster gastric emptying **(Kaur et al., 2018 ; Ceylan et al., 2020 and Gozen et al., 2021)**.

Developmentally supportive care integrates many approaches that are similar to intra uterine environment as nesting.Nesting is a comfortable, protecting technique for preterm neonates that conserves them from muscular and skeletal deformities and promotes self regulation and normal development. Nesting means using of rolled-up sheets to form a 'nest' to provide physiological, behavioral and postural stability to the preterm neonates (**Ahmed, and Mohamed., 2019**). It enhances breathing movements by supporting the rib cage, improves oxygenation, heart rate and enhances sleep pattern from irregular disturbed spells to deep peaceful nights. It also improves feeding tolerance, reduces pain, stress and crying time, reduces reflux, saves energy and helps faster weight gain (**American University of Beruit Medical Center, 2015).** Accordingly ,the preterm neonates must be positioned in such way, which is similar to the fetal position in mother's uterus which leads to earlier feeding success and decreases hospital stay. Morover it makes neonates feel more secure and more physiologically stable when they are supported by boundaries as they are in the womb (**Reyhani ,et al 2016**)

Neonatal intensive care unit environment takes on an affirmative obligation not just to avoid harm to specific illness but to support all the biological systems of preterm neonates. Neonatal intensive care nurses have crucial role in care of the preterm neonates and paying special attention to nutrition is mandatory science **(Kaur., 2018)**. Proper enteral nutrition in premature neonates decreases mortality rate and spread of infection, improves weight gain, and also shortens hospitalization. It is important for nurses to be aware of the literature and also to guide their practice based on neonates' assessment and presentation of symptoms related to feeding intolerance. Developmentally supportive Post feeding positioning provides nurses with a noninvasive and safe option for caring of the preterm neonate. Ultimately, the application of such positioning could effectively improve gastrointestinal tolerance and physiological parameters of those neonates **(Cheraghi et al., 2018)**

Aim of the Study

The aim of the study was to determine the effect of developmentally supportive post feeding positions on gastrointestinal tolerance among preterm neonates.

Hypotheses

1. Preterm neonates who are placed on developmentally supportive semi recumbent post feeding position exhibit

more gastrointestinal tolerance than those who are placed on developmentally supportive right and left lateral post feeding positions.

2. Preterm neonates who are placed on developmentally supportive right lateral post feeding position exhibit more gastrointestinal tolerance than those who are placed on developmentally supportive left lateral and semi recumbent post feeding positions.
3. Preterm neonates who are placed on developmentally supportive left lateral post feeding position exhibit more gastrointestinal tolerance than those who are placed on developmentally supportive right lateral and semi recumbent post feeding positions.

Operational Definitions

- **Developmentally supportive position:** means that preterm neonate placed in a position similar to the fetal position in the mother's uterus through a nest made of cotton cloth.

Materials and Method

Research Design

A cross-over experimental research design was used to accomplish this study.

Setting

The study was conducted at the Neonatal Intensive Care Unit (NICU) of El-Shatby Maternity University Hospital in Alexandria.

Subjects

A purposive sample of 30 preterm neonates who fulfilled the following criteria comprised the study subjects:

- Gestational age ≤ 34 weeks.
- Birth weight 1000 to 1400 grams.
- Postnatal age > 10 days to avoid physiological weight loss.
- Receiving oro-gastric tube feeding.
- Free from congenital malformations or GIT infection.
- Not attached to mechanical ventilator.
- Preterm neonates were assigned as one study group to maintain homogeneity of preterm neonates and each preterm neonate was sequentially placed on developmentally supportive three post feeding positions.

Tools: Three tools were used to collect the data.

Tool I: Preterm Neonates' Characteristics and Clinical Data Assessment Sheet:

This tool was developed by the researchers after thorough review of related literature to assess demographic and clinical data of preterm neonates (**Sangers, et al, 2017;Jebraieli ,. 2018).** It includes the following:

Gestational age, gender, birth weight, current weight, diagnosis, medication received temperature, pulse, respiratory rate and O_2 saturation.

