OPEN ACCESS

GAVIN PUBLISHERS

International Journal of Nursing and Health Care Research

Maher G and Elarousy W. Int J Nurs Res Health Care: IJNHR-114.

DOI: 10.29011/ IJNHR-114.100014

Research Article

Effect of Nested and Swaddled Prone Positioning on Sleep and Physiological Parameters of Low Birth Weight Neonates

Gehan Maher, Wafaa Elarousy*

Department of Pediatric Nursing, Faculty of Nursing, Alexandria University, Egypt

***Corresponding author:** Wafaa Elarousy, Assistant Professor in Pediatric Nursing, Faculty of Nursing, Alexandria University, Egypt. Tel: +20233372704; Email: wafaaelarousy@hotmail.com

Citation: Maher G, Elarousy W (2018) Effect of Nested and Swaddled Prone Positioning on Sleep and Physiological Parameters of Low Birth Weight Neonates. Int J Nurs Res Health Care: IJNHR-114. DOI: 10.29011/ IJNHR-114.100014

Received Date: 15 May, 2018; **Accepted Date:** 26 June, 2018; **Published Date:** 02 July, 2018

Abstract

Nesting position is a comfort measure that simulates in-utero feeling of lack of space by providing a "Nest" with a rolled blanket. Nesting facilitates deep peaceful sleep pattern, the flexed posture reduces the surface area exposed to the environment, minimizing heat loss [1].

Aim: The aim of the study is to determine the effect of nested and swaddled prone positioning on sleep and physiological parameters of low birth weight neonates.

Design: Experimental design was used in the study.

Setting: This study was conducted at the Neonatal Intensive Care Unit of Maternity University Hospital at El-Shatby in Alexandria.

Methods: Convenient sampling for 60 low birth weight neonates was used to recruit the neonates, randomly allocating the first neonate either to control or experimental group. Then, the others low birth weight neonates of each group were chosen alternatively. Thirty neonates were received nested and swaddled prone positioning (study group) and other 30 neonates were received prone position only (control group). Neonates' physiological parameters and sleep state using sleep state assessment observational checklist were assessed for all neonates in both groups.

Results: The mean neonates' heart rate was 143.40 ± 14.95 after nesting compared with 157.57 ± 15.88 for neonates of control group and the differences were statistically significant. Furthermore, the mean Oxygen saturation of neonates in study group was higher than in the control group (97.43 ± 1.47, 95.63 ± 0.76 respectively) and the differences were statistically significant. In addition, it was found that 43.3% of neonates of study group and 10% of neonates in control group were in deep sleep and the differences between both groups were statistically significant.

Conclusion: It can be concluded that nested and swaddled position improve sleep and heart rate stability compared to prone position alone among the neonates of low birth weight.

Keywords: Heart Rate; Low Birth Weight Neonates; Nesting Position; Prone Position; Sleep

Background

Low Birth Weight (LBW) continues to be a significant public health problem globally and is associated with a range of both short and long-term consequences. Low birth weight is defined by the World Health Organization (WHO) as weight at birth less than 2500 g [2]. Low birth weight includes preterm neonates, small for gestational age neonates at term [3]. Worldwide, it is estimated that 15% to 20% of all births are LBW, representing more than 20 million births a year. The great majority of LBW births occur in low and middle-income countries [2]. Low birth weight is not only a major predictor of prenatal mortality and morbidity, but recent studies have found that low birth weight also increases the risk for non-communicable diseases such as diabetes and cardiovascular disease later in life [2].

As a result of the developments in medical technology, the survival rate of premature and low birth weight infants has been markedly improved, but the risk for later poor developmental outcomes remains. Nursing and medical researchers have raised the public's awareness of the extreme physiological and neurobehavioral stress experienced by premature infants [4]. There is a need to have a synthesis of "Art and Science" of neonatal care in order to provide holistic care to newborn babies. neonates should be handled gently. Improper handling may lead to hypoxemia and sudden elevation of blood pressure with risk of development of intra-ventricular hemorrhage [1]. Although it's impossible to achieve in-utero comfort levels and cushioning, all efforts should be made to provide babies with, as comfortable positioning as [1].

