Effect of Nesting and Swaddled Position on Behavioral Readiness and Feeding Progression of Preterm Neonates

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Abstract

***Background**: Nesting and swaddling are supportive, comfortable, and protective techniques that assist preterm neonates self-regulation, maximize their stability, preserve energy, improve growth, and promote neurobehavioral organization. **Objective**: This study aims to determine the effect of nesting and swaddled position on behavioral readiness and feeding progression of preterm neonates. **Subjects**: A quasi-experimental design was used to accomplish this study. A convenient sample of 80 preterm neonates was divided into two equal groups: the control group was subjected to hospital routine care, and the study group was subjected to nesting and swaddling positions in addition to hospital routine care. **Tools**: Three tools were used to assess necessary data. "Tool One: Characteristics and Clinical Data of Preterm Neonates Assessment Record". Tool two: "Feeding Behavioral Readiness Skills Assessment Record Prior to and During Feeding" Tool Three: "Preterm Neonates Feeding Progression Assessment Record". **Results**: Significant statistical differences were found in preterm neonates oral feeding behavioral readiness skills prior to and during feeding among both groups (P≤0.005). Moreover. There was also a statistical significant increase in mean body weight and the amount of milk consumed over the four weeks (p =0.001) for both groups. **Conclusion**: Preterm neonates supported by nesting and swaddling positions have better behavioral readiness and feeding progression than those who do not. **Recommendations**: Using the nesting and swaddling positions as regular forms of developmental care for all preterm neonates receiving care in NICUs. Educational programs are recommended in order to enhance the knowledge and practice of NICU nurses regarding developmental supportive positioning.*

Keywords: Nesting, Swaddled position, Feeding progression, Behavioral Readiness, Preterm Neonates.

Introduction

Prematurity is still the leading cause of death and illness among newborns in NICUs. (NICUs) worldwide. It is the second most substantial cause of death among newborns after congenital anomalies (Heron et al., 2010). It is worth mentioning that the burden of preterm birth death and illness rates are highest in poor and middle-income countries. Preterm birth complications are the main reason for death among children under 5 years of age, accountable for approximately 900,000 deaths in 2019. According to the World Health Organization, Iraq has 47% of the deaths, while Egypt has 20.6% of the deaths due to prematurity (Walani, 2020; World Health Organization [WHO] & Maternal and Child Epidemiology Estimation Group [MCEE], 2022; World Health Organization [WHO], 2023).

Preterm neonates have problems making the transition outside the womb, These include breathing and feeding (Stanford Medicine Children's Health, 2023). Prematurity most problems are caused by immature organs and systems. The risk of complications increases with the degree of prematurity. Several complications arise when a preterm neonates is born with

incomplete brain development, such as inconsistent breathing and difficulty coordinating feeding and breathing, because the mouth and throat being immature, so the ability to suck and swallow normally is compromised in premature neonates Balest, (2022); Stanford Medicine Children's Health (2023) The behavioral state is crucial to feeding efficiency of the neonates as well cranial and facial competence, ability to contract muscle, posture, general state, muscle tone, global flexion, and alertness. Thus, clinical factors like internal and external stability affect behavior and are considered determinants of the stability of suction harmony (Balest, 2022).

Developmental supportive care incorporates a variety of techniques that are mimic the conditions present in the womb as nesting and swaddling. Preterm neonates usually feel more secure and physiologically stable when they are supported by boundaries as they are in the womb. In addition, they gain comfort from being able to grasp their hands together, suck their fingers or hold onto bedding (Coughlin et al., 2010). Nesting and swaddling positions are feasible to meet some of the unique care needs of preterm neonates during long-term hospitalization. Placing preterm neonates in special positions can relieve pain, improve flexion and sleep, increases feeding tolerance and the amount of consumed milk, conserve energy and enhance weight gain (Yang, 2023)**.**

Neonatal intensive care nurses must be provided with the best evidences regarding the importance of applying nesting and swaddling techniques for preterm neonates in the NICUs as standard of developmentally supportive care. Neonatal intensive care nurses should use appropriate positioning through nesting and swaddling at NICU as a routine clinical practice (Ahmed & Mohammed, 2019). NICU nurses nest and swaddle preterm neonates throughout the day to minimize pressure sores and postural deformities (Santos et al., 2017).

Aims of the Study

This study aims to Determine the effect of nesting and swaddled position on behavioral readiness and feeding progression of preterm neonates.

Research hypotheses

- Preterm neonates who are supported by nesting and swaddled position exhibit organized behavioral readiness than those who do not.
- Preterm neonates who are supported by nesting and swaddled position exhibit more feeding progression than those who do not.

