LONG BOLSTER NEST EFFECTIVELY NORMALIZE HEART RATE, INCREASE OXYGEN SATURATION AND BODY WEIGHT IN LOW-BIRTH-WEIGHT INFANTS IN THE NICU OF PIRNGADI GENERAL HOSPITAL IN MEDAN

Tiurlan Mariasima Doloksaribu
Politeknik Kesehatan Kementerian Kesehatan Medan
Email : tiiurlan.doloksaribu77@gmail.com

ABSTRACT

Low Birth Weight (LBW) suffers from various health problems due to organ maturity as indicated by abnormal heart rate and low oxygen saturation. Babies have difficulty in adapting extra uterine environment, so they need special care. The Neonatal Intensive Care Unit (NICU) is the best place for treatment, but the characteristics of this place have the potential to cause physiological stress due to bright lighting, high sound intensity and the baby's position. A comfortable environment can be created through the Newborn Individualized Developmental Care and Assessment Program method, one of which is the use of long bolster nest. The frequency of heartbeats beats per minute, the value of oxygen saturation and the baby's weight are indications of the effectiveness of using a long bolster nest.
The purpose of this study was to determine the effectiveness of using a long bolster nest to normalize heart rate, increase oxygen saturation and body weight in LBW infants in the NICU of Pirngadi General Hospital in Medan.
Quasi-experimental research method with two groups before and after design. Respondents were LBW in the NICU of Pirngadi General Hospital in Medan, samples of 56 respondents, 28 respondents each group. Sampling by consecutive sampling.
The results of the intervention group study from day 0 to day 5 showed the average oxygen saturation levels and body weight increased regularly and the average heart rate beats per minute became normal regularly. In the control group, the values of oxygen saturation, heart rate and body weight experienced fluctuating phases, namely up and down or unstable. In conclusion, long bolster nest are effective in supporting the physiological adaptation of LBW.

Keywords : *LBW, Long Bolster Nest, Oxygen Saturation, Heart Rate, Body Weight*

INTRODUCTION

Premature birth is a global problem that still need attention. This condition is primarily reserved for LBW. This group is a high-risk group for morbidity and mortality (Rocha *et al.*, 2021)It is estimated that there are 15 million premature births (births less than 37 weeks). The number continues to increase every year, and this contributes greatly to the high mortality rate in children under 5 years. The percentage of premature births in 184 countries is around 5% to 18% of newborns (WHO, 2023)In Indonesia there are 29.5% of babies born prematurely, while others are born full term and more. In North Sumatra Province, the percentage is greater than Indonesia's percentage 56.6% (*Laporan nasional Riskesdas 2018*, 2019) Premature births are grouped into moderate premature babies (gestational age 32-37 weeks), very premature babies (28 to <32 weeks) and extreme premature babies (<28 weeks (WHO, 2023)). The characteristics of premature babies differ according to their stage of development. In general, the physical condition of premature babies is the absence of subcutaneous fat deposits, so they look very thin, very small, their head looks bigger than their body. Premature skin's babies have bright, light and thin appearance that show blood vessels under the epidermis. The entire surface of the skin is lanugo, the ear cartilage feels flabby and weak, the feet and hands have minimal folds so they look smooth. The appearance of the skull and ribs is soft, if before 26 weeks the eyes are still closed. In baby boys, the scrotum does not yet have rugae and the testicles have not descended into the scrotal sac, whereas in baby girls the labia minor and clitoris protrude (Badan Penelitian dan Pengembangan Kesehatan., 2019)

During pregnancy, the mother's placenta functions as exchange of gases, nutrients, removal of waste products, and circulation from mother to baby (Hockenberry and Wilson, 2015) Immediately after birth, the work of the placenta stops causing the respiratory, cardiovascular, digestive, urinary and metabolic systems to function, therefore the baby must quickly adapt to the extrauterine environment (Burton and Jauniaux, 2015). The inability of neonatal physiological functions causes some babies to be unable to adapt in the first 28 days of life, causing infant death (Graves and Haley, 2013). Babies experience changes in the intrauterine to extrauterine environment in the first 24 hours of birth (UNICEF, 2023). The transition from the fetus in the intrauterine environment to the newborn in the extrauterine environment is the most complex adaptation that occurs in human life. This transition is fraught with crisis because it must take place quickly for its survival involving all organ systems (Potter *et al.*, 2022).