Nesting position is a comfort measure that simulates in-utero feeling of lack of space by providing a *"Nest"* with a rolled blanket. Nesting facilitates deep peaceful sleep pattern, thus conserving energy (may be lost in crying) and minimizing weight loss. In addition, the flexed posture reduces the surface area exposed to the environment, minimizing heat loss which also minimize weight loss [1]. Nesting is effective in improving the posture of low birth weight infants as it promotes a flexed posture of the limbs with adduction of shoulders as well as reduces the discomfort [4,5,6,7]. Findings of a true experimental study by Poulose, Babu and Rastogi [4] revealed that low birth weight infants in experimental group experienced stable physiological parameters in terms of heart rate and respiration during the stay in Neonatal Intensive Care Unit (NICU). In addition, Comaru found that all neonates displayed increased distress and pain scores during diaper change and these were significantly less for neonates nested compared with non-nested neonates. Furthermore, a study done by Kihara & Nakamura [8] revealed that, a prone position with nested and swaddled position might lead to stability of heart rate and facilitate sleep in very low birth weight neonates compared to prone positioning alone. Swaddling is also associated with decreased stress and improved self-regulation during handling [6,9].

Significance of the Study

Nurses are central in NICU efforts to improve quality of care. Comforting interventions in the field of nursing care of neonates are very important. Neonatal intensive care nurse should be equipped with the recent evidences in newborn care and should be alert to provide developmental care in an NICU setting. Sleep is essential to brain development and neurosensory maturation in infants. Sleep in the NICU is critical to ensuring vulnerable infants receive the best care possible [10]. The importance of improving sleep in LBW newborn is to ensure that nursing care focuses on prevention of stress in the infant to conserve energy and avoid physiologic alterations. Nurse administrators should provide and recommend the interventions like nesting in the setting like NICU of the hospital [4]. More researches are needed regarding positioning of preterm neonates for optimal developmental outcomes. This body of existing researches serve as a good starting point to furthering the knowledge base, allowing new studies to fill in knowledge gaps, and increase outcomes of preterm infant development [11]. So, the current study aimed to determine the effect of nested and swaddled prone positioning on sleep and physiological parameters of low birth weight neonates.

Aim of the Study

This study aims to determine the effect of nested and swaddled prone positioning on sleep and physiological parameters of low birth weight neonates.

Research Hypothesis

- Low birth weight neonates who receive nested and swaddled prone positioning exhibit better sleep state than those who do not.
- Low birth weight neonates who receive nested and swaddled prone positioning exhibit better physiological parameters than those who do not.

Materials and Method

Materials

Research Design: A quasi experimental design was used to accomplish the study.

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

Subjects: A convenient sample of 60 low birth weight neonates who fulfill the following criteria comprised the study subjects:

- Low birth weight neonates.
- Homodynamic and physiological stable with no apnea or bradycardia.
- Initially, the first low birth weight neonate was randomly assigned into either study or control groups. Then, the others low birth weight neonates of each group were chosen alternatively.
- Thirty neonates were received nested and swaddled prone positioning **(study group)** and other 30 neonates were received

prone position only without support as routine NICU care **(control group)**.

- Epi-info program was used to estimate the sample size using the following parameters: Population size: 110 neonates, expected frequency: 50%, acceptable error: 10%, confidence coefficient:95% so, the minimal sample size; 51 neonates.

Tools: Two Tools Were Used to Collect the Necessary Data

The tools for data collection were developed by the researcher after thorough review of related literature. They comprised the following:

Tool I: Characteristics of the Low Birth Weight Neonates: This tool was developed to assess low birth weight neonates' characteristics and physiological parameters. It included the following:

Part I: Characteristics of Low Birth Weight Neonates: such as age, sex, weight, gestational age, type of delivery, method of feeding either oral or NGT and diagnosis on admission.