Materials and Method

Materials

Design: A quasi experimental research design was used to conduct this study.

Settings: This study was carried out in the NICU of Kirkuk Pediatric Hospital in Iraq. This unit provided care for preterm neonates regardless of general conditions and gestational age. The preterm unit includes 6 sections. Each section includes 4 beds and 4 incubators.

Subjects: A convenient sample of 80 preterm neonates whose gestational age < 37 weeks at birth, their birth weight was more than 1500 grams, and they were free from any congenital anomalies, especially those that interfere with feeding progression, neonatal sepsis, neurological problems, and congenital heart disease. They were randomly assigned in to two equal groups. Each group comprises 40 preterm neonates: the control group, who were subjected to hospital routine care, and the study group, who were subjected to nesting and swaddling positions in addition to hospital routine care.

Tools: Three data collection were used for necessary data:

Tool One: Characteristics and Clinical Data of Preterm Neonates Assessment Record:-

This tool is used to assess the characteristics and clinical data of preterm neonates.

Tool Two: Feeding Behavioral Readiness Skills Assessment Record:-

This tool was used to assess the neonate's early feeding behavioral readiness skills. It includes two parts.

Part I: - Oral Feeding Behavioral Readiness Skills Prior to Feeding:

Part II: Oral Feeding Behavioral Readiness Skills During Feeding :

It included: Preterm neonates ability to maintain engagement in feeding, organize oral-motor functioning, coordinate swallowing, and maintain physiologic stability.

Tool Three: Preterm Neonates Feeding Progression Assessment Record:-

This tool was used to assess preterm neonate's feeding progression. It includes amount of consumed milk during study weeks and weight of preterm neonates.

Method

The study was conducted: Before initiating the study, the Alexandria University Faculty of Nursing Research Ethics Committee approved it. An official letter from the Postgraduate Affairs Department Faculty of Nursing, University of Alexandria was sent to the previously mentioned setting to obtained an approval to conduct the study. Tools was developed by the researcher after thorough review of the recent and relevant literature (Thoyre et al., 2005; Williamson, 2013; Fujinaga et al., 2018). Tools was tested for their content validity by five experts in the Pediatric Nursing Field. Cronbach's Alpha (internal consistency) was used to assess tool reliability and results were satisfactory (0.87). Twenty preterm neonates were used in a pilot research to examine the instruments' feasibility, application, and clarity. The necessary modifications were done accordingly. Those preterm neonates were excluded from the total study subjects. Tool I was used to evaluate preterm infants characteristics at first contact. Oral feeding behavioral readiness of preterm neonates was assessed before feeding for both groups by using Tool II. For the control group: preterm neonates received routine care of NICU. For the study group: The researcher performed nesting swaddled positions with routine care of NICU for preterm neonates through four consecutive weeks as follows:

Nesting position was performed one hour before and after feeding at morning and evening shifts as follows: A hand towel nest was used to provide support for both sides of the neonates and form U shape under the buttocks. The nest was suitable for preterm neonates size not too loose nor too tight. Swaddled position was performed immediately before feeding at morning and evening shifts as follows: Preterm neonates were securely wrapped by soft, thin cotton blanket. The upper part of the blanket folded down in the shape of a diamond .The preterm neonates were placed in the supine position with maintaining intrauterine flexed position. The preterm neonate's head was cited above the folded edge of the blanket in a neutral position, and the body extended straight down towards the bottom corner. The lower limbs of the preterm neonate were kept flexed. The shoulders and hips were neutral. The preterm neonate's shoulder was aligned with the blanket's upper rim. The other part of the blanket folded into the backs of the preterm neonates.

The researcher assessed oral feeding behavioral readiness during feeding for four consecutive weeks in the morning and evening by using Tool II. Feeding progression in preterm neonates was assessed after feeding at the end of the first, second, third, and fourth weeks using Tool III. A comparison between two groups was done to evaluate the impact of nesting and swaddled

position on feeding progression and behavioral responses of preterm neonates.

Ethical Considerations

Parental written informed consent was obtained from preterm neonatal parents once the study purpose was explained. It is the parents' choice whether or not to enrolled their preterm neonates in the study. Preterm neonates were given privacy. The application process guarantees the privacy of data collected on preterm neonates.

Results

Table 1 clarifies characteristics and clinical data of preterm neonates. It is clear from the table that, 47.5% of preterm neonates among study group had 36 weeks of gestation compared to 40% of preterm neonates in the control group. Males constituted 52% of preterm neonates in the study group and 60% in the control group. The table also showed that 60% of preterm neonates were delivered by caesarean section in the study group and 62.5% in the control group. Furthermore 52.5% of preterm neonates in the study group had respiratory distress syndrome and 65% in the control group.

