Original Article

Effect of Nesting and Swaddling on Sleep Duration of Preterm Neonate Hospitalized at Tertiary Care Centre of Eastern Nepal

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Academic Editor: Dr. Kapil Amgain **esting and Swaddling on Sleep Duration of Preterm Neonate Hospitalized at Tertiary Care Centre of Eastern Nepal.**

ABSTRACT

Background: All preterm neonates' sleep is disturbed during hospitalization period due to various stressful environmental factors and human error and without focusing in individual developmental care. This impacts neonatal neurological development as well as normal growth resulting lifelong disabilities. Thus, modification of the environment by intervening developmental care could minimize the iatrogenic effect and neuro-developmental delay by decreasing stressful environment. This study was conducted to assess the effect of nesting and swaddling on sleep duration of preterm neonates during hospitalization at B.P.Koirala Instituted of Health sciences (BPKIHS).

Methods: True experimental (post-test control design) study conducted among 36 preterm neonates, admitted in Nursery and Neonatal Unit of BPKIHS. The objective of this study was to assess the effect of nesting and swaddling on sleep duration. Consecutive sampling technique was used for total sample size then after random allocation is applied for creates the samples into two groups: experimental and control. Performa was used to collect socio-demographic characteristics. Sleep duration was recorded in self-administer observation form base on the observational behavior characteristics scoring of neonatal sleep by AASM (American Academy of sleep Medicine). As intervention, nesting and swaddling were performed in experimental group, then the sleep was video-recorded for 2 hours for each neonate. Finally, data were analyzed using descriptive and inferential statistics.

Results: Among the enrolled neonates, there were 23 male (63.9%) and 13 female (36.1%) preterm. There was significant difference in sleep duration between experimental and control group. The mean ± SD of sleep duration was 59.22 ± 22.61 minute in experimental group and 39.50 ± 8.06 minute in control with p-value 0.001. The mean sleep duration was not associated with other selected study variables except the performed intervention.

Conclusions: Nesting and Swaddling can be used as convenient and effective method to increase neonatal sleep duration or rest period.

Keywords: Nesting, Swaddling, Effect, Sleep duration, Preterm

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INTRODUCTION

According to the definition of the World Health Organization (WHO), preterm period refers to a baby born before complete 37 weeks of pregnancy [1-2].In 2012, globally 15 million babies were born premature, 37.6% were in South Asia and 14 % in Nepal. Among those, 1 million preterm babies die each year and babies who survive can face lifelong disabilities [1]. Preterm neonates have immature organ systems that often need additional support to survive. There are five core major developmental cares: protected sleep, pain and stress assessment and management, developmental activities of daily living, family-centered care and the healing environment [3-5]. It's determinant of mortality as well as morbidity, and is more vulnerable to organ injury, illness death and neurological developmental disabilities [6].

Adequate sleep is important for brain development in neonates where the need of neonatal sleep duration is 10-19 hours/24 hours and may be higher in prematurity [7,8]. Swaddling is an ancient practice of encircling an infant in a restrict movement that is more effective for self-regulatory ability of neonates, where they spend more time sleeping [9,10]. Nesting, as a component of developmental care, improves neonates sleep quality through preservation of neonates curved limb position that exhibit fewer motor responses to stimuli when keeping in cocoon [7,9,11].

METHODS

The Experimental study design (post-test control group design) was adopted as a consecutive sampling technique with random allocation. Sample size is calculate based on literature using the formula for comparison of two mean and samples consisted of 36 [12]. Total 39 respondents were assessed for eligibility (preterm neonate, spontaneous breathing, no need of oxygen administration and ventilator support, no used of sedatives, no any congenital anomalies, not diagnosed with hyperbilirubinemia and septicemia) [13]. Three samples were excluded as per the criteria, and 36 were included in study where random sampling was done by lottery method to allocate each subject into either intervention or control group. Eighteen pieces of paper each for experimental and control group was prepared, and put into a box and shuffled. Single piece of paper at a time was drawn as lottery before assigning the sample to the group without replacement method until researcher gets required number of samples. Ethical clearance was obtained from the Institutional Review Committee of BPKIHS (IRC/1044/017). Written assent was obtained from parents and confidentiality maintained throughout the study. The data were collected from 28th December 2017 to 14th February 2018. A semi structured questionnaire regarding socio-demographical characteristics and observation tool for sleep duration including clinical medical data form was used for data collection.

Intervention: An interview was taken regarding socio-demographic variables, and medical history was obtained from patient chart. Intervention was done once, at least for 1 hour [14, 15].

For experimental group: Preterm neonate who meets the inclusion criteria within intervention group were fed according to pediatrician's advice; then after diaper were changed and neonate was swaddle on flannel smooth non allergic clothes below the neck by following 4 steps of swaddle **[**16].