Part I: Physiological Parameters of Low Birth Weight Neonates: such as heart rate, oxygen saturation and respiratory rate.

- **Tool II: Low Birth Weight Neonates' Sleep State Assessment Observational Checklist:** It was developed by the researcher guided by Brazelton and Nugent's index (1995) to assess sleep state of neonates. Sleep states of low birth weight neonates were categorized as the following:
- **State 1: Deep sleep** (eyes closed, no eye movements, regular breathing and no spontaneous movements).
- **Sate 2: Light sleep** (eye closed, eye movements, irregular breathing, and slight spontaneous movements).
- **Sate 3: Slumber** with eyes opened or closed (heavy eyes), eye movements, irregular breathing, and sporadic spontaneous movements.
- **State 4: Arousal** with eyes opened (eyes with alacrity), and slight spontaneous movement.
- **State 5: Excitemen**t with brief periods of being cranky and active spontaneous movement.
- **State 6: Crying** with violent intense crying and active spontaneous movement.

Method

- An official approval for conducting the study was obtained from faculty of nursing and hospital administrative personnel after explaining the aim of the study to collect the necessary data.
- Tools of the study were developed after thorough review of the related literature.
- Content validity of the tools was done by five experts in the pediatric nursing field and recommended changes were done.
- A pilot study was carried out on 6 neonates to test the applicability of the tools. Those neonates were excluded from the study.
- Subjects were assigned into two groups. Study group was received nested and swaddled prone positioning and control group was received prone position only as routine NICU care.
- Characteristics of each neonate among both groups were assessed using tool I.
- Neonates' physiological parameters were assessed before and after one hour of nesting position for study group and prone position for control group using tool (I) for the both groups.
- Low birth weight neonates' sleep states were assessed after one hour of nesting position for study group and prone position for control group using tool (II).
- Nested and swaddled prone positioning was done for 1 hour as follows:

-The neonates were placed in the prone position and support head in the midline.

-Shoulders of the neonates were aligned and assisted with support to attain a flexed position towards the chest.

- The elbow, shoulder and hip joint of the neonates were kept in flexion position.

- The knee of the neonates tucked under the abdomen.

-The knees of the neonates should be slightly higher than the abdomen.

- A nest was created by a hand towel to support both sides of the neonates and forming U shape under the buttocks.

- The neonates of the control group were received prone position only as routine care of the NICU.
- Comparison between two groups was done to evaluate the effect of nested and swaddled prone positioning on sleep and physiological parameters of low birth weight neonates.
- Steps and conceptual framework of the study is presented in figure 1.

