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The Effect of Preterm Neonates Position on their Gastric Residual Volume at Neonatal Intensive Care Unit

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ABSTRACT

Background: The early initiation of enteral feeding in preterm neonates is crucial for promoting the maturation and functional development of their underdeveloped gastrointestinal system. Additionally, ensuring appropriate positioning for preterm neonates is vital for maintaining physiological stability and optimising their nutritional outcomes. **Objective:** The aim of the study is to evaluate the effectiveness of different positions on gastric residual volume for preterm neonates at neonatal intensive care units. **Methods:** A quasi-experimental research design was utilised. The study was carried out at the Neonatal Intensive Care Units in Mostafa Hassan Hospital, Fayoum University, and Fayoum General Hospital, both affiliated with the Ministry of Health in Egypt. A purposive sample of 60 preterm neonates in the previously mentioned settings satisfies the inclusion and exclusion criteria. There were two tools used to collect data for the study. The first was a simple questionnaire sheet used to get personal and medical information from preterm babies and their mothers. The second was a gastric residual volume record sheet used to measure the gastric residual volume before formula feeding. **Results:** The study findings demonstrated that the prone position was associated with the minimum gastric residual volume, whereas the supine position showed the highest. A statistically significant difference was identified concerning gastric residual volume between the study and control groups on the first and second days when comparing prone and supine positions, with a *p*-value of <0.001. **Conclusion:** The present study showed that the lowest gastric residual volume was found with the prone position, followed by the right lateral position, and then the supine position. The research findings supported the researcher's hypothesis. **Recommendation:** Prone and right lateral positions should be integrated into daily practices as effective positions for reducing gastric residual volumes in preterm neonates following feeding.

Keywords: Gastric Residual Volume; Neonatal Intensive Care Unit; Positioning; Preterm Neonate

INTRODUCTION

Preterm neonates, delivered <37 weeks of gestation, face numerous health challenges due to the immaturity of their organ systems. Among these, their gastrointestinal (GI) tract is particularly underdeveloped, making it challenging for them to tolerate and effectively process enteral nutrition. This can result in feeding intolerance and subsequent growth-related complications. Feeding intolerance in preterm infants is commonly evaluated by measuring Gastric Residual Volume (GRV), which represents the volume of undigested milk remaining in the stomach prior to the next feeding. Elevated gastric residual volume (GRV) levels often indicate delayed gastric emptying, which is associated with an increased risk of complications such as necrotizing enterocolitis (Baldassarre *et al*., 2022).

Effective nutritional management is essential for preterm infants' growth and survival in Neonatal Intensive Care Units (NICU). Enteral feeding, which delivers nutrients directly to the GI tract, serves as the primary mode of nutrition once the neonate achieves stability. However, due to immature gut motility and frequent episodes of feeding intolerance, continuous monitoring and individualised strategies are necessary to

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optimise feeding outcomes. GRV testing on a regular basis is very important for feeding because it shows how well the newborn can handle enteral nutrition (Thoene & Anderson-Berry, 2021).

Consequently, increased GRV often necessitates the temporary suspension of feedings, potentially hindering the neonate's nutritional progress and growth. Thus, it is clinically crucial to identify non-invasive interventions that can reduce GRV and enhance feeding tolerance. One such approach involves positioning the neonate in specific postures after feeding to promote gastric emptying and decrease GRV (Elhusein & Fadlalmola, 2024).

Adequate enteral nutrition in preterm neonates reduces mortality rates, minimises infection risks, supports weight gain, and shortens the length of hospitalisation. In contrast, inadequate nutrition can lead to extended hospital stays. Gastric emptying is influenced by several factors, including the milk type (formula or breast milk), amount of milk, and the neonate's overall physical condition. Proper positioning of the neonate is a key responsibility of nurses, and achieving optimal positioning requires reliable evidence and well-established guidelines (Khatony *et al*., 2019).