Step 1: Folded the swaddle flannel into a triangle, and baby was placed in the center with shoulders just below the fold.

Step 2: Baby's right arm was placed alongside the body, slightly bent. Same sides of the swaddle (flannel) were taken and pulled it securely across baby's arm and chest, tucking the flannel under the baby. Left arm was kept free.

Step 3: Bottom of the swaddle was folded up over baby's feet. Then after point of the flannel was tuck into the top of the swaddle.

Step 4: Baby's left arm was placed alongside the body, slightly bent, then remaining swaddled, neonate was wrapped over arm and chest; at last, the remaining flannel were tuck under the baby to secure the swaddle.

Then after, preterm neonates were kept within cocoon on supine position for nesting in radiant warmer. Then continuous video recording was done throughout the intervention (start of nesting to wake up of neonate) for 2 hours with the DSLR Camera Canon EOS 100D**.** (Table 1)

Figure 1: Preterm Neonate with Swaddling and Nesting.

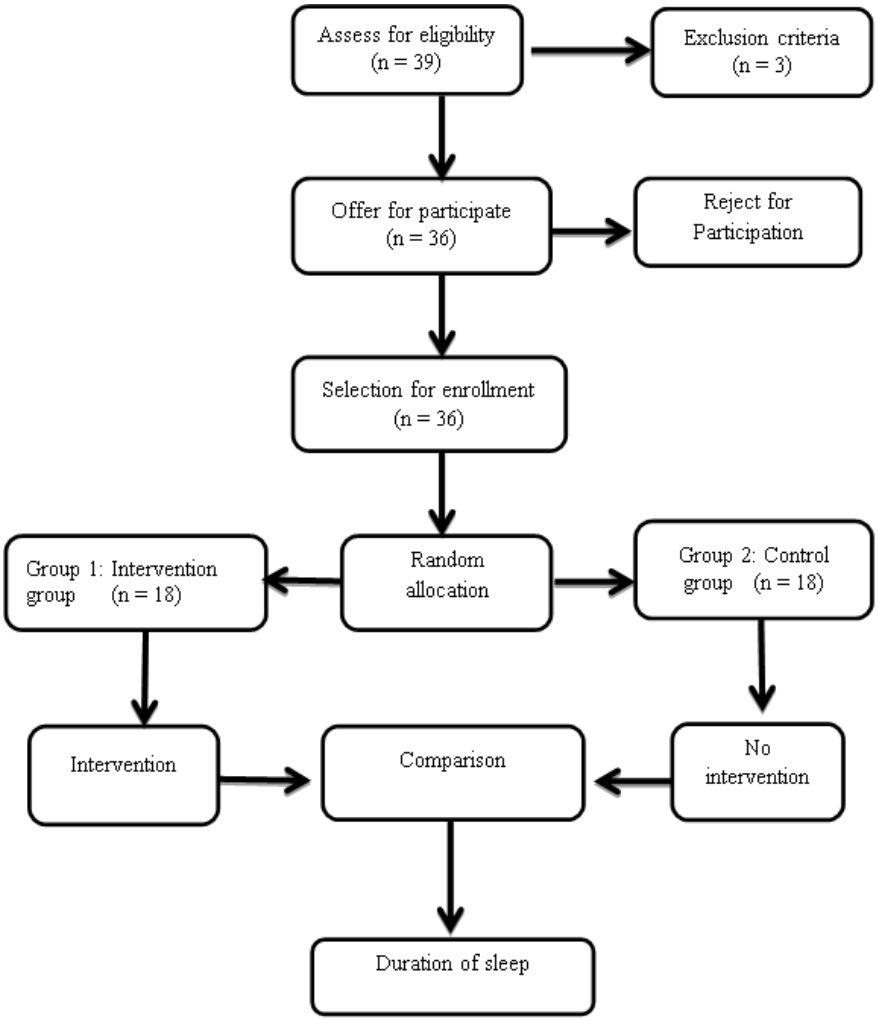

Figure 2: Flow diagram of study

The sleep duration was observed by analyzing the recorded 1-hour videos, on the basis of neonatal behavioral characteristics related to sleep which are included in American Academy of sleep Medicine Manual/sleep- wake state characteristics scoring [17].

For Control group - Similar procedure as in experimental group was done (Preterm neonate who met the inclusion criteria within control group were feed according to pediatrician's advice then after diaper were changed and kept for sleep in radiant warmer) except step wise swaddling and Nesting.