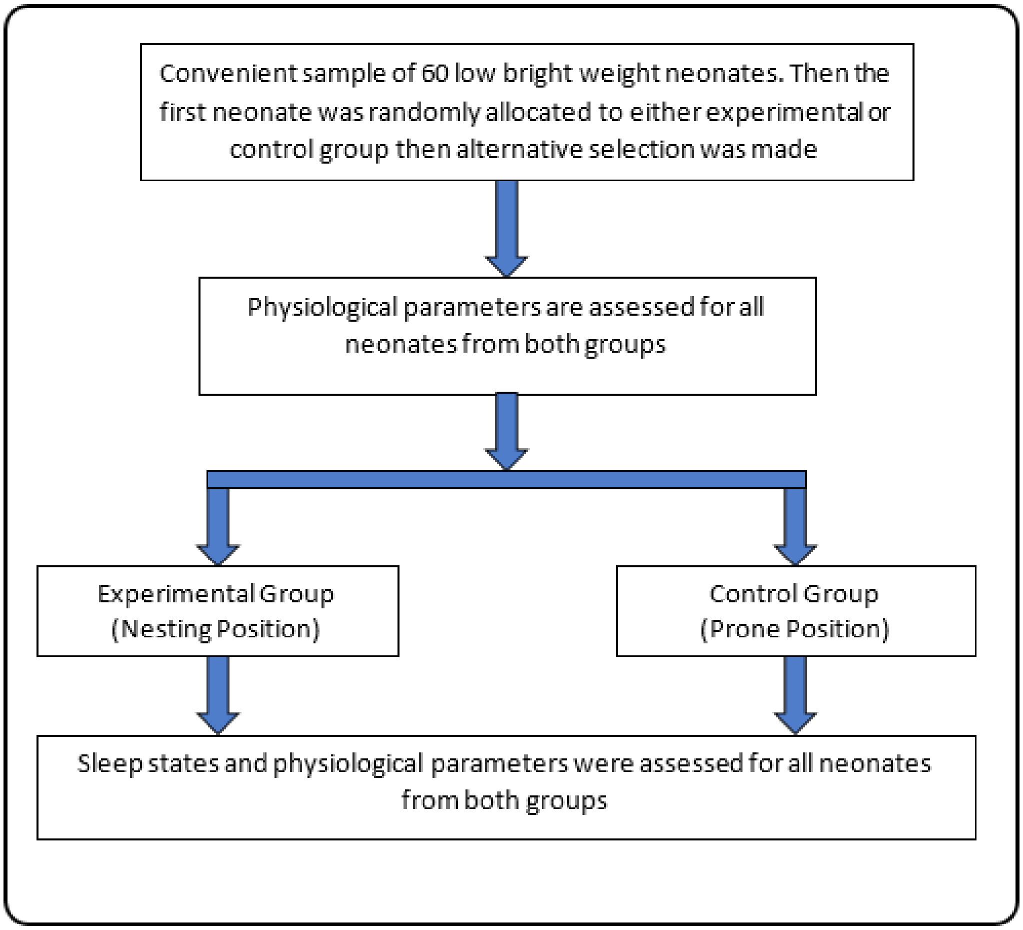

Figure 1: Conceptual framework of the study.

Ethical considerations were considered all over the study phases as following:

- Written consent of neonates' parent was obtained after explaining the aim of the study.
- Parent were ascertained about confidentiality of their neonates' data.

Results

Table 1 presents the sociodemographic characteristics of the neonates of the study and control groups. The current study included 60 neonates; 30 neonates for study group and 30 neonates for experimental group. Their age ranged from 1day to 28 days with mean age of 10.40 ± 7.73 days for neonates of the study group and ranged from 2 days to 28 days with mean age of 9.57 ± 8.78 days for neonates of the control group. Their birth weight ranged from 1300 gm to 2400 gm for all neonates in both groups with mean birth weight of 1900 ± 340.39 gm for neonates of the study group and 1880 ± 396.88 gm for neonates of the control group. As regards the gestational age of neonates of both groups, 56.7% of neonates of study group and 53.3% of neonates of control group were premature, while 40% and 33.3% of neonates of study and control groups respectively were term. More than half (53.3%) of neonates of the study group compared with two third (66.7%) of neonates of the control group were delivered by cesarean section. Respiratory distress syndrome was the admission diagnosis of 40% of neonates among both groups. About half of neonates either in the study group or in the control group received gavage feeding (56.7% and 53.3% respectively), while 20% of neonates of the study group compared with 33.3% of neonates of the control group received Total Parental Nutrition (TPN). The differences between both groups regarding sociodemographic characteristics were not statistically significant which means homogeneity of neonates between both groups.