Table 2 demonstrates comparisons between the study and control groups regarding oral feeding behavioral readiness skills prior to feeding during the first and fourth weeks .There was no statistical significant difference regarding preterm neonates using a pacifier, rooting reflex, and respiration within the normal range (30–60) prior to feeding in the first week compared to the fourth week there was statistical significant where p 0.001* among both groups. Also, regarding preterm neonates ability to sucking and tongue descending there was no statistical significant difference in the first week, but in the fourth week there was statistical significant where p 0.003*.Furthermore, There was no statistical significant difference regarding preterm neonates ability to promote breathing in the normal range during the first week. But in the fourth week, there was statistical significant where p 0.001.* Moreover, there were statistical significant differences concerning oxygen saturation greater than 90% and heart rate rhythm for preterm neonates in both groups during the first and fourth weeks prior to feeding where p 0.001* .

Table 3 shows comparisons between the study and control groups regarding oral feeding behavioral readiness skills during feeding. Concerning the ability of preterm neonates to organize their oral-motor functioning. sucking duration and latching on there were no statistical significant differences among the study and control groups between the first weeks. In the fourth weeks, there were statistical significant differences among the study group and control group where p ≤0.007*, p ≤0.013* respectively.

Regarding preterm neonates ability to coordinate swallowing. There were no statistical significant differences among both groups between the first weeks, there was statistical significant differences among both groups where p <0.005* in the fourth week.

Respecting the preterm neonate's ability to maintain physiologic stability. There were statistical significant differences where p ≤ 0.001* regarding oxygen saturation, respiration rhythm, and heart rate rhythm within the normal range (110–160) in the first and fourth weeks. Moreover, there were no statistical significant differences in the first weeks regarding stop sucking to breath, stop respiration, and behavioral state cues, with statistical significant differences in the fourth week where p 0.001*.

Table 4 illustrates comparisons between study and control groups for preterm neonates feeding progression regarding weight. The table shows that the mean weight of preterm neonates among the study group by the first week was 2141.4±177.59, compared to 2025.25±177.4 among the control group. The mean weight of preterm neonates increases to 3080.0±302.7 among the study group compared to 2608.75±187.4 among the control group by the fourth week. There were statistical significant differences between the first and

fourth weeks among both groups where p <0.001.* The mean weekly weight progress for the study group was 312.87 ± 53.05 compared to 194.50 ± 20.37 among the control group. The difference in weight was statistical significant where p <0.001*.

Table 5 illustrates comparison between the study and control groups according to amount of consumed milk per day. It was revealed from the table that only 17.5% of preterm neonates had the amount ≤ 60 ml of milk among the study group compared to all preterm neonates had the amount ≤ 60 ml among the control group during the first weeks. By the fourth weeks none of preterm neonates had the amount ≤ 60 ml of milk among the study and control group. On the other hand, the table shows that all preterm neonates were unable to consume ≥ 150 ml of milk during the first week among the study and control groups. This percentage increased to 40% among the study group compared to 5% among the control group during the fourth week. It was found that there was a statistical significant difference regarding the amount of milk consumed for both groups in respect to the first and fourth weeks, where p <0.001*

Discussion

Positioning is vital for retaining a good position to the preterm neonate; it lets them feel more secure and aids in the development of midline abilities by encouraging flexibility of the limbs and trunk. Furthermore, it helps preterm neonates get comfort by holding hands and sucking fingers, preserving their energy, promoting their growth, and organizing neurobehavioral processes. Also, positioning reduces preterm neonates crying and suffering. It improved sleep and physiological stability (Warren, 2015). Therefore, it is crucial in the NICU to investigate the impact of nesting and swaddling posture on preterm neonates, the current study demonstrates that slightly less than half of preterm neonates were 36 weeks of gestation in the study and control group. These findings corroborate the fact that the coordination maturation between sucking, swallowing, and breathing usually occurs between 34 and 36 weeks. Therefore, assessment of oral behavioral readiness skills is essential to identify when it is safe to start feeding, also understand factors that are inherent to prematurity, such as adjusted age, weight, and signs of oral motor readiness among preterm neonates that can interfere with preterm neonate feeding performance (Brantes et al., 2021).