Table 1: Sleep and wakefulness Behavioral characteristics of neonate (as per American Academy of sleep Medicine)

State	Respiration	Eye Movements	Behavior
Wakefulness	Irregular	Eyes open eye blinks, rapid or scanning eye movements; transient eye closure especially when crying	Quiet wakefulness (QW): eyes open, Crying, active, or crying; vigorous, diffuse motor activity of varying intensities; may whimper, occasional directed motor actions.
sleep	Regular respiration	Eyes closed, not moving	Absence of eye movements and body movements except for an occasional startle (eye closed, periodic sucking, occasional startle

RESULTS

Out of 36 neonates; 18-18 neonates were included in the experimental and control group each. The age ranged from 1 day to 24 days, mean age is 7.22 days in experimental, and 5.06 days in control group. More than half of the neonates were male in both groups i.e. 61.1% male in experimental group, 66.7% in control group. It was homogenously distributed in the groups (p=0.729). About ethnicity; maximum 30.6% belongs to Janajati and rest of the 8.3% belongs to Muslim and others like Giri/Puri.

Table 2 shows the baseline characteristics of participants. Nearly 3 in 10 participants (27.8%) were preterm neonate i.e. born between 28 to 32 weeks of gestation in both groups. There was no statistically significant difference in mean of gestation period between experiment and control group. One in two neonates fell within a weight range of 1000 to 1500 grams. The mean weight did not differ statistically significantly between the experimental and control groups. Nearly 7 in 10 neonates received their nutrition through breastfeeding in both groups. There was no proportion difference in breast feeding practices (66.7% vs 69.4%, p=0.72) and types of feeding (44.4% vs. 33.3%, p=0.49) between experimental and control group groups.

Table 3 shows that the mean sleeping duration was significantly higher in experiment group than in control groups (p=0.001).

Table 4 depicts that the association of sleep duration with other variables such as age of neonate, sex, gestational age, body weight, feeding type and feeding methods. There was no significant association in average sleep duration between experimental and the control groups across the studied variables in either of the groups (p>0.05).

Table 5 describe the multi variant linear regression was calculated to predict the effect of independent variables including nesting and swaddling in the dependent variable i.e. sleep duration. There is linear relationship of sleep duration with demography (age and sex) and with other variables (week of gestation, weight, type of feeding). About 68% of the variation in sleep duration could be explained by change in age, sex, week of gestation, weight, type of feeding and intervention and remaining percentage where other factors not include in model (R^2 =0.675, F change significant at (0.343). There is no significant relationship between sleep hour and age, sex, week of gestation, weight and type of feeding. However, we found statistically significant association between sleep duration and the intervention (p= 0.001). It means if intervention is done sleeping time is increased by 19.95 minutes.

Table 2: Baseline Characteristics of Participants, n = 36

Variable	Category	Groups		Total	χ^2 value	p-value
		Experiment	Control			
Week of gestation	28-<32weeks	5 (27.8%)	5 (27.8%)	10 (27.8%)	1.17*	0.25*
	32-<37weeks	13 (72.2%)	13 (72.2%)	26 (72.2%)		
Weight in gm	>1000 – 1500gm	9 (50.0%)	10 (55.6%)	19 (52.8%)	0.11	0.738
	>1500 – 2500 gm	9 (50.0%)	8(44.4%)	17 (47.2%)		
	Mean (SD)	1625.17 (± 524.20	1715.00 (± 397.95)			
Type of Feeding	Breast milk	12 (66.7%)	13 (72.2%)	25 (69.4%)	0.13	0.717
	Lactodex	6 (33.3%)	5 (27.8%)	11 (30.6%)		
Method of feeding	Breast feeding	8 (44.4 %)	6(33.3%)	14(38.9%)	0.47	0.494
	Cup feeding	10 (55.6%)	12(66.7%)	22(61.1%)		

*Fisher's Exact test

Table: 3: Comparison of Sleep Duration between experimental and control group (as per 1-hour video record observation), n =36

Group	N	Mean duration (minutes)	Standard Deviation	t-test	p-value
Experimental	18	59.22	± 22.61	3.485	0.001*
Control	18	39.50	±8.06		
Total	36	49.36	± 19.49		

Table 4: Association of Sleep Duration of neonates with different variables (as per 1-hour video record observation), n=36