	Study (n=30)		Control (n=30)		Test of sig.	p
	No.	%	No.	%		
Sex						
Male	16	53.3	15	50.0	χ^2= 0.067	0.796
Female	14	46.7	15	50.0		
Age (days)						
Min. – Max.	1.0 – 28.0		2.0 – 28.0		t=0.390	0.698
Mean ± SD.	10.40 ± 7.73		9.57 ± 8.78			
Birth weight (gm)						
Min. - Max.	1300.0 – 2400.0		1300.0 – 2400.0		t=0.210	0.835
Mean ± SD.	1900.0 ± 340.39		1880.0 ± 396.88			
Gestational age						
Pre-term	17	56.7	16	53.3	χ^2= 1.885	^{MC}p= 0.463
Term	12	40.0	10	33.3		
Post term	1	3.3	4	13.3		
Type of delivery						
Normal delivery	14	46.7	10	33.3	χ^2= 1.111	0.292
Cesarean section	16	53.3	20	66.7		
Diagnosis on admission						
RDS	12	40.0	12	40.0	χ^2= 7.632	^{MC}p= 0.051
Congenital pneumonia	11	36.7	6	20.0		
RDS and congenital	0	0.0	6	20.0		
Others	7	23.3	6	20.0		
Method of feeding						
Oral	7	23.3	4	13.3	χ^2= 1.848	0.397
Gavage	17	56.7	16	53.3		
TPN	6	20.0	10	33.3		

^{2}, p: ^{2} and p values for Chi square test for comparing between the two groups
^{MC}p: p value for Monte Carlo for Chi square test for comparing between the two groups
t, p: t and p values for Student t-test for comparing between the two groups

Table 1: Sociodemographic Characteristics of the Neonates of the Study and Control Groups.

Physiological parameters of neonates in both groups were presented in table 2. The mean neonates' heart rates were 143.40 ± 14.95 after nesting compared with 157.57 ± 15.88 for neonates of control group and the differences were statistically significant. In addition, heart rates of the neonates of control group were increased after "Prone Position" (157.57 ± 15.88 and 153.0 ± 16.79 respectively). Furthermore, the mean Oxygen saturations after nesting were higher than before nesting for neonates in the study group (97.43 ± 1.473 and 94.37 ± 2.34 respectively) and the differences were statistically significant. In addition, the mean Oxygen saturations of neonates of the study group was higher than the mean Oxygen saturations of the neonates of the control group and the differences were statistically significant. Regarding the respiratory rates before and after nesting for the neonates of the study group and before and after prone position for neonates of the control group, it was found that the mean respiratory rates of the neonates of the study group after nesting decreased than before (40.13 ± 5.68 and 43.90 ± 9.41respectively) and the differences were statistically significant. On the other hand, the mean respiratory rates of the neonates of the control group increased (48.83 ± 10.06 after and 47.17 ± 8.77 before). In addition, the mean respiratory rates of neonates in study group was lower than of control group and the differences were statistically significant.

	Physiological parameters	Study group (n=30) (Nesting)	Control group (n=30) (Prone)	t	p
Heart rate	**Before**				
	Min. – Max.	90.0 – 177.0	100.0 – 177.0	1.168	0.248
	Mean ± SD.	146.93 ± 22.98	153.0 ± 16.79		
	After				
	Min. – Max.	100.0 – 164.0	120.0 – 188.0	3.557*	0.001*
	Mean ± SD.	143.40 ± 14.95	157.57 ± 15.88		
	p_2	0.122	0.030*		
Oxygen saturation	**Before**				
	Min. – Max.	89.0 – 97.0	90.0 – 97.0	1.820	0.075
	Mean ± SD.	94.37 ± 2.34	95.27 ± 1.36		
	After				
	Min. – Max.	95.0 – 99.0	95.0 – 97.0	6.077*	<0.001*
	Mean ± SD.	97.43 ± 1.473	95.63 ± 0.76		
	p_2	<0.001*	0.148		
Respiratory rate	**Before**				
	Min. – Max.	30.0 – 60.0	30.0 – 64.0	1.391	0.170
	Mean ± SD.	43.90 ± 9.41	47.17 ± 8.77		
	After				
	Min. – Max.	30.0 – 55.0	30.0 – 66.0	4.126*	<0.001*
	Mean ± SD.	40.13 ± 5.68	48.83 ± 10.06		
	p_2	0.003*	0.245		

t, p: t and p values for Student t-test for comparing between the two groups
p_2: p values for Paired t-test for comparing between before and after nesting in each group
*: Statistically significant at $p \leq 0.05$

Table 2: Physiological Parameters of the Neonates among Study and Control Group.