The findings of the current study demonstrates that slightly more than half of preterm neonates were male in the study group, while in the control group, they were estimated to be two-thirds of preterm neonates. These results are consistent with the announcement of the Ministry of Planning in Iraq in 2022, which mentioned that more than half of preterm neonates were males, based on the Central Statistical Organization's (Ministry of Planning, 2022). Moreover, caesarean delivery has been associated with preterm birth in multiple pregnancies due to assisted reproductive technologies conception. Twin pregnancies are also associated with increased mortality or morbidity, mainly related to prematurity (Wong et al., 2016). The current study reflected that two-thirds of the preterm neonates among both groups were born via caesarean section; this was in congruence with a study conducted by Tanigaki et al. (2020), which reported that planned caesarean section is recommended for low-birth weight twins and preterm delivery rather than singleton pregnancy. These findings corroborate the fact that most births in the current study were twin and triplet pregnancies among both groups.

The findings of study reflected that the superiority of preterm neonates oral behavioral cues improved prior to feeding in the study group compared to the control group. There was statistical significant differences by the fourth week among both groups. This result could be attributed to the fact that therapeutic positioning can have beneficial outcomes for preterm infants as they feel comfortable when sucking their fingers, develop coordination in

sucking patterns, swallow, and promote weight gain Yapicioglu et al. (2021). The appropriate growth of the upper airway structures, including as the lips, palate, jaw, tongue, pharynx, larynx, and esophagus, has also been demonstrated to be crucial for proper feeding coordination Elarousy et al. (2020). These oral behavioral cues involve the preterm neonates ability to physiologically maintain food interest, organize their oral motor functioning synchronization of breathing with suction and swallowing breathing, suction, and swallowing in unison, and maintain their physiological stability. This complicated process balances brain maturation with physiological and behavioural development (Brantes et al., 2021).

The findings in the present study reflected that the majority of preterm neonates respiration range, oxygen saturation, and heart rate rhythm improved prior to feeding in the study group compared to the control group. There was statistical significant differences by the fourth week among both groups. This finding is in line with the findings of Kaur et al. (2022); Thakur et al. (2022); Hassan et al. (2020) concluded that nesting stabilizes heart rate, breathing rate, and oxygen saturation and can be implemented as a useful measure, also, effective, safe, simple, and noninvasive method that can be helpful in stabilizing the cardiorespiratory status of preterm. Meanwhile, there were no statistical significant differences regarding respiratory rate or heart rate. Moreover, Smith et al. (2023) mentioned that preterm neonates show no difference in the frequency of bradycardia or oxygen desaturations.

According to the results of the current study, there was a dramatic improvement in the ability of preterm neonates to organize oral-motor functioning and coordinate swallowing in the study group compared to the control group. A significant statistical difference between the study and control groups regarding preterm neonates ability to latch on, sucking organizing, organizing swallows, and sucking consecutiveness was found by the fourth week during feeding. This can be explained by the fact that elevated rates of sucking, swallowing, bolus size, and suction amplitude which enhanced feeding performance, and neonatal outcomes Liu et al. (2013) Furthermore, the study result is compatible with the study conducted by Li et al. (2022); Astuti et al. (2022); Smith et al. (2023). summarized their results as follows: Oral motor intervention in regarded to supportive care positioning can greatly enhanced sucking, swallowing, and breathing coordination in preterm neonates with sucking and swallowing problems play a consequential role in improving the efficiency of feeding, regulate oral-motor functions; control sensory functions; maintain physiological stability; and regulate feeding behavior. These factors demonstrate factors that affect the development of preterm neonates oral feeding skills..

The results of the current study reflected that the majority of preterm neonates had the ability to maintain physiological stability such as oxygen saturation, heart rate, stopping sucking to breathe, respiratory rate, and behavioral state cues in the study group compared to half of them in the control group during feeding. Differences between the study and control groups were statistically significant in the fourth week. This finding is in harmony with Yapicioglu et al. (2021); Radwan and Mohammed (2019); Nikam et al. (2023), emphasized that positioning of preterm neonates affects oxygen saturation and comfort levels positively, also a positive effect on the physiological functioning and neurobehavioral organization of preterm neonates, it improve their behavioral organization. According to Smith et al. (2023), preterm neonates demonstrated no difference in frequency of bradycardia or oxygen desaturations, which is in contrast with the findings of the present study.

According to the results of the current study, the mean body weight of preterm neonates involved in the study group after nesting and swaddling showed statistical significant differences compared to the control group. These outcomes may be connected to the fact that nesting enhanced the neonate's oral

feeding readiness, physiologic stability, sucking pattern, sucking coordination, swallowing organization, breathing pattern, conserving energy, and minimizing weight loss. Mony et al. (2018); Elsheshtawy et al. (2022). The result is congruent with the study conducted by El-Nagger and Bayoumi (2016); Rohmah et al. (2020); emphasized that positioning has a positive effect on increasing weight gain at discharge and reducing the duration of hospital stay. Otherwise, the result is not compatible with the study conducted by Yapicioglu et al. (2021); Smith et al. (2023) concluded that waddling and nesting have no effect on either the rate of weight increase or the degree of feeding tolerance and it's outcomes.