Tool II: **Feeding Pattern of Preterm Neonates Assessment Sheet:**

This tool was developed by the researchers after thorough review of related literature to assess feeding pattern of preterm neonates (**Sangers, et al, 2017 ;Jebraieli ,. 2018)**. It includes the following:

Type of milk, number of feeding and amount of feeding/day.

Tool III: Preterm Neonates' Gastrointestinal Post Feeding Tolerance Assessment Sheet, it includes two parts as:

Part I: **Preterm Neonates' Gastric Residual Volume:**

This tool was developed by the researchers after thorough review of related literature to assess the gastric residual volume of preterm neonates (**Sangers, et al, 2017 ;Jebraieli ,. 2018).**

A Percentage Gastric Residuals (%) = Aspirated volume (ml) ×100 given milk volume (ml).

Part II: Preterm Neonates' Signs of Gastrointestinal Feeding Intolerance of Preterm Neonates

This tool was developed by the researchers after thorough review of related literature to

assess signs of preterm neonates post feeding tolerance of preterm neonates (**Sangers, et al, 2017 ;Jebraieli ,. 2018)**. It includes abdominal distention, constipation and vomiting.

Method

- Approval from the Ethical Nursing Research Committee of the Faculty of Nursing, Alexandria University was obtained before carrying out this study.
- An official letter for conducting the study was obtained from the Faculty of Nursing and was sent to the director of El -Shatby University Hospital to take their permission to facilitate the research implementation after explaining the aim and the nature of the study.
- Tools were developed by the researcher after review of the related literature.
- Content validity of the tools was done by five experts in the pediatric nursing field.
- Reliability of the tools was ascertained using appropriate statistical test (r= 0.87).
- A pilot study was carried out on 5 preterm neonates to test the applicability of the tools and modifications were done. Those neonates were excluded from the study subjects.
- At initial contact data concerning demographic and clinical data of each preterm neonates were assessed using tool I.
- Feeding pattern, gastric residual volume and gastrointestinal feeding tolerance were assessed before feeding at 9 AM, 12 MD and 3 PM for each preterm neonate using tools II and III.
- Immediately after feeding, the preterm neonates were placed on developmentally supportive position with maintaining intra-uterine flexed position using a nest as follows:
  - A hand towel to support both sides of the preterm neonates was used forming U shape under the buttocks.
  - Cover blanket with a wrap will be flattened at the top of the 'U' shape.
  - The nest was suitable for preterm neonates' size not too loose and not too tight.
- Each preterm neonate was sequentially placed on the three alternatives developmentally supportive post feeding positions (right lateral position, left lateral position and semi recumbent position) at 9 am, 12 md and 3 pm as follows:
  - On the first day, preterm neonate was placed on developmentally a supportive right lateral position.
  - On the second day, preterm neonate was placed on developmentally supportive left lateral position.
  - On the third day, preterm neonate was placed on developmentally supportive semi recumbent position (by elevate head of incubator 30- 45 degree).
- Physiological parameters, feeding pattern, gastric residual volume and signs of gastrointestinal post feeding tolerance were measured and recorded for each preterm neonate after 60 and 120 minutes of feeding for 9 hours observation period, which was followed by wash-off period of 15 hours during which preterm neonates were nursed predominantly on right side position as a routine of the unit to avoid the effect of the previous body position.
- Comparison between three alternatives developmentally supportive post feeding positions was done to evaluate the effect of developmentally position on gastrointestinal tolerance and gastric residual volume among preterm neonates.
- Data were collected over a period of 4 months from the beginning of May 2021 till the end of August 2021.

Data Analysis

Collected raw data will be revised, coded and transferred into specially designed formats to be suitable for computer feeding; and they were entered into IBM SPSS software package version 20.0. Qualitative data will be described using numbers and percent. Quantitative data will be described using range (minimum and maximum), mean, and standard deviation. Friedman test was used for comparing between the developmentally supportive post feeding positions.

Ethical considerations included:

- Written consent was obtained from all parents of preterm neonates after providing appropriate explanation about the purpose of the study and they have the right to withdraw at any time.
- Data privacy and confidentiality of the collected data was guaranteed.