LBW is difficult to adapt to the extrauterine environment because the characteristics of organs such as the lungs, kidneys, liver, heart and digestive system organs are immature, causing complications such as respiratory problems due to the lack of surfactant formation, lack of smooth muscle in blood vessels and low blood pressure. Low oxygen levels result in trauma to the central nervous system, delayed closure of the ductus arteriosus and the inability to regulate incoming stimuli cause the baby to tend to experience stress (M. Sholeh kosim, 2012). This condition is a cause of high morbidity, disability and mortality in neonates, and have a lasting impact on health status into adulthood (Adam *et al.*, 2019).

There are many problems that will be experienced by babies with LBW or premature. Premature babies have immature immune function and low adaptability to the extra-uterine environment (Adam *et al.*, 2019). Premature babies have immature organs that require medical treatment to treat them (Martin *et al.*, 2011). Premature infants are admitted to the NICU due to life-saving procedures (Provenzi, Guida and Montirosso, 2018). However, NICU procedures and environments actually provide inappropriate stimuli and the consequences will have a negative impact (Gardner *et al.*, 2020). Negative stimuli in the NICU include painful invasive medical/surgical procedures and uncomfortable environments such as positioning, too bright lighting and noise from monitors causing the baby's rest and sleep needs to be unfulfilled and the baby separated from the mother (Fiske, 2020). This excessive stimulation causes disturbances in the neurodevelopment of the brain (Chaudhari, 2011)

The uncomfortable environment of care in the NICU causes babies to experience many health problems such as episodes of intermittent hypoxia (Martin *et al.*, 2011), hypoxemia, apnea (Maguire *et al.*, 2008), increased heart rate and decreased Oxygen saturation (Pinelli, 2000). To minimize the risk of disrupting the baby's development due to overstimulation in the NICU, comfortable environmental settings are designed using long bolster nest during treatment (Altimier and Phillips, 2016)The intervention using long bolster nest is one of the NIDCAP (Newborn Individualized Developmental Care and Assessment Program) treatment methods developed by Heideline Als. NIDCAP is structured and developed based on Synactive Theory. NIDCAP is based on the neurodevelopment of the baby's brain up to 9 years of age, consequently influencing brain structure and behavior (Als and McAnulty, 2011). The use of long bolster nest facilitates the baby to remain in a physiologically flexed position and prevents the baby from experiencing sudden changes in position due to gravity.

A sudden change in position can result in the breakdown of excess energy from the neonate's body.

The purpose: to examine the effect of applying long bolster nest to oxygen saturation values, heart rate and baby’s weight in the NICU of Pirngadi General Hospital. The frequency of heartbeats beats per minute, the value of oxygen saturation and the baby's weight are indications of the effectiveness of using a long bolster nest.

METHOD

The study population was the total LBW admitted to the NICU room of Dr. Pirngadi Medan Hospital in 2018. Respondents were LBW in the NICU of Pirngadi Hospital Medan from June to November 2019. The sample was 56 respondents, 28 respondents per group. Sampling by consecutive sampling. The design in this study was quasi-experimental with two groups, namely the intervention group and the control group. The control group did not receive treatment but only measured oxygen saturation, heart rate and body weight from day 1 to day 5. The intervention group was given treatment, namely LBW who were treated using a long bolster nest from day 1 to day 5. In the intervention group, oxygen saturation, heart rate and body weight were measured from day 1 to day 5 starting on day 1 before treatment, then treatment was carried out and measured from day 1 to day 5. Body weight was measured every morning at 7:00 am, while heart rate and oxygen saturation were measured at 7:00 am, 2:00 pm, and 8:00 pm in the control group and intervention group. Weight measurement tools used digital baby scales, oxygen saturation measurements using a pulse oximeter and heart rate measurements using a clock. The data obtained were documented on the observation sheet. Univariate and bivariate data analysis. Univariate analysis described the values of oxygen saturation, heart rate and infant weight before and after the intervention in the intervention group and control group.

Because the number of samples was less than 50, the bivariate analysis used normality test using Shapiro Wilk on body weight, oxygen saturation, and heart rate data. The results of the normality test showed that the data were not normally distributed, so the Wilcoxon test was performed.

RESULTS AND DISCUSSION

Data analysis includes univariate and bivariate analysis.

Table 1. Effect of Using Long Bolstered Nest on Oxygen Saturation, Heart Rate and Body Weight in LBW Babies in the NICU of Pirngadi General Hospital Medan

Oxygen Saturation						
Days to	**Intervention Group**			**Control Group**		
	$\bar{x}$	**SD**	***p-value***	$\bar{x}$	**SD**	***p-value***
Before Intervention				**No Intervention**		
Day 0	95.57	0.61	-	96.35	0.57	-
After Intervention				**No Intervention**		
Day 1	97.25	0.35	0.001	97.51	0.35	0.008

Day 2	98.16	0.25	0.000	97.84	0.30	0.003
Day 3	98.63	0.18	0.000	98.26	0.23	0.001
Day 4	98.86	0.17	0.000	98.30	0.27	0.000
Day 5	99.00	0.13	0.000	98.55	0.24	0.000
Heart Rate						
Days to	**Intervention Group**			**Control Group**		
	$\bar{x}$	**SD**	*p-value*	$\bar{x}$	**SD**	*p-value*
Before Intervention				**No Intervention**		
Day 0	171.75	3.1	-	155.14	3.72	-
After Intervention				**No Intervention**		
Day 1	152.39	1.92	0.000	151.83	1.88	0.299
Day 2	147.39	1.34	0.000	149.91	1.78	0.133
Day 3	145.48	0.83	0.000	150.02	1.49	0.158
Day 4	142.64	0.80	0.000	147.28	1.45	0.049
Day 5	141.63	0.82	0.000	145.09	1.52	0.030
Body Weight						
Days to	**Intervention Group**			**Control Group**		
	$\bar{x}$	**SD**	*p-value*	$\bar{x}$	**SD**	*p-value*
Before Intervention				**No Intervention**		
Day 0	1508.75	49.09	-	1556.42	42.99	-
After Intervention				**No Intervention**		
Day 1	1513.67	50.08	0.330	1542.50	44.50	0.101
Day 2	1520.35	50.23	0.012	1511.60	42.85	0.004
Day 3	1528.21	50.59	0.000	1541.25	44.73	0.041
Day 4	1533.75	51.09	0.000	1543.03	45.05	0.047
Day 5	1540.85	51.43	0.000	1511.07	45.31	0.027

1. Oxygen Saturation Value of LBW Before and After Intervention using Long Bolster Nest in the NICU of Pirngadi General Hospital in Medan

Intervention group before given using long bolster nest, on day 0 the average oxygen saturation was 95.57%. Then the average oxygen saturation after the intervention on day 1 to day 5 was 97.57%. On day 1, its averaged was 98.16%, averaged on day 2 become 98.63%, average on day the 3rd, the 4th day increased 98.86% and average the 5th day reached 99.00%. The average oxygen saturation increased every day from day 1 to day 5 after the intervention was given.

From the results of the Wilcoxon test, the probability (p) from day 1 to day 5 is 0.001; 0.000; 0.000; 0.000; 0.000; < 0.05. This means that there is an effect of average daily oxygen saturation, which make the NIDCAP with long bolster nest intervention in LBW increases oxygen saturation and reduces physiological stress. In the control group at the beginning of the examination on day 0, the average oxygen saturation was 96.35%, on day 1, its average was

97.51%, average on day 2 become 97.84%, average on day 3 become 98.26%, average on day 4 increased 98.30%, average on day 5 reached 98.50%. This means that the average oxygen saturation increases every day from before day 0 to day 5.

From the results of the Wilcoxon test, the probability (p) on day 1 to day 5 was 0.008; 0.003; 0.001; 0.000; 0.000; <0.05, meaning that there was an effect on the average oxygen saturation.

Comparing the two results, the intervention group showed a better increase in average oxygen saturation than the control group. Research by (Ginting *et al.*, 2023)states that the use of nests greatly affects the value of oxygen saturation with a p value of 0.00. In line with Priyati's research, (Saputro *et al.*, 2023). (Priyati, 2017) states that there is an effectiveness of using nesting and prone position on oxygen saturation in premature babies in the Perinatology ward of Cipto Mangunkusumo Hospital, Central Jakarta with a p value: 0.001 (<0.05). Research by (Saputro *et al.*, 2023) also states that there is a significant difference in the intervention group and control group on oxygen saturation in premature infants at Cengkareng Hospital. The intervention group produced a p-value <0.05 (0.000), which means there is a significant difference in oxygen saturation values.

2. Heart Rate in LBW Before and After Intervention Using Long Bolster Nest in the NICU Pirngadi General Hospital in Medan

In the control group, at the initial examination on day 0, the average heart rate was 155.14 beats per minute. On the first day, the average heart rate was 151.83 beats per minute. On day 2, its average was 149.91 beats per minute. On day 3, the average was 150.02 beats per minute. On day 4, the average was 147.28 beats per minute. On day 5, the average was 145.09 beats per minute.

In the intervention group before the installation of the long roll nest, the average heart rate on day 0 was 171.75 beats per minute. On the first day after the intervention, the average heart rate was 152.39 beats per minute, day 2 average 147.39 beats per minute, day 3 average 145.48 beats per minute, day 4 average 142.64 beats per minute, day 5 average 141.63 beats per minute. This means that the average heart rate decreased every day from day 0 to day 5 during the NIDCAP intervention through the installation of a long rolling nest. Wilcoxon test results, the probability (p) on day 1 to day 5 is 0.000; 0.000; 0.000; 0.000; 0.000; <0.05. This means that there is an effect on the average daily heart rate, so that NIDCAP intervention in LBW can reduce heart rate and have implications for reducing physiological stress.

From the results of the Wilcoxon test, the probability (p) from day 1 to day 3 is 0.269; 0.113; 0.158 > 0.05 which indicates there is no effect from day 0 to day 3. On day 4 to day 5, the probability (p) of 0.049; 0.030 <0.05 was obtained, meaning that there was an effect of the long bolster nest warmer intervention on the frequency of infant heart rate. This is in line with the research of (Ginting *et al.*, 2023) which states that the use of the nest greatly affects the pulse frequency or heart rate of infants with a p value of 0.00.

3. Weight Gain at LBW Before and After Intervention Using Long Bolster Nest in the NICU Perinatology Room Pirngadi General Hospital in Medan

In the intervention group before the installation of long bolster nest, the average body weight on day 0 was 1508.75 grams. After the intervention, on day 1 the average body weight was 1513.67 grams. On day 2 the average body weight was 1520.35 grams. On day 3 the average body weight was 1528.21 grams. On the 4th day the average body weight was 1533.75 grams. On day 5 the average body weight is 1540.85 grams. This means that the average body weight increases every day from day 0 to day 5 given the NIDCAP intervention through the installation of long bolster nest. From the results of the Wilcoxon test, the probability (p) on day 1 was 0.330 > 0.05. This means that on day 0 to day 1 there was no significant difference in average body weight before and after the intervention was given. However, from the results of the Paired Samples Test conducted, the probability values (p) from the 2nd to the 5th day were: 0.012; 0.000; 0.000; 0.000 < 0.05. This means that there is an effect of placing long bolster nest on the increase in average body weight on day 2 to 5, this shows that giving NIDCAP interventions through placing long bolster nest can increase baby's weight.

Whereas in the control group at the initial examination on day 0, the average body weight measurement results were 1556.42 grams. On day 1 the average body weight decreased to 1542.50 grams. On day 2 the average body weight decreased to 1511.60 grams. On the 3rd day the average body weight increased to 1541.25 grams. On the 4th day the average body weight increased to 1543.03 grams. On the 5th day the average body weight decreased to 1511.07 grams. This means that the average body weight fluctuates from day 0 to day 5. From the results of the Wilcoxon test, the probability (p) on day 1 was 0.101> 0.05, indicating that there was no increase in average body weight from day 0 to day 1. On day 2 to day 5 the probability (p) was 0.004; 0.041; 0.047; 0.027 < 0.05. This means that from day 2 to day 5 there was an increase in average body weight.

Comparing the two results, the intervention group showed a better increase in average body weight compared to the control group. In line with research by Noor M., et al. (2016) stated that the use of nesting with fixation helps increase body weight, pulse frequency and respiratory frequency, as well as the length of use of respiratory aids becomes shorter.

CONCLUSION

1. The use of long bolster nest can reduce cardiac work activity down to 100-160 beats per minute, impact on the effectiveness of the heart work. Decreased physical activity has an impact on decreasing the work of the heart which minimizes oxygen use and increases oxygen saturation. Normal heart work can increase oxygen saturation. The use of long bolster nest provides a comfortable LBW care environment, where external stimulation is minimal, thereby reducing the risk of hypoxemia.
2. The use of long bolster nest is an application of the theory of energy conservation, likely saving or reducing body energy expenditure, so that it can encourage a faster increase in LBW baby weight.

SUGGESTION

The intervention using long bolster nest which is one of the NIDCAP programs has been proven to be able to increase oxygen saturation, reduce heart rate in the normal range and increase the weight of low-birth-weight babies in the NICU of Pirngadi General Hospital Medan. This research is expected to be a choice of nursing interventions in care for premature babies and LBW babies in the NICU

ACKNOWLEDGEMENT

Thanks to the Director of Poltekkes Kemenkes Medan, Director of RSUD. Dr. Pirngadi Medan who has facilitated so that this research can be carried out properly. Especially for the great nurses in the NICU / Perinatology room, for their sincerity in assisting the implementation of this research. May God bless every nursing care we do so that the little babies cared for during this study can achieve optimal growth and development, healthy and productive in adulthood.

REFERENCES

Adam, Z. *et al.* (2019) 'Determinants of low birth weight in neonates born in three hospitals in Brong Ahafo region, Ghana, 2016- an unmatched case-control study', *BMC Pregnancy and Childbirth*, 19(1), p. 174. Available at: https://doi.org/10.1186/s12884-019-2315-6.

Als, H. and McAnulty, G.B. (2011) 'The Newborn Individualized Developmental Care and Assessment Program (NIDCAP) with Kangaroo Mother Care (KMC): Comprehensive Care for Preterm Infants', *Current Women's Health Reviews*, 7(3), pp. 288–301. Available at: https://doi.org/10.2174/157340411796355216.

Altimier, L. and Phillips, R. (2016) 'The Neonatal Integrative Developmental Care Model: Advanced Clinical Applications of the Seven Core Measures for Neuroprotective Family-centered Developmental Care', *Newborn and Infant Nursing Reviews*, 16(4), pp. 230–244. Available at: https://doi.org/10.1053/j.nainr.2016.09.030.

Badan Penelitian dan Pengembangan Kesehatan. (2019) *Laporan Dinas Kesehatan Riset Fasilitas Kesehatan (Rifaskes) 2019*. Jakarta: Kementerian Kesehatan Republik Indonesia.

Burton, G.J. and Jauniaux, E. (2015) 'What is the placenta?', *American Journal of Obstetrics and Gynecology*, 213(4), p. S6.e1-S6.e4. Available at: https://doi.org/10.1016/j.ajog.2015.07.050.

Chaudhari, S. (2011) 'Neonatal intensive care practices harmful to the developing brain', *Indian Pediatrics*, 48(6), pp. 437–440. Available at: https://doi.org/10.1007/s13312-011-0071-4.

Fiske, E. (2020) '■ *Trauma-Informed Care in the NICU: Evidence-Based Guidelines for Neonatal Clinicians* Mary E. Coughlin, MS, NNP RNC-E. 2016. Springer Publishing Company', *Creative Nursing*, 26(4), pp. 281–284. Available at: https://doi.org/10.1891/crnr-d-20-00044.

Gardner, S.L. *et al.* (2020) *Merenstein & gardner's handbook of neonatal intensive care nursing: an interprofessional approach*. 9th edn. Philadelphia: Elsevier, Inc.

Ginting, C.N. *et al.* (2023) 'Efektivitas Penggunaan Nesting dan Posisi Prone terhadap Suhu Tubuh, Saturasi Oksigen dan Frekuensi Nadi Bayi Prematur dan BBLR di RSU Dr.Pringadi Medan', *Malahayati Nursing Journal*, 5(7), pp. 2259–2266. Available at: https://doi.org/10.33024/mnj.v5i7.9037.

Graves, B.W. and Haley, M.M. (2013) 'Newborn Transition', *Journal of Midwifery & Women's Health*, 58(6), pp. 662–670. Available at: https://doi.org/10.1111/jmwh.12097.

Hockenberry, M.J. and Wilson, D. (eds) (2015) *Wong's nursing care of infants and children*. 10th edition. St. Louis, Missouri: Elsevier.

Laporan nasional Riskesdas 2018 (2019). Jakarta: Kementerian Kesehatan, Republik Indonesia, Badan Penelitian dan Pengembangan Kesehatan.

M. Sholeh kosim (2012) *Buku Ajar Neonatologi.* Jakarta: Ikatan Dokter Anak Indonesia.

Maguire, C.M. *et al.* (2008) 'Effects of Basic Developmental Care on Neonatal Morbidity, Neuromotor Development, and Growth at Term Age of Infants Who Were Born at <32 Weeks', *Pediatrics*, 121(2), pp. e239–e245. Available at: https://doi.org/10.1542/peds.2007-1189.

Martin, R.J. *et al.* (2011) 'Intermittent Hypoxic Episodes in Preterm Infants: Do They Matter?', *Neonatology*, 100(3), pp. 303–310. Available at: https://doi.org/10.1159/000329922.

Pinelli, J. (2000) 'Effects of Family Coping and Resources on Family Adjustment and Parental Stress in the Acute Phase of the NICU Experience', *Neonatal Network*, 19(6), pp. 27–37. Available at: https://doi.org/10.1891/0730-0832.19.6.27.

Potter, P.A. *et al.* (2022) *Fundamentals of nursing*. 11th edn. St. Louis: Elsevier Inc.

Priyati, L. (2017) 'Efektivitas penggunaan nesting dan posisi prone terhadap saturasi oksigen pada bayi prematur di Ruang Rawat Perinatologi di Rumah Sakit Cipto Mangunkusumo Jakarta Pusat', *Bachelor thesis, Universitas Binawan* [Preprint]. Available at: http://repository.binawan.ac.id/id/eprint/514.

Provenzi, L., Guida, E. and Montirosso, R. (2018) 'Preterm behavioral epigenetics: A systematic review', *Neuroscience & Biobehavioral Reviews*, 84, pp. 262–271. Available at: https://doi.org/10.1016/j.neubiorev.2017.08.020.

Rocha, G. *et al.* (2021) 'Early anemia and neonatal morbidity in extremely low birth-weight preterm infants', *The Journal of Maternal-Fetal & Neonatal Medicine*, 34(22), pp. 3697–3703. Available at: https://doi.org/10.1080/14767058.2019.1689948.

Saputro, M.G. *et al.* (2023) 'The Effect Of Prone Position On Oxygen Saturation In Premature Infants', *Jurnal MID-Z (Midwivery Zigot) Jurnal Ilmiah Kebidanan*, 6(1), pp. 77–87. Available at: https://doi.org/10.56013/jurnalmidz.v6i1.2155.

UNICEF (2023) 'Neonatal mortality'. Available at: https://data.unicef.org/topic/child-survival/neonatal-mortality/.

WHO (2023) 'Preterm birth'. Available at: https://www.who.int/news-room/fact-sheets/detail/preterm-birth.