Finally, the findings of the present study demonstrated that there was a statistical significant difference in the amount of consumed milk by preterm neonates among both groups during the fourth week; these results are consistent with Raczyńska and Gulczyńska (2019); emphasized that the swaddled position is safe in introducing oral feeding for preterm neonates and lowers the total number of chokings. The difference between the amount of consumed milk by preterm neonates before the end of the feeding and the amount of milk consumed during the feeding was statistical significant. This attributed to the fact that the development of oral motor skills for feeding in these preterm neonates depends on various aspects, namely the capacity to organize and coordinate their mouth processes to support efficient calorie consumption and enhance their growth (Brantes et al., 2021).

Conclusion

The present study concluded that preterm neonates who are supported by nesting and swaddled position exhibit organized behavioral readiness regarding their oral behavioral cues. Moreover they exhibit more feeding progression, weight gain and increases amount of consumed milk than those who do not.

Recommendations.

In order to improve the understanding and practice of NICU nurses regarding developmental supportive positioning, educational programs are recommended. Possible areas of focus for future studies emphasizing on the difference between the effect of nesting and the effect of swaddling on behavioral readiness and feeding progression. Place a strong emphasis on the significance of using the nesting and swaddling positions for all preterm neonates that are being cared for in NICUs as a regular form of developmental care.

Table (1): Characteristics and Clinical Data of Preterm Neonate

Characteristics and clinical data of preterm neonates assessment record	Study (n = 40)		Control (n = 40)		χ^2	P
Age /weeks	**No.**	**%**	**No.**	**%**		
- **34**	6	15.0	6	15.0	0.530	0.767
- **35**	15	37.5	18	45.0		
- **36**	19	47.5	16	40.0		
Sex	**No.**	**%**	**No.**	**%**		
- **Male**	21	52.5	24	60.0	0.457	0.499
- **Female**	19	47.5	16	40.0		
Method of delivery	**No.**	**%**	**No.**	**%**		
- **Spontaneous vaginal**	16	40.0	15	37.5	0.053	0.818
- **Caesarean section**	24	60.0	25	62.5		
Complications during delivery	**No.**	**%**	**No.**	**%**		
- **Respiratory distress syndrome**	21	52.5	26	65.0	2.452	^{MC}p= 0.331
- **Jaundice requiring phototherapy**	17	42.5	14	35.0		
- **Others**	2	5.0	0	0.0		

Table (2): Comparison Between Study and Control Groups Regarding Oral Feeding Behavioral Readiness Skills Prior to Feeding

Feeding Behavioral Readiness Skills Prior to Feeding	First week				$\chi 2$ (p1)	Fourth week				χ^2 (p_4)
	study (n = 40)		Control (n = 40)			study (n = 40)		Control (n = 40		
	No.	%	No.	%		No.	%	No.	%	
Able to hold body in flexion position.	13	32.5	12	30	0.000 (1.000)	40	100.0	40	100.0	–
Oral behavioral cues										
- **Searches for nipple or opens mouth**	0	0.0	0	0.0	–	40	100.0	37	92.5	3.117 (^{FE}p=0.241)
- **Pacifier use**	0	0.0	0	0.0	–	40	100.0	36	67.5	15.522* (<0.001*)
- **Rooting**	0	0.0	0	0.0	–	40	100.0	24	60.0	20.000* (<0.001*)
- **Sucking**	0	0.0	0	0.0	–	35	87.5	23	57.5	9.028* (0.003*)
- **Tongue descending**	0	0.0	0	0.0	–	35	87.5	23	57.5	9.028* (0.003*)
Respiration within 30- 60 breaths/minute	0	0.0	0	0.0	–	39	97.5	34	85.0	23.226* (<0.001*)
Heart rate rhythm within the normal range `110-160	18	45.0	12	30.0	23.226* (<0.001*)	40	100.0	23	57.5	21.587* (<0.001*)
Oxygen saturation greater than 90 %	13	32.5	0	0.0	15.522* (<0.001*)	40	100.0	27	67.5	15.522* (<0.001*)

χ^2: **Chi square test** FE**: Fisher Exact** *: Statistical significant at $p \leq 0.05$ p_1: p value for comparing between the studied groups in **first** week p_4: p value for comparing between the studied groups in **Fourth** week

Table (3): Comparison Between The Study and Control Groups Regarding Oral Feeding Behavioral Readiness Skills During Feeding