Results

Table 1 illustrates demographic and clinical data of preterm neonates. It was found that 60% of preterm neonates were males and 40 % were females. Regarding gestational age, it was found that, the mean gestational age of preterm neonates were 34 ± 3. While the mean birth weight was 1326.33 ± 111.44. The table clarifies that the mean current weight preterm neonates was 1403.50 ± 118.58. The table also illustrates that neonatal jaundice constituted half of preterm neonate's diagnosis (50%). The majority of preterm neonates (80%) received antibiotics medication.

Table 2 demonstrates the feeding pattern of preterm neonates. It was cleared from the table that, all preterm neonates received artificial milk formula. Regarding the number of feeding per day, it was found that all preterm neonates (100%) received from 7-8 feeds per day and the mean of amount of feeding received by preterm neonates per day was 40.80 ± 10.0.

Table 3 illustrates gastric residual volume of the preterm neonate before and after developmentally supportive feeding positions. It is revealed from the table that 36.7% of preterm neonates before feeding had no gastric residual volume on the first day. This percentage increased to 53.3% and 73.3% after positioning preterm neonates on developmentally supportive left lateral position at 60 and 120 minutes respectively. In addition, slightly more than half of preterm neonates (53.3%) had 10% to less than 20% of gastric residual volume before feeding. After 60 minutes of positioning the preterm neonates, the percentage of gastric residual volume decreased to 36.7%. Further decrease was found after 120 minutes where only 16.7% of those preterm neonates had gastric residual volume from 10% to less than 20%.

The table also revealed that 26.7% of preterm neonates on the second day had no gastric residual volume before feeding. After positioning the preterm neonates on developmentally supportive right lateral post feeding position the percentage increased to 83.3% and 86.7% at 60 and 120 minutes respectively. Moreover, it was found that more than half of neonates (60%) had gastric residual volume 10% -< 20% before feeding. This percentage was declined to only 6.7% and 3.3% after positioning at 60 and 120 minutes respectively.

On the third day, 33.3% of preterm neonates had no gastric residual volume before feeding. Meanwhile, after 60 and 120 minute the majority of those preterm neonates (96.7% and 96.3%, respectively) had no gastric residual after positioning on developmentally supportive semi recumbent position after feeding. Fortunately, 33.3% of those preterm neonates who had 10% to less than 20% of gastric residual volume before feeding decreased to none of them after 60 and 120 minutes respectively. There were statistically significant differences between the developmentally supportive post feeding positions among preterm neonates at 60 and 120 minutes ($p < 0.001$ and $p = 0.032$ respectively).

Table 4 illustrates the signs of feeding intolerance of preterm neonate before and after developmentally supportive feeding positions. It was found from the table that before feeding 30% of the preterm neonates exhibited abdominal distention on the first day. This percentage decreased to 16.7% and 10% after positioning preterm neonates on developmentally supportive left lateral position at 60 and 120 minutes respectively.

The table also clarifies that, before feeding 30% of preterm neonates exhibited abdominal distention on the second day. This percentage decreased to 10% and 6.7% after positioning preterm neonates on developmentally supportive right lateral position at 60 and 120 minutes respectively.

It can be also seen from the table that before feeding 33.3% of preterm neonates exhibited abdominal distention on the third day. This percentage decreased to 6.7% at 60 minutes and none of preterm neonates exhibited abdominal distention after

positioning preterm neonates on developmentally supportive semi recumbent position at120 minutes There was statistically significant differences found between developmentally supportive post feeding positions either at 60 and 120 minutes after feeding where p 0.001 and p<0.001 respectively. Concerning vomiting, it was found that there were statistically significant differences found between developmentally supportive post feeding positions at 60 minutes after feeding where p=0.035. In addition to regurgitation, it was found that there were statistically significant differences found between developmentally supportive post feeding positions at 60 and 120 minutes after feeding where p=0.000, p=0.001

Table 5 portrays physiologic parameters of the preterm neonate before and after developmentally supportive feeding positions. It is clear from the table that there were no statistically significant differences immediately before feeding. Moreover, there were no statistically significant differences at 60 and 120 minutes after feeding regarding temperature, pulse, respiration and oxygen saturation between developmentally supportive left, right lateral and semi recumbent positions.