Sleep state assessment of the neonates of both groups was illustrated in table 3. It was found that 43.3% of the neonates of the study group and 10% of the neonates of the control group were in deep sleep and the differences between both groups were statistically significant. In addition, 23.3% of the neonates from the study group were in light sleep compared with 10% of the neonates from the control group while 10% of the neonates from the study group were in slumber compared with 20% of neonates from the control group. Furthermore, 13.3% of the neonates of the study group and the control group were in arousal state, while 6.7% of the neonates from the study group were in excitement state compared with 16.7 % of the neonates from the control group. Crying were not observed in neonates from the study group compared with 30% of the neonates from the control group and the differences between both groups were statistically significant.

Sleep state assessment	**Study group (n=30)**		**Control group (n=30)**		χ^2	**p**
	No.	**%**	**No.**	**%**		
State 1: Deep sleep						
No	17	56.7	27	90.0	8.523*	0.004*
Yes	13	43.3	3	10.0		
State 2: Light sleep						
No	23	76.7	27	90.0	1.920	0.166
Yes	7	23.3	3	10.0		
State 3: Slumber						
No	27	90.0	24	80.0	1.176	^{FE}p= 0.472
Yes	3	10.0	6	20.0		
State 4: Arousal						
No	26	86.7	26	86.7	0.0	^{FE}p= 1.000
Yes	4	13.3	4	13.3		
State 5: Excitement						
No	28	93.3	25	83.3	1.456	^{FE}p= 0.424
Yes	2	6.7	5	16.7		
State 6: Crying						
No	30	100.0	21	70.0	10.588	^{FE}p= 0.002*
Yes	0	0.0	9	30.0		

^{2}, p: ^{2} and p values for Chi square test for comparing between the two groups
^{FE}p: p value for Fisher Exact for Chi square test for comparing between the two groups
*: Statistically significant at $p \leq 0.05$

Table 3: Sleep State Assessment among Neonates of Study and Control Groups.

Discussion

Low birth weight neonates are particularly a vulnerable group who require advanced medical interventions and highly specialized nursing care in order to survive. The low birth weight neonates require support to facilitate and maintain postures that improve motor control, physiological functioning and decrease stress. Certainly, the swaddled positioning provides flexion of the limbs and trunk and facilitates of midline skills. Also, it assists neonate's self-regulation and maximizes neonate's stability, preserve energy, growth, and promote neurobehavioral organization. In addition, nesting directly impacts the amount of energy that neonates expend in several ways. Whereas, it decreases cry and pain among neonates, enhances sleeping, prevents fluctuations in cerebral blood flow and prevents the fragile blood vessels in the brain from rupturing. It also facilitates ventilation and helps in preventing trauma to the airways, which aid in prevention of chronic lung disease. So, studying the effect of nesting and swaddling position in low birth weight neonates is very essential in NICU [12].

Nesting is very effective intervention for neonates that greatly enhance their physiological parameters. The results of the current study revealed that, the differences between heart rate after nested and swaddled prone position for study group and prone position for control group were statistically significant. In addition, heart rate in neonates of control group was increased after prone position and the difference was statistically significant. These results could be attributed to the fact that, nesting can increase time of sleep and decrease energy expenditure. Nesting position resemble fetus in utero which stimulates quiet sate and keep a stable heart rate to save energy; however, neonates in prone position only experienced different sensorimotor stressors, such as sound, light, and pain [8]. These findings are congruent with [4] who has done a study about effect of nesting on posture discomfort and physiological parameters of low birth weight infants. They revealed that low birth weight infants in experimental group experience stable physiological parameters in terms of heart rate and respiration during the stay in NICU. Nevertheless, the findings of the current study contradicted with El-Nagger and Bayoumi [13] who reported that, there was no statistical significant difference regarding the heart rate between study and control groups (nesting and un-nesting positioning) in the three different positions (supine, side-lying and prone).