Oral Feeding Behavioral Readiness Skills	First week				χ^2 (p_1)	Fourth week				χ^2 (p_4)
	Study (n = 40)		Control (n = 40)			Study (n = 40)		Control (n = 40)		
B) Ability to Organize Oral-Motor Functioning	No.	%	No.	%		No.	%	No.	%	
- **Rooting**	21	52.5	18	45.0	0.450 (0.502)	40	100.0	40	100.0	–
- **Mouth opening at feeding onsets.**	17	42.5	16	40.0	0.052 (0.820)	40	100.0	38	95.0	2.051 (^{FE}p=0.494)
- **Tongue descending to receive the nipple at feeding onsets.**	2	5.0	0	0.0	2.051 (^{FE}p=0.494)	40	100.0	36	90.0	4.211 (^{FE}p=0.116)
- **Areolar grasp (how much of the breast was inside the baby's mouth**	2	5.0	0	0.0	2.051 (FEp=0.494)	32	80.0	24	60.0	3.810 (0.051)
- **Latched on and fixed to the breast**	2	5.0	0	0.0	2.051 (FEp=0.494)	28	70.0	16	40.0	7.273*(0.007*)
- **Sucking organizing**	2	5.0	0	0.0	2.051 (FEp=0.494)	30	75.0	22	55.0	3.516(0.061)
- **Sucking duration**	0	0.0	0	0.0	–	23	57.5	12	30.0	6.146*(0.013*)
C) Ability to Coordinate Swallowing										
- **Drooling.**	0	0.0	0	0.0	–	40	100	40	100	–
- **Pharyngeal sounds**	0	0.0	0	0.0	–	25	62.5	20	50.0	1.270 (0.260)
- **Organization swallows**	0	0.0	0	0.0	–	35	87.5	24	60.0	7.813* (0.005*)

D) Ability to Maintain Physiologic Stability										
- **Oxygen saturation stability**	13	32.5	2	5.0	9.928* (0.002*)	40	100.0	34	85.0	6.486* (^{FE}p=0.026*)
- **Heart rate rhythm within the normal range `110-160**	19	47.5	0	0.0	24.918* (<0.001*)	40	100.0	35	87.5	5.333 (^{FE}p=0.055)
- **Stops sucking to breathe.**	0	0.0	0	0.0	–	34	85.0	20	50.0	11.168* (0.001*)
- **Stopping respiration**	0	0.0	0	0.0	–	34	85.0	20	50.0	11.168* (0.001*)
- **Behavioral state cues**	0	0.0	0	0.0	–	36	90.0	20	50.0	15.238* (<0.001*)
- **Respiration rhythm**	18	45.0	0	0.0	23.226* (<0.001*)	28	70.0	21	52.5	6.146* (0.013*)

Table (4): Comparison Between Study and Control Groups for Preterm Neonates Feeding Progression Regarding Weight

Weight	First week			Fourth week		t (p_4)
	Study (n = 40)	Control (n = 40)	t (p_1)	Study (n = 40)	Control (n = 40)	
Mean ± SD.	2141.4±177.59	2025.25±177.4	2.926* 0.004*	3080.0±302.7	2608.75±187.4	8.371* <0.001*
Increase in weight (g/ week)	Study (n = 40)		Control (n = 40)			
Mean ± SD.	312.87 ± 53.05		194.50 ± 20.37			13.174 (<0.001*)

t: Student t-test p: p value for comparing between the studied groups*: Statistical significant at $p \leq 0.05$

Table (5): Comparison Between The Study and Control Groups According to Amount of Consumed Milk Per Day

Amount of consumed milk / Day	First week				χ^2 ($^{MC}p_1$)	Fourth week				χ^2 ($^{MC}p_4$)
	Study (n = 40)		Control (n = 40)			Study (n = 40)		Control (n = 40)		
	No.	%	No.	%		No.	%	No.	%	
≥ 60 ml -	7	17.5	40	100.0	56.170* (<0.001*)	0	0.0	0	0.0	34.489* (<0.001*)
90 ml -	33	82.5	0	0.0		0	0.0	22	55.0	
110 ml -	0	0.0	0	0.0		24	60.0	16	40.0	
≤150ml	0	0.0	0	0.0		16	40.0	2	5.0	

χ^2: **Chi square test** MC: **Monte Carlo**
p_1: p value for comparing between the studied groups in **first** week
p_4: p value for comparing between the studied groups in **Fourth** week
*: Statistical significant at $p \leq 0.05$