Neonatal nurses play a vital role in addressing the nutritional needs of preterm infants in the NICU, particularly by monitoring and optimising GRV. They are responsible for assessing GRV prior to each feeding, modifying feeding plans according to residual volumes, and implementing interventions such as positioning to enhance feeding tolerance (Halemani *et al*., 2023). Additionally, nurses must ensure that preterm infants are positioned appropriately after feeding to promote gastric emptying while addressing safety issues, like the possibility of Sudden Infant Death Syndrome. Through continuous monitoring, clinical assessments, and collaboration with the healthcare team are essential for the early detection of feeding intolerance and the prevention of complications (Özgörü, Mutlu & Erkut, 2024). In addition, nurses play a crucial role in educating parents on safe feeding techniques for their babies and emphasizing the importance of proper positioning during feeding.This helps with both the immediate care and long-term development of babies born before they are due (Elhusein & Fadlalmola, 2024).

Significance of the Study

Globally, approximately out of the 130 million newborns born each year, about 15 million (11.1%) are born prematurely worldwide. Prematurity remains a leading cause of neonate and infant death and morbidity, as well as an important factor in long-term negative health consequences (Khasawneh & Khriesat, 2020). In Egypt, about 23.13% of preterm births occur between 32 and 37 weeks of pregnancy, suggesting an increased rate of neonatology admissions annually. According to a study by Algameel *et al*. (2020) in Upper Egypt, 28% of the neonates in the study were late preterm.

Nutritional challenges in premature neonates are critical to their development. As such, the positioning of neonates during and after feeding can significantly impact their nutritional tolerance, which in turn positively influences their growth and development. Furthermore, there is a limited body of research on GRV positioning effectiveness among preterm neonates, particularly in Egypt. Therefore, the main aim of this study is to evaluate the effectiveness of different positions on gastric residual volume for preterm neonates at the NICU.

Aim of the Study

This study aimed to evaluate the effectiveness of different positions on gastric residual volume for preterm neonates at the NICU.

This aim can be achieved through the following objectives:

Assessing preterm neonates conditions.

Assessing GRV for preterm neonates post feeding.

Apply different positions to the studied preterm neonates based on basic assessment.

Evaluating the effectiveness of each position on GRV for preterm neonates.

Research Hypothesis

Varying the post-feeding positions in preterm neonates can have a more favorable impact on gastric residual volume in the study group compared to the control group.

METHODOLOGY

Design: This study used a quasi-experimental research design.

Setting: The Ministry of Health in Egypt affiliated the NICUs at Mostafa Hassan Hospital, Fayoum University, and Fayoum General Hospital with the study.

Sampling: A purposive sample was obtained and including 60 preterm neonates from both genders, and admitted to the NICUs at previously mentioned settings during the period of the study and then coded and allocated into two equal groups based on their admission codes: odd codes were assigned to the control group, and even codes were assigned to the study group, each group included 30 preterm neonates with the following inclusion criteria namely. Preterm neonates fed by a nasogastric tube, had a gestational age 28 : 36 weeks, whom Apgar score at the fifth minute of birth more than 6, weighed 800g or more, and were physiologically stable (heart and respiratory rate, and oxygen saturation), and exclusion criteria namely; preterm neonates with congenital anomalies, digestive problems and mechanically ventilation neonates.

Tools of Data Collection

Study Data was Collected Using Two Tools

Tool I: A Simple Questionnaire Sheet

It was designed by the researcher to collect the needed data based on the available related studies and references, and it consisted of four parts:

Part I: The preterm neonate's characteristics were studied: current age, gestational age, gender, birth weight, and current birth weight.

Part II: The s medical data of the studied preterm neonate was collected: type of delivery, diagnosis, five-minute Apgar score, and length of hospital stay.

Part III: Medical data of mothers: Including chronic diseases (such as heart diseases, diabetes, hypertension, kidney diseases), previous preterm labour, previous abortion, and previous caesarean section.

Tool II: Record Sheet for Gastric Residual Volume:

Hussein (2012), which assessed the GRV remaining in the stomach prior to formula feeding, served as the model for modification. It consisted of five items: time of feeding, formula amount, colour of GRV, the studied neonates post-feeding position (right lateral, prone and supine position), and GRV.

Content Validity

A panel of five nursing experts evaluated the tools' content validity for comprehensiveness, accuracy, clarity, relevance, and usefulness. They made changes and suggestions.

