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THE EFFECTIVENESS OF QUARTER PRONE POSITION ON STATUS HEMODYNAMICS AND SLEEP DURATION OF PREMATURE INFANTS

Mursiah[1,2]*, Nyimas Heny Purwati[2], Anita Apriliawati[2], Awaliah