References

- Ahmed, G. E., & Mohammed, B. A. (2019). Effect of implementing learning package of nesting and swaddling for premature infants on nurses' knowledge and performance in NICU. *American Journal of Nursing Research*, *7*(4), 428-436. https://doi.org/10.12691/ajnr-7-4-4.
- Astuti, D. D., Rustina, Y., & Wanda, D. (2022). Oral feeding skills in premature infants: A concept analysis. *Belitung Nursing Journal*, *8*(4), 280-286.
- Balest, A. L. (2022). Preterm (Premature) Newborns. Merck & Co., Inc. Avilable from: https://www.msdmanuals.com/home/children-s-health-issues/general-problems-in-newborns/preterm-premature-newborns. [Accessed in: Apr, 2023]

- Brantes, A. L. G., dos Santos Curado, M. A., & Cruz, I. R. (2021). Feeding methods in promoting the oral motor skills of the preterm newborn: A scoping review. *Enfermería Global*, *20*(1), 521-535. https://doi.org/10.6018/eglobal.410411.
- Coughlin, M., Lohman, M. B., & Gibbins, S. (2010). Reliability and effectiveness of an infant positioning assessment tool to standardize developmentally supportive positioning practices in the Neonatal Intensive Care Unit. *Newborn and Infant Nursing Reviews, 10*(2), 104-106. https://doi.org/10.1053/j.nainr.2010.03.003.
- El-Nagger, N., & Bayoumi, O. R. (2016). Effect of applying nesting technique as a developmental care on physiological functioning and neurobehavioral organization of premature infants. *Life Science Journal, 13*, 79-92. https://doi.org/10.7537/marslsj1301s1609.
- Elarousy, W., Khamis, G., & Rashwan, I. (2020). Effect of sensory-motor interventions on feeding outcomes and weight-gain among preterm neonates after weaning from noninvasive mechanical ventilation. *International Journal of Novel Research in Healthcare and Nursing, 7*(1), 702-716.
- Elsheshtawy, O. R., Arafa, N. M., & Khamis, G. M. (2022). Effect of wee care on physical growth and behavioral responses of preterm neonates. *Port Said Scientific Journal of Nursing, 9*(2), 154-180. https://doi.org/10.21608/PSSJN.2022.94134.1145.
- Fujinaga, C. I., Maltauro, S., Stadler, S. T., Cheffer, E. R., Aguiar, S., Amorin, N. E. Z., & Salla, C. M. (2018). Behavioral state and the premature's readiness performance to begin oral feeding. *Revista CEFAC, 20*, 95-100. https://doi.org/10.1590/1982-021620182015317.
- Hassan, A., Mohamed, F., & Mohamed, N. (2020). Effect of different body positions on cardiorespiratory parameters of preterm neonates undergoing mechanical ventilation. *American Journal of Nursing Research, 8*(4), 463-470. https://doi.org/10.12691/ajnr-8-4-6.
- Heron, M., Sutton, P. D., Xu, J., Ventura, S. J., Strobino, D. M., & Guyer, B. (2010). Annual summary of vital statistics: 2007. *Pediatrics, 125*(1), 4-15. https://doi.org/10.1542/peds.2009-2416.
- Kaur, K., Selvi, A. M., & Thomas, S. (2022). An experimental study to assess the effectiveness of nesting on physiological parameters and posture of preterm babies in a selected hospital, New Delhi. *Indian Journal of Public Health Research & Development, 13*(2), 64-71. https://doi.org/10.37506/ijphrd.v13i2.17894.
- Li, L., Liu, L., Chen, F., & Huang, L. (2022). Clinical effects of oral motor intervention combined with non-nutritive sucking on oral feeding in preterm infants with dysphagia. *Jornal de Pediatria, 98*(6), 635-640. https://doi.org/10.1016/j.jped.2022.02.005.
- Liu, Y. L., Chen, Y. L., Cheng, I., Lin, M. I., Jow, G. M., & Mu, S. C. (2013). Early oral-motor management on feeding performance in premature neonates. *Journal of the Formosan Medical Association, 112*(3), 161-164. https://doi.org/10.1016/j.jfma.2012.08.003.
- Ministry of Planning. (2022). *Central Statistical Organization, status of the population of Iraq*. Available from: https://pukmedia.com/EN/Details/71092. [Accessed in: Apr, 2023].
- Mony, K., Selvam, V., Diwakar, R., & Raghavan, R. (2018). Effect of nesting on sleep pattern among preterm infants admitted in NICU. *Biomedical Research (India), 29*(10), 1994-1997. https://doi.org/10.4066/biomedicalresearch.29-18-326.
- Nikam, P. N., Naregal, P. M., Mohite, V. R., & Karale, R. B. (2023). Efficacy of nesting on physiological parameters among preterm babies admitted at tertiary care hospital Karad. *Journal of Datta Meghe Institute of Medical Sciences University, 18*(2), 181-184. https://doi.org/10.4103/jdmimsu.jdmimsu_622_22.
- Raczyńska, A., & Gulczyńska, E. (2019). The impact of positioning on bottle-feeding in preterm infants (≤ 34 GA). A comparative

study of the semi-elevated and the side-lying position - a pilot study. *Developmental Period Medicine*, *23*(2), 117-124. https://doi.org/10.34763/devperiodmed.20192302.117124.