Reliability

To ascertain the degree of relationship between the questionnaire items, the reliability of the tools were examined. An internal consistency model called Cronbach's alpha was employed in the analysis. For tool (II), the gastric residual volume record sheet, the reliability factor was 0.878. The normal range of the Cronbach's alpha reliability coefficient's statistical equation is 0 to 1. Reliability is considered satisfactory when Cronbach's alpha values are higher than 0.7.

Pilot Study

Of the total sample, 10% (6 preterm neonates) participated in a pilot study to test the study tools' efficiency,

applicability, and clarity, as well as the time needed to complete them. The appropriate modifications were made in light of the pilot study's findings. The preterm infants who were included in the pilot study were later excluded from the main study sample.

Fieldwork

Data for this study was gathered over a nine-month period starting in early June 2023 and ending in late February 2024. The researcher applied an intervention for two preterm neonates on the two days of the week of collected data, which took place between 8 a.m. and 2 p.m.

The sociodemographic and medical data of the studied preterm neonate's was collected from the neonate's sheet in about ten minutes. GRV was assessed before feeding in three timed sessions (10 am, 12 pm, & 2 pm) using the GRV record sheet (tool II); this was also completed in about five minutes.

Intervention

A properly positioned nasogastric tube performs the feeding. The studied preterm neonate was placed in a supine position with his head slightly elevated during the procedure, and the feeding syringe was 30 cm above his head. The appropriate volume of milk was then given to the neonate.

In the study group, preterm neonates were placed in different positions post-feeding, and gastric residual volume (GRV) was measured after each position. At 8:00 am, the neonates were positioned in a right lateral position for 2 hours post-feeding, followed by GRV measurement. Again at 10:00 am, they were positioned in a prone position for 2 hours post-feeding, and GRV was measured again. At 12:00 pm, the neonates were placed in a supine position for 2 hours post-feeding, after which GRV was measured.

Control Group

Preterm neonates received routine nursing care from the unit, including feeding. The unit cared for them and measured their GRV three times (10 am, 12 pm, and 2 pm).

The studied preterm neonates involved in the control group received routine nursing care from the unit (usually positioned in a supine position only), while study group subjects were positioned in right lateral, supine, and prone positions post feeding.

Evaluation

The mean and standard deviation were used to compare the measured GRV of preterm infants in three postures. If GRV exceeds 50% of last feeding, it is considered evidence of feeding intolerance (Ifran *et al*., 2024).

Statistical Analysis

SPSS (Statistical Package for the Social Sciences) was used to organise, categorise, tabulate, enter, and analyse the data that was gathered, software program version 26. Statistical significance and association were assessed using chi-square (X^2), arithmetic mean, standard deviation (SD), and *p*-value to detect the relationship between the standard's variables. Statistical significance was defined as *P*-value <0.05.

Ethical Consideration

The study received Ethical Approval before the start of data collection from the Scientific Research Ethics Committee of the Faculty of Nursing at Helwan University, Egypt with reference number NuR No. (30)19/10/2022 on 19th October, 2022, and individual consent was obtained from each parent.

The researcher explained the purpose of the study to the parents of the participating preterm children. The researcher assured the participants of the guarantee of confidentiality and anonymity. Parents were made aware that they might opt out of the study at any point of the study.

RESULTS

Table 1: Preterm Condition among the Study and Control Groups Based on their Personal Characteristics (n = 60)

Items	Study (n = 30)		Control (n = 30)		Total (n = 60)	
	n	%	n	%	n	%
Gender						
Female	16	53.3	13	43.3	29	48.3
Male	14	46.7	17	56.7	31	51.7
Male to Female Ratio	**1.07 : 1**					
Birth Weight (gram)						
800: < 1000	10	33.3	6	20.0	16	26.7
1000: <1200	2	6.7	8	26.7	10	16.7
1200: <1400	4	13.3	5	16.7	9	15.0
1400: <1600	6	20.0	6	20.0	12	20.0
≥ 1600	8	26.7	5	16.7	13	21.7
Mean and SD	1394±521		1347±527		**1370±520**	
Gestational Age (weeks)						
28: < 30	6	20.0	4	13.3	10	16.7
30: <32	8	26.7	7	23.3	15	25.0
32: <34	8	26.7	10	33.3	18	30.0
34: 36	8	26.7	9	30.0	17	28.3
Mean and SD	31.8±2.39		32.2±2.28		**32.0±2.33**	

Table 1 revealed that the mean±SD birth weights and gestational ages of all studied neonates were 1370±520 and 32.0±2.33 respectively while, male to female ratio was 1.07 : 1.