Variable categories		Sleep duration (minutes)							
		Experimental group				Control group			
		N	Mean (SD)	t-test	P value	N	Mean (SD)	t-test	P value
Age	Up to 7 days	12	68.67 (±21.63)	-1.25	0.22	13	40.15 (±8.98)	0.5	0.59
	>7- 28 days	6	40.33 (± 8.14)			5	37.80 (±5.40)		
Gender	Male	11	59.45 (±26.97)	0.05	0.95	12	36.67 (± 6.18)	2.37	0.30
	Female	7	58.86 (±15.34)			6	45.17 (± 8.90)		
Gestation Week	28-<32	5	48.60 (±16.54)	1.25	0.22	5	40.60 (±13.05)	0.35	0.73
	32-<37	13	63.31 (±23.83)			13	39.08 (±5.89)		
Body weight	1000-1500gm	9	51.22 (±14.94)	1.56	0.13	10	39.60 (±0.78)	0.06	0.95
	>1500-2500gm	9	67.22 (±26.82)			8	39.38 (±5.90)		
Feeding type	Breast Milk	12	58.75 (±18.94)	0.12	0.91	13	37.69 (±8.51)	-1.61	0.13
	Lactodx	6	60.17 (±30.79)			5	44.20 (±4.60)		
Feeding Method	Mother Breast Feeding	10	66.40 (±25.92)	1.57	0.136	12	40.67 (±9.28)	0.86	0.42
	Cup Feeding	8	50.25 (±14.57)			6	37.17 (±4.65)		

Table 5: Association between Sleep Duration and independent variable: A Multiple Regression Analysis

Model	Unstandardized Coefficients		t- score	P-value.
	B	Std. Error		
(constant)	24.62	25. 41	0.96	0.34
Age in days	-14.67	6.09	-2.41	0.23
Sex	5.91	6.05	0.98	0.34
Week of gestation	5.21	6.32	0.83	0.42
Weight	4.81	6.41	0.75	0.46
Type of feeding	-0.15	5.	-0.03	0.98
Experimental group	19.95	5.33	3.75	0.001
Multiple regressions, R^2 =0.675 (67.5%)				

DISCUSSION

The study revealed that the effect of nesting and swaddling experiment was significant on sleep duration of preterm neonate in experimental group. Kihara and Nakamura, in a study on the effect of swaddling and nesting on premature infants' behavioral condition and sleep, concluded that infants either in the nest or swaddled, had more prolong quiet sleep time (QST) [18]. The study conducted by Franco et al. on the "Influence of Swaddling on Sleep and Arousal Characteristics of Healthy Infants" conclude that Swaddling promotes more-sustained sleep and reduces the frequency of spontaneous awakenings [19]. Abdeyazda Z et. al. studied on effects of nesting and swaddling on the sleep duration of premature infants hospitalized in neonatal intensive care units, and concluded that both swaddling and nesting could significantly increase the duration of total sleep time (TST) and quite sleep time (QST), compared to the control ($p<0.001$) [7].

This study result suggests that the sleep duration of preterm neonate was not associated with other selected variables. This result is similar to the study conducted by Abdeyazda et.al. on effects of nesting and swaddling on the sleep duration of premature infants, which showed no significant difference in the mean of gestational age, postnatal age, weight between two groups (p->0.05 [7].

Linear regression analysis showed that effect of intervention (i.e. nesting and swaddling) was significant in the sleep duration. Literature review of the available studies showed limited number of

studies on preterm neonate sleep possibly due to difficulty in sleep assessed in neonates. In addition, with extensive review of literature, authors found no study that compared the effect of two different cares at same time on preterm neonatal total sleep duration therefore the results of this study could not be compared with other similar studies. Hence this is a unique interventional study on the sleep pattern of preterm neonate, which can be valuable for healthcare workers as well as for general public. It can also be useful as a base for future study.

Limitation of the study: the study is limited due to small size sample and single setting study. Additional tools such as polysomnography could be utilized for further sleep characterization. Future study could utilize diverse population for study along with long term follow up to evaluate the long-term effect of the interventions in children's health.

CONCLUSION

Nesting and Swaddling significantly increased in sleep duration. Adequate sleep period in preterm neonates can prevent the neurological abnormalities in later life. Therefore, considering the existing facilities and equipment in the ward as well as policy of hospital, swaddling, nesting care needs to be given to improve neonates' sleep to help their normal neurological development.

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Author Contributions

Ms. Nirmala Kumari Pahadi (Conception and design, literature search, acquisition of data interpretation, Statistical analysis and interpretation, Manuscript preparation, revising the article, Guarantor)
Prof. Mr. Ramanand Chaudhary (conception and design review, data interpretation, Statistical analysis and interpretation review, article review)
Prof. Mr. Basant Kumar Karna (Concept and design review, final report review)
Prof. Mr. Upendra Yadav (Concept and design review, final report review)

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Ethical Approval: IRC of KAHS (Registration no: 1044/017)

Patient's Consent: Written consent was developed and taken from parents of neonate

Conflict of Interests: The authors declare that they have no conflict of interest.

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Availability of Data and Materials: Data and materials are available on reasonable request.

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