The present study findings revealed that the mean Oxygen saturation after nested and swaddled prone position were higher than before nesting for neonates in study group and the differences were statistically significant. In addition, the mean Oxygen saturation of neonates in study group was higher than the mean Oxygen saturation of neonates in the control group and the differences were statistically significant. These findings are supported by El-Nagger and Bayoumi [13]. Furthermore, the results of the present study are in agreement with Prasenjit [14] who pointed out that the trials of various developmentally supportive care programs have shown positive results for the infants through improving lung and neurophysiological functioning. Such similarity between the latter study and the result of the current study could be attributed to the developmentally supportive care programs which included nesting position that designed to simulate the intra-uterine environment; to promote normal neonatal development, enhance the physiological stability and oxygenation of neonates.

Regarding the respiratory rate, the result of the current study reflected that the mean respiratory rate of neonates in the study group after nesting decreased than before and the differences were statistically significant. On the other hand, the mean respiratory rate of neonates in control group increased. In addition, the mean respiratory rate of neonates in study group was lower than in control group and the differences were statistically significant. These results are in accordance with Picheansathian [15] who reported that prone position can improve lungs and cardio-respiratory development and facilitate improvement of respiratory status. However, such results are contradicted with El-Nagger and Bayoumi [13] who reported that, there was no statistical significant difference between study and control groups regarding respiratory rate.

Sleep is a fundamental need for pre-term neonates and it has a crucial role for proper brain development. Accordingly, deep sleep allows neonates to resist superfluous environmental stimulants [16,17]. On examination the sleeping pattern of low birth weight neonates in the form of sleep/awake state, the results of the current study reflected that the percentage of neonates in deep sleep among study group were more than neonates among control group and the difference between both groups was statistically significant. In addition, crying was not observed among the neonates of study group compared with one third of neonates among control group and the difference between both groups was statistically significant. The results of the current study could be justified by nesting with swaddled position facilitates transformation of sleep pattern from erratic disturbed spells to deep sleep rather than prone position only [1].

The findings of the present study are congruent with a study done by Reyhani et. al. [18] about evaluation of the effect of nest posture on sleep/awake state premature infants who reported that nest posture increased the sleep hours of premature infant as the most imperative state of brain development. In addition, Kihara & Nakamura [8] concluded that prone position with nested and swaddled positioning support might facilitate sleep compared to prone positioning alone. In addition, the findings of the current study are in agreement with Baley [19] who mentioned that developmental positioning was associated with longer quiet sleep duration and better sleep organization. These similarities could be explained by the developmental positioning incorporates nesting with swaddled position. In contrast, Cole and Gavey [20] reported that behavior of neonates did not differ between prone un-nested and prone nested. Accordingly, more self-regulatory and stress behaviors were related to longer periods of fussing and crying. So, longer periods of sleep were related to fewer stress behaviors.

Conclusion

Based on the findings of the current study, it can be concluded that nested and swaddled position improve sleep and heart rate stability compared to prone position alone among the neonates of low birth weight.

Recommendation

Based on the previous findings, the following recommendations are suggested:

- Emphasize on the importance of applying nesting technique for neonates in the NICUs as standard of developmental supportive care.
- Provide a training program for all nurses in NICU regarding the application of nesting technique for neonates.

Acknowledgment

The authors would like to express their appreciation to NICU nurses in the Maternity University Hospital for their support during the data collection.

What Does This Paper Contribute to the Wider Global Clinical Community?

- Caring of low birth weight neonates is one of the nursing challenges in Neonatal Intensive Care Unit. Providing the nurses with the best evidences will enable them to provide high quality of care and improve holistic care of this group of fragile patients. The clinical implications of the current research are the following:
- Sleep is a fundamental need and it has a crucial role for proper brain development of this fragile group of patients, the current research provides the evidence for improving sleep state using the nesting position.
- Empower the neonatal intensive care nurses with best evidence to improve the nursing care.
- Might be an evidence to establish a written policy that regulates the use of nesting position at NICU as a routine clinical practice.