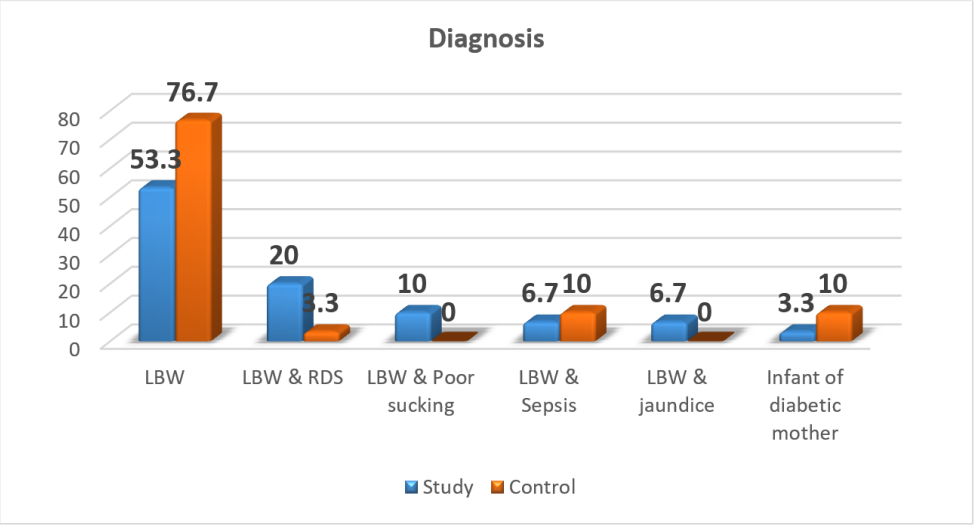

Figure 1: Percentage Distribution of Preterm Neonates' Diagnosis among the Study and Control Groups (n= 60)

Figure 1 clarifies that, 53.3% and 76.7% of all studied neonates among study and control groups concerning their diagnosis were with low birth weight (LBW).

Table 2 represents the difference between mean±SD measurements on the 1st and 2nd days of the study and control groups. According to this table, the study and control groups differed statistically significantly in terms of GRV in the prone and supine positions on the 1st and 2nd days (p-value <0.001) and mean ± SD 0.600 ± 0.75 and 1.850 ± 0.94 for the first day and 0.23 ± 0.521 & 1.200 ± 0.887 for the second day.

Table 2: Comparison of Study and Control Groups' Means of Measure Parameters on the 1st and 2nd Days (N=60)

Items	First day					Second day		
	Study (n = 30)		Control (n = 30)		*P*-value	Study (n = 30)	Control (n = 30)	*P*-value
	Mean±SD	Position	Mean±SD	Position		Mean±SD	Mean±SD	
10 AM								
Formula Amount	21.23±12.97	Right lateral	17.80±11.83	Supine	0.273	21.13±11.55	20.70±11.97	0.804
Gastric Residual Volume	1.97±2.07		2.50±1.89		0.085	1.32±1.61	1.35±0.94	0.215
12 PM								
Formula amount	21.03±13.12	Prone	18.80±12.41	Supine	0.420	22.70±13.02	21.20±11.41	0.445
Gastric Residual Volume	0.60±0.75		1.85±0.94		**<0.001****	0.23±0.52	1.20±0.89	**<0.001****
2 PM								
Formula Amount	21.03±13.12	Supine	19.20±12.07	Supine	0.530	21.67±12.10	21.80±10.96	0.946
Gastric Residual Volume	2.02±1.34		2.22±0.95		0.466	2.27±1.34	2.48±1.11	0.685