Table (1): Demographic and Clinical Data of Preterm Neonates

Demographic and Clinical Data of Preterm Neonates	No. (n = 30)	%
Gender		
Male	18	60.0
Female	12	40.0
Gestational age		
Min. – Max.	34.0 – 37.0	
Mean ± SD.	34.0 ± 3	
Birth weight/ gm.:		
Min. – Max.	1000.0 – 1400.0	
Mean ± SD.	1326.33 ± 111.44	
Current weight/ gm.:		
Min. – Max.	1050– 1500	
Mean ± SD.	1403.50 ± 118.58	
Diagnosis		
RDS	9	30.0
Congenital pneumonia	6	20.0
Neonatal jaundice	15	50.0
Medication Received#		
Antibiotics	24	80.0
Vitamins	13	43.3
Caffeine	10	33.3

SD: Standard deviation #: More than one answer

Table 2: Feeding Pattern of Preterm Neonates

Feeding Pattern	No. (no=30)	%
Types of milk Artificial milk formula	30	100.0
Number of feedings/ day 7 – 8	30	100.0
Amount of Feeding ml/day		
Min. – Max.	10 – 50	
Mean ± SD	40.80 ± 10.0	

Table 3: Gastric Residual Volume of Preterm Neonates before and after Developmentally Supportive Feeding Positions

Gastric Residual Volume	1st day Developmentally Supportive Left Lateral Position (no=30)						2nd day Developmentally Supportive Right Lateral Position (no=30)						3rd day Developmentally Supportive semi recumbent Position (no=30)						Fr. (p_1)	Fr. (p_2)	Fr. (p_3)
	Before Feeding		After Feeding				Before Feeding		After Feeding				Before Feeding		After Feeding						
			60 minutes		120 minutes				60 minutes		120 minutes				60 minutes		120 minutes				
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%			
No gastric residual	11	36.7	16	53.3	22	73.3	8	26.7	25	83.3	26	86.7	10	33.3	29	96.7	28	93.3			
Less than 10%	1	3.3	1	3.3	1	3.3	2	6.7	1	3.3	4	13.3	6	20.0	0	0.0	1	3.3			
10% -< 20%	16	53.3	11	36.7	5	16.7	18	60.0	2	6.7	1	3.3	10	33.3	0	0.0	0	0.0	1.659 (2.001)	20.468* (<0.001*)	6.914* (0.032*)
20% and more	2	6.7	2	6.7	2	6.7	2	6.7	1	3.3	0	0.0	4	13.3	1	3.3	1	3.3			
Mean ± SD.	7.32±11.35		6.60± 8.07		5.52±10.32		1.69±4.58		1.71± 4.71		2.85 ± 6.82		1.01 ± 4.64		0.74± 4.06		0.91± 3.84				
Median	0.0		0.0		0.0		0.0		0.0		0.0		0.0		0.0		0.0				

Fr: **Friedman test**

p_1: p value for comparing between the developmentally supportive positions before feeding.

p_2: p value for comparing between the developmentally supportive post feeding positions at 60 minutes

p_3: p value for comparing between the developmentally supportive post feeding positions at 120 minutes

SD: **Standard deviation**

*: Statistically significant at $p \leq 0.05$

Table 4: Signs of Feeding Intolerance of Preterm Neonates before and after Developmentally Supportive Feeding Positions

Signs of Feeding Intolerance	1st day Developmentally Supportive left Lateral (no=30)						2nd day Developmentally Supportive Right Lateral Position (no=30)						3rd day Developmentally Supportive Semi recumbent Position (no=30)						Fr. (p_1)	Fr. (p_2)	Fr. (p_3)
	Before Feeding		After feeding				Before Feeding		After feeding				Before Feeding		After feeding						
			60 minutes		120 minutes				60 minutes		120 minutes				60 minutes		120 minutes				
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%			
Abdominal distension or girth	9	30	5	16.7	3	10	9	30	3	10.0	2	6.7	10	33.3	2	6.7	0	0.0	6.800 (1.001)	13.273* (0.001*)	16.800* (<0.001*)
Vomiting	2	6.7	2	6.7	1	3.3	4	13.3	1	3.3	0	0.0	2	6.7	0	0.0	0	0.0	1.308 (3.006)	6.727* (0.035*)	2.571 (0.276)
Regurgitation	6	20.0	5	16.7	5	16.7	6	20.0	2	6.7	2	6.7	5	16.7	0	0.0	0	0.0	3.556 (0.169)	11.167* (0.000*)	16.800* (<0.001*)
Constipation	3	10.0	1	3.3	4	13.3	3	10.0	0	0.0	1	3.3	2	6.7	0	0.0	0	0.0	1.600 (0.449)	1.750 (0.417)	3.600 (0.165)
Diarrhea	1	3.3	1	3.3	0	0.0	1	3.3	1	3.3	0	0.0	1	3.3	0	0.0	0	0.0	4.000 (0.135)	2.000 (0.368)	2.000 (0.368)
Visible bowel movement	1	3.3	1	3.3	0	0.0	1	3.3	1	3.3	0	0.0	1	3.3	0	0.0	0	0.0	3.000 (0.223)	–	2.000 (0.368)