- Radwan, R. I. M., & Mohammed, A. (2019). Effect of nesting position on behavioral organization among preterm neonates. *International Journal of Novel Research in Healthcare and Nursing*, *6*(3), 803-818. https://doi.org/10.21608/EJHC.2022.228203.
- Rohmah, M., Saputri, N., & Bahari, J. (2020). Effectiveness of use of nesting on body weight, oxygen saturation stability, and breath frequency in prematures in NICU room Gambiran Hospital Kediri City. *STRADA Jurnal Ilmiah Kesehatan*, *9*(1), 119-128. https://doi.org/10.30994/sjik.v9i1.275
- Santos, A. M. G., Viera, C. S., Bertolini, G. R. F., Osaku, E. F., Costa, C. R. L., & Grebinski, A. T. K. (2017). Physiological and behavioural effects of preterm infant positioning in a neonatal intensive care unit. *British Journal of Midwifery*, *25*(10), 647-654. https://doi.org/10.12968/bjom.2017.25.10.647.
- Smith, A. P., Sweeney, J. K., Ross, E. S., & Blackburn, S. (2023). Effects of swaddling during bottle feeding in preterm infants. *Advances in Neonatal Care*, *23*(2), 182-191. https://doi.org/10.1097/anc.0000000000001042.
- Stanford Medicine Children's Health. (2023). *The Neonatal Intensive Care Unit (NICU)*. Available from: https://www.stanfordchildrens.org/en/topic/default?id=the-neonatal-intensive-care-unit-nicu-90-P02389. [Accessed in: Jun, 2023]
- Tanigaki, S., Takemori, S., Osaka, M., Watanabe, M., Kitamura, A., Ueyama, S., Tanaka, K., Matsushima, M., & Kobayashi, Y. (2020). Caesarean section of multifetal pregnancy. *Surgery Journal*, *6*(Suppl 2), S92-S97. https://doi.org/10.1055/s-0040-1712924.
- Thakur, S., Nandan, L., & Devi, T. K. (2022). An experimental pragmatic observational study to evaluate the efficacy of nesting on posture and physiological parameters among premature neonates in Tertiary Care Neonatal Intensive Care Unit, Delhi/NCR. *International Journal of Pediatric Nursing*, *8*(2), 1-5.
- Thoyre, S. M., Shaker, C. S., & Pridham, K. F. (2005). The early feeding skills assessment for preterm infants. *Neonatal Network*, *24*(3), 7-16. https://doi.org/10.1891/0730-0832.24.3.7.
- Walani, S. R. (2020). Global burden of preterm birth. *International Journal of Gynecology & Obstetrics*, *150*(1), 31-33. https://doi.org/10.1002/ijgo.13195.
- Warren, I. (2015). The nursery environment. In I. Warren & C. Bond (Eds.), *Guide to infant development in the newborn nursery* (7th ed p.p. 170-225). Winnacot Baby Unit.
- Williamson, L. R. (2013). *Early feeding skills assessment in preterm infants* [Master Thesis]. University of Kansas.
- Wong, L. F., Wilkes, J., Korgenski, K., Varner, M. W., & Manuck, T. A. (2016). Risk factors associated with preterm birth after a prior term delivery. *British Journal of Obstetrics and Gynaecology*, *123*(11), 1772-1778. https://doi.org/10.1111/1471-0528.13683.
- World Health Organization [WHO]. (2023). *Preterm birth, WHO fact sheet on preterm birth*. WHO.
- World Health Organization [WHO], & Maternal and Child Epidemiology Estimation Group [MCEE]. (2022). *Leading causes of neonatal deaths in Iraq (2019)*. WHO/MCEE.
- Yang, L., Fu, H., & Zhang, L. (2023). A systematic review of improved positions and supporting devices for premature infants in the NICU. Heliyon, 9, e14388. https://doi.org/10.1016/j.heliyon.2023.e14388.
- Yapicioglu, H., Barutcu, A., Gülcü, Ü., Özlü, F., & Leventeli, M. (2021). Effect of supportive positioning on COMFORT scale scores in preterm newborns. *Duzce Medical Journal*, *23*, 20-24. https://doi.org/10.18678/dtfd.833534.