Table 3: Comparison between Neonate's Positions, Gastric Residual Volume and Formula Amount among Study Group (N = 30)

Variables	Right Lateral	Prone	Supine	*P*-value
	Mean±SD	Mean±SD	Mean±SD	
Formula Amount				
1st Day	21.23±12.966	21.03±13.119	21.03±13.119	0.135
2nd Day	21.13±11.566	22.70±13.020	21.67±12.095	0.174
Gastric Residual Volume				
1st Day	1.967±2.072	0.600±0.747	2.017±1.336	**<0.001****
2nd Day	1.317±1.605	0.233±0.521	2.267±1.344	**<0.001****

** Level of Significance = p-value <0.05 ** high Level of Significance =p value <0.01*

This table demonstrates comparison of neonate's positions in relation to GRV. There was a significant statistical difference in the amount of GRV between the right lateral, prone and supine position on the 1st and 2nd day among study goup with *p*= <0.001.

Table 4: Correlation Coefficient between Studied Neonates' Personal Characteristics and Gastric Residual Volume

Variables	GRV		Amount of Feeding	
	r	*P*-value	*r*	*P*-value
Birth Weight	0.162	0.392	0.296	0.112
Gestational Age	0.109	0.567	0.296	0.113
Five minute Apgar score	-1.88	0.320	-214	0.256
Amount of Feeding	0.737	0.001**	---	---
Length of Hospital Stay	0.204	0.280	0.205	0.277

**Statistically Significant Correlation = P value <0.05 **High Statistically Significant Correlation = P value <0.01*

Table 4 showed that there were no a statisticallly significant associations among studied neonates between gastric residual volume and neonates' characteristics with *p*-value (>0.05), while, there was a high statistically significant positive association between amount of feeding and gastric residual volume with *p*-value <0.001.

DISCUSSION

The demographic information of the study and control groups of the preterm neonates (Table 1) showed that about half of the preterm neonates were male. This means that the two groups were similar in terms of gender, which reduces the chance of bias in the study. This finding aligns with Sajadi *et al*. (2019), who reported that approximately half of the preterm neonates were male. On the contrary, Gözen *et al*. (2022) found that the

proportion of male preterm neonates was less than two-thirds.

Concerning the studied preterm neonates' birth weights, this study revealed a mean weight of 1370±520 grams, indicating that the majority of the sample had low birth weight. These neonates require close monitoring and professional nursing care to support their nutritional status, growth, and development. In a similar context, Halemani *et al*. (2023) found that most of the preterm neonates had birth weights ranging from 1272 to 2683 grams.

Regarding the gestational age, the current study demonstrated that the preterm neonates had a gestational age of 32.0 ± 2.33 weeks. Similarly, Anwar *et al*. (2021), in their study, reported that mean gestational age was 32.45 ± 2.46 weeks. In contrast, Sajadi *et al*. (2019) found that more than half of the neonates had a gestational age that ranged from 28 to 30 weeks.

Concerning medical data (Figure 1), this study findings noted that less than two-thirds of neonates were diagnosed with low birth weight. This finding highlights the critical importance of feeding to enhance the growth and weight of preterm neonates. Conversely, Sajadi *et al*. (2019) found that more than half of the neonates were diagnosed with respiratory distress syndrome.

The findings of the current study also showed that there were no statistically significant differences between both groups in several demographic data, such as birth weight, gender, Apgar score, gestational age, diagnosis, and delivery method. Which confirms that the researcher took the randomisation of the sample into account to ensure the inclusion criteria were met for both groups. This finding aligns with the study by Altay and Küçükoğlu (2022), who stated that the control and study groups did not differ statistically significantly in terms of demographics, indicating that there were similarities across the groups.

Regarding the comparison between the two groups on the first and second days concerning GRV (Table 2), the findings of the current study showed a statistically significant difference between the two groups. This difference could be attributed to the effect of positioning on improving feeding and digestion.The results of this study agreed with those of Anwar *et al*. (2021) research, which found that the formula amount and GRV were statistically different between the two groups on both the first and second days.