References

1. Prasanna K, Radhika M (2015) Effectiveness of Nesting on Posture and Motor Performance Among Newborn babies. IJSR - International Journal of Scientific Research 4: 149.
2. WHO (2014) WHA Global Nutrition Targets 2025: Low Birth Weight Policy Brief.
3. Chen Y, Li G, Ruan Y, Zou L, Wang X, et al. (2013) An epidemiological survey on low birth weight infants in China and analysis of outcomes of full-term low birth weight infants. BMC Pregnancy and Childbirth 13: 242.
4. Poulose R, Babu M, Rastogi SH (2015) Effect of Nesting on Posture Discomfort and Physiological Parameters of Low Birth Weight Infants. Journal of Nursing and Health Science 4: 46-50.
5. Ferrari F, Bertoncelli N, Gallo C, Roversi M, Guerra M et al. (2007) Posture and movement in healthy preterm infants in supine position in and outside the nest. Arch Dis Child Fetal Neonatal Ed 92: F386-F390.
6. Zarem C, Crapnell T, Tiltges L, Madlinger L, Reynolds L, et al. (2013) Neonatal Nurses' and Therapists' Perceptions of Positioning for Preterm Infants in the Neonatal Intensive Care Unit. Neonatal Netw 32: 110-116.
7. Zahed M, Berbis J, Brevant- Malaty V, Busuttil M, Tosells B, et al. (2015) Posture and movement in very preterm infants at term age in and outside the nest. Childs Nrev. Syst, Springer-Verlag Berlin Heidelberg 31: 2333-2340.
8. Kihara H, Nakamura T (2013) Nested and swaddled positioning support in the prone position facilitates sleep and heart rate stability in very low birth weight infants. Research and Reports in Neonatology 3: 11-14.
9. Madlinger-Lewisa L, Reynoldsb L, Zarema C, Crapnella T, Inderc T, et al. (2014) The Effects of Alternative Positioning on Preterm Infants in the Neonatal Intensive Care Unit: A Randomized Clinical Trial. Res Dev Disabil 35: 490-497
10. Allen K (2012) Promoting and Protecting Infant Sleep. Adv Neonatal Care 12: 288-291.
11. Halverson K (2010) The Effects of Positioning on Premature Infant Development. Pediatrics CATs.
12. Waitzman A (2014) The importance of positioning the near-term infant for sleep, play and development. Newborn and Infant Nursing Reviews 7: 76-81.
13. El-Nagger N, Bayoumi O (2016) Effect of applying nesting technique as a developmental care on physiological functioning and neurobehavioral organization of premature infants. Life Science Journal 13: 97-72.
14. Prasenjit H, Debabrata B, Arindam B (2015) Developmentally Supportive Care. In: Neonatal Intensive Care Unit (NICU): A Review. Indian Journal of Medical Research and Pharmaceutical Sciences 2: 34.
15. Picheansathian W, Woragidpoonpol P, Baosoung C (2009) Positioning of preterm infants for optimal physiologic development: A systematic review. Joanna Briggs Institute Library of Systematic Reviews 7: 224-59.
16. Bastani F, Rajaei N, Amini E, Haghani H, Jan Mohamadi S (2012) Assessment of preterm Infants Who Sleep in the NICU and its Relationship with Demographic Variables. Alborz University of Medical Sciences Journal 2: 1-6.
17. Rahimi O (2014) The importance of neonatal sleep care in Neonatal Intensive Care Unit. JCE 2: 83-98.
18. Reyhani T, Ramezani S, Boskabadi H, Mazlom S (2016) Evaluation of the Effect of Nest Posture on the Sleep-wake State of Premature Infants. Evidence Based Care Journal 6: 29-36.
19. Baley J (2015) Committee on Fetus and Newborn. Developmental Care for Term and Preterm Infants in the Neonatal. Pediatrics 136 :596.
20. Cole P, Gavey J (2011) Are they lying comfortably? A direct observational study examining current practices of infant positioning in the neonatal unit. Journal of Neonatal Nursing 7: 25-32.