Fr: **Friedman test**

p_1: p value for comparing between the developmentally supportive positions before feeding.

p_2: p value for comparing between the developmentally supportive post feeding positions at 60 minutes

p_3: p value for comparing between the developmentally supportive post feeding positions at 120 minutes

*: Statistically significant at $p \leq 0.05$

Table 5: Physiological Parameters of Preterm Neonates before and after Developmentally Supportive Feeding Positions

Physiological Parameters	1st day Developmentally Supportive left Lateral Position (n = 30)			2nd day Developmentally Supportive Right Lateral Position (n = 30)			3rd day Developmentally Supportive Semi recumbent Position (n = 30)			Fr. (p_1)	Fr. (p_2)	Fr. (p_3)
	Before Feeding	After Feeding		Before Feeding	After Feeding		Before Feeding	After Feeding				
		60 minutes	120 minutes		60 minutes	120 minutes		60 minutes	120 minutes			
	Mean ±SD.	Mean ±SD.	Mean ±SD.	Mean ±SD.	Mean ±SD.	Mean ±SD.	Mean ±SD.	Mean ±SD.	Mean ±SD.			
Temperature	36.81±0.13	36.81±0.13	36.81±0.15	36.81±0.18	36.81±0.10	36.80±0.12	36.85±0.14	36.87±0.14	36.68±1.12	F=1.274 (0.288)	F=0.661 (0.532)	F=0.360 (0.679)
Pulse	139.8±8.18	139.6±7.76	139.5±7.55	139.9±7.84	137.7±9.67	139.9±7.72	140.3±6.58	141.3±6.77	141.1±7.42	F=0.093 (0.911)	F=2.966 (0.059)	F=0.933 (0.399)
Respiration	47.60±3.07	47.27±3.30	47.23±3.43	47.23±3.06	46.69±2.97	47.23±3.36	46.97±2.92	46.73±3.05	47.13±3.21	Fr.=3.897(0.142)	Fr.=1.649 (0.439)	Fr.=0.463 (0.793)
Oxygen Saturation	98.03±1.16	98.0±1.17	98.07±1.14	97.93±1.23	97.33±4.36	97.97±1.25	97.97±1.16	98.03±1.16	98.03±1.16	Fr.=4.667 (0.097)	Fr.=1.000 (0.607)	Fr.=4.667 (0.097)

Fr: **Friedman test** **SD: Standard deviation**

p_1: p value for comparing between the developmentally supportive positions before feeding.

p_2: p value for comparing between the developmentally supportive post feeding positions at 60 minutes

p_3: p value for comparing between the developmentally supportive post feeding positions at 120 minutes

Discussion

Enteral feeding in preterm neonates is challenging due to immaturity of bowel function, biological factors such as decreased intestinal motility, decreased gastrointestinal hormones and enzymes. This is frequently associated with pre-feed gastric residuals, delayed attainment of full enteral feeding, gastro intestinal feeding intolerance, and prolonged hospital stay. **(kaur V .,et al., 2018)**.

Gastro intestinal feeding intolerance is considered as inability to digest enteral feedings associated with increased gastric residuals, abdominal distension and/or emesis, which is frequently encountered in the very preterm neonates and often leads to a disruption of the feeding plan. In most cases, feeding intolerance represents a benign condition related to the immaturity of gastrointestinal function **(Sokou R., 2021**).So the current study was conducted to determine the effect of developmentally supportive post feeding positions on gastrointestinal feeding tolerance among preterm neonates.

The finding of the current study clarifies that there were statistically significant differences between developmental supportive post feeding position either at 60 and 120 minutes after feeding in relation to vomiting and abdominal distention as a signs of gastrointestinal feeding intolerance (**kaur, V., 2018**). These findings are in the same line with Ceylan S ., 2020.

Gastric residual volume is an objective and primary indicator for gastric emptying and gastrointestinal tolerance of feeding in Neonatal Intensive care Units. It is becomes more dangerous when it is accompanied by bilious vomiting, abdominal distention occult blood and temperature instability (**Sajadi, M., 2019**). The result of the current study revealed that the majority of preterm neonates who are placed on developmentally supportive semi recumbent post feeding position had no gastric residual volume after 60 and120 minutes of feeding compared to preterm neonates who are placed on developmentally supportive right lateral and left lateral post feeding positions. There were statistically significant differences between the developmentally supportive post feeding positions among preterm neonates at 60 and 120 minutes. These findings could be justified by the fact that placing preterm neonates on semi recumbent developmentally supportive position could reduce work of breathing by facilitating lung expansion through the head and trunk elevation as well as it enhances the ability to provide head-neck alignment, this could improve digestion. Furthermore, semi recumbent developmental supportive post feeding position promotes digestion as this position represents no pressure upon the stomach of preterm neonates. Farsi et al., (2020) is in line with the finding of the present study which found that, the gastric residual volume is lower in semi recumbent position .On the contrary, the Egyptian study done by Hssein, (2012**)** reported that there was no statistically significant difference between placing infants on the right side and semi recumbent position after feeding regarding the amount of gastric residual volume at three sequential times. In addition, a clinical trial cross-over study was carried out by Khatony A et.al' (2019) on premature infants in NICU contradicted the result of the current study and concluded that prone position was featured with the lowest gastric residual volume than right and left lateral.

Accordingly to the result of the current study, the mean value of gastric residual volume of the developmental supportive right lateral position was significantly lower than the mean of gastric residual volume of developmental supportive left lateral position. It could be justified by the fact that right lateral position can enhance the digestion when keeping the preterm neonate in the anatomical structure of gastrointestinal system by minimizing pressure on the stomach. In the same line Sajadi M et al ., (2019) found that gastric residual was significantly lower in the right lateral position than those in the left lateral position . Pourazar F et al., .(2018) were incongruent with the finding of the current study where their findings revealed that there were no significant difference between the three positions supine, left and right lateral position.

Developmentally supportive positioning in the NICU is essential for optimal gastric empty, physiologic function and stability. This

intervention has been proven to improve postural and musculoskeletal outcomes as well as improve gastro intestinal tolerance outcomes. Developmental positioning has not yet become a standardized intervention .There remains a gap between what is known in the evidence and what is practiced in NICUs (**Spilker et al. ,2016**)

Regarding the physiological parameters of preterm neonates the finding of the current study revealed that there were no significant differences between the developmental supportive three post feeding positions and physiological parameters. Furthermore, forming a "nest" with soft boundaries, as well as a padded foot-roll for foot-bracing, provides postural, behavioral, and physiological stability to the preterm neonates. Infants who are contained within soft boundaries are usually calmer, require less medication, and sleep longer.(**Altimier,& Phillips 2016**). The finding is in the same line with Spilker A et al., (2016) and Altimier L et al (2016) .

Conclusion

Based on the finding of the current study, it can be concluded that, placing preterm neonates on developmentally supportive right lateral, left lateral and semi recumbent post feeding positions reduces gastric residual volume and improves signs of gastrointestinal feeding tolerance. Furthermore, the smallest gastric residual volume and improvement of signs of gastrointestinal feeding tolerance were determined in the developmentally supportive semi recumbent post feeding positions

Recommendations

Based on the finding of the current study, the following recommendations were suggested:

- Continuous training in neonatal intensive care units for nurses should be performed for caring and placing preterm neonate in developmentally supportive right lateral, left lateral and semi recumbent post feeding positions.
- Health education programs should be done for parents about the effects and benefits of developmentally supportive post feeding positions.

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