With a *p*-value of less than 0.001, there was a very important difference in the GRV between the three positions of the newborns in the study group (Table 3). This finding aligns with the study by Anwar *et al.* (2021), which showed a statistically significant difference in GRV among the three positions. However, this finding contradicts that of Khatony *et al*. (2019), that reported no significant difference between the neonate's positions in terms of GRV.

Regarding the comparison between the neonate's positions regarding GRV among the study group on the first and second days, the study demonstrated that the lowest gastric residual volume was observed in the prone position, followed by the right lateral position, and then the supine position. These findings were consistent with Yayan *et al*. (2018), who found that the prone position led to the lowest GRV 120 minutes after feeding. The current study confirmed that the lowest mean GRV was associated with the prone position, followed by the right lateral and supine positions. From the researcher's perspective, the prone position was the most effective for gastric emptying, followed by the right lateral position, with higher GRV in the supine position.

The prone position, which aligns the digestive tract better and lowers the pressure inside the abdomen, may contribute to these results by helping the stomach empty faster. This posture can facilitate better motility and minimise reflux, which is particularly advantageous for preterm neonates with immature digestive systems. Khatony *et al*. (2019) agree with these findings and postulated that the prone position had the lowest GRV and the maximum potential to make formula digestion easier.

Regarding the correlation between study variables (Table 4), the study revealed a statistically significant positive association between the amount of feeding and the gastric residual volume, indicating that an increase in feeding volume is associated with an increase in GRV. This reflects a balance between the intake and the emptying capacity of the stomach. While this relationship is logical, it highlights the importance of carefully monitoring feeding volumes to avoid overfeeding, which could increase the risk of complications like feeding

intolerance or aspiration.

These findings align with Anwar et al. (2021), who reported a significant positive association between the feeding volume and GRV. Moreover, this finding aligns with the observations of Ahmed *et al*. (2019), demonstrating that the implementation of the GRV protocol enhanced nutrient delivery in critically ill patients, reduced hospital length of stay, and decreased mortality rates.

Limitation

Factors such as differences in feeding protocols, medication regimens, and underlying medical conditions may have influenced gastric residual volume, complicating the ability to attribute changes solely to positioning. Future studies should explore standardised approaches to minimise these variables, enabling a clearer understanding of role of positioning in improving feeding outcomes.

CONCLUSION

The findings of this study revealed that the prone position resulted in the lowest gastric residual volume, followed by the right lateral position and the supine position. These results align with and support the research hypothesis. Further exploration is needed to assess the effect of neonatal positioning on other gastrointestinal complications, including gastroesophageal reflux and feeding intolerance. The significance of this study lies in its potential to guide evidence-based positioning practices, ultimately improving feeding outcomes and reducing gastrointestinal complications in neonates.

Recommendation

The following recommendations are suggested based on the present study results:

Prone and right lateral positions should be integrated into daily practices as effective positions for reducing gastric residual volumes in preterm neonates following feeding. NICU nurses should enhance different positions of preterm neonates correctly after feeding for delivering optimal nutrition. Educational training programs and regular educational sessions for NICU nurses are essential to enhance their performance related to the appropriate positioning of preterm neonates after feeding. Further studies with a larger sample size are recommended to investigate the effect of different positions of preterm neonates on gastric residual volume (GRV) in the NICU.

Conflict of Interest

The authors declare that they have no competing interests.

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REFERENCES

Ahmed, S. H., El-Hakeem, A., Ezzat, E., Mohammed, M. A., & Khalaf, G. S. (2019). Effect of implementing gastric residual volume protocol on critically ill patient outcomes. *Assiut Scientific Nursing Journal, 7*(18), 170-179. https://dx.doi.org/10.21608/asnj.2019.291000

Algameel, A., Elhawary, M., Amin, S., & Abd Elmenem, M. (2020). Outcome of late preterm newborns in Upper Egypt. *Egyptian Pediatric Association Gazette, 68*, 1-11. https://doi.org/10.1186/s43054-020-00023-1

Altay, G., & Küçükoğlu, S. (2022). Effects of the facilitated tucking position in early period on physiological parameters, comfort and breastfeeding performance in late preterm infants: A randomized controlled trial. *Midwifery, 115*. https://doi.org/10.1016/j.midw.2022.103492

Anwar, N., Refaat, N., mohammed, F., mohammed, H. (2021). Effect of different positions on gastric residual volume of preterm neonates at neonatal intensive care unit. *Assiut Scientific Nursing Journal, 9*(26), 132-139. https://doi.org/10.21608/asnj.2021.88041.1216

Baldassarre, M. E., Panza, R., Cresi, F., Salvatori, G., Corvaglia, L., Aceti, A., ... & Italian Society of Paediatrics (SIP), Italian Society of Neonatology (SIN) and Italian Society of Paediatric Gastroenterology, Hepatology and Nutrition (SIGENP). (2022). Complementary feeding in preterm infants: a position paper by Italian neonatal, paediatric and paediatric gastroenterology joint societies. *Italian Journal of Pediatrics, 48*(1). https://doi.org/10.1186/s13052-022-01275-w

Elhusein, A. M., & Fadlalmola, H. A. (2024). The effects of different nursing positions during preterm infants feeding on gastric residual volume and emptying rate: a systematic review and network meta-analysis. *International Journal of Nursing Practice, 30*(6). https://doi.org/10.1111/ijn.13309

Gözen, D., Erkut, Z., Uslubaş, R., & Bilgin, L. (2022). Effect of different positions on gastric residuals in preterm infants initiating full enteral feeding. *Nutrition in Clinical Practice, 37*(4), 945-954. https://doi.org/10.1002/ncp.10789

Halemani, K., Issac, A., Dhiraaj, S., & Mishra, P. (2023). Efficacy of body position on gastric residual in preterm infant: a systematic review and meta-analysis. *Clinical and Experimental Pediatrics, 66*(6), 262–270. https://doi.org/10.3345/cep.2021.01508

Hussein, H. A. (2012). The difference between right side and semi recumbent positions after feeding on gastric residual volume among infants. Retrieved from: https://efaidnbmnnnibpcajpcglclefindmkaj/https://www.jofamericanscience.org/journals/am-sci/am0801/019_7656am0801_127_132.pdf. Accessed on 24th October, 2024.

Ifran, E. K. B., Hegar, B., Rohsiswatmo, R., Indriatmi, W., Yuniarti, T., Advani, N., ... & Vandenplas, Y. (2024). Feeding intolerance scoring system in very preterm and very low birth weight infants using clinical and ultrasound findings. *Frontiers in Pediatrics, 12*. https://doi.org/10.3389/fped.2024.1370361

Khasawneh, W., & Khriesat, W. (2020). Assessment and comparison of mortality and short-term outcomes among premature infants before and after 32-week gestation: A cross-sectional analysis. *Annals of Medicine and Surgery, 60*, 44-49. https://doi.org/10.1016/j.amsu.2020.10.017

Khatony, A., Abdi, A., Karimi, B., Aghaei, A., & Brojeni, H. S. (2019). The effects of position on gastric residual volume of premature infants in NICU. *Italian Journal of Pediatrics, 45*, 1-6. https://doi.org/10.1186/s13052-018-0591-9

Özgörü, H., Mutlu, B., & Erkut, Z. (2024). Effect of lying position on gastric residual volume in premature infants: A systematic review. *Nutrition in Clinical Practice, 39*(2), 295-310. https://doi.org/10.1002/ncp.11070

Sajadi, M., Akbari, M., Alinejad, S., & Khosravi, S. (2019). Comparison of Effect of Prone and Right Lateral Positions on Gastric Residual Volume in Preterm Newborns. *Iranian Journal of Neonatology, 10*(2). https://doi.org/10.22038/ijn.2019.34332.1501

Thoene, M., & Anderson-Berry, A. (2021). Early enteral feeding in preterm infants: a narrative review of the nutritional, metabolic, and developmental benefits. *Nutrients, 13*(7). https://doi.org/10.3390/nu13072289

Yayan, E. H., Kucukoglu, S., Dag, Y. S., & Karsavuran Boyraz, N. (2018). Does the post-feeding position affect gastric residue in preterm infants? *Breastfeeding Medicine, 13*(6), 438-443. https://doi.org/10.1089/bfm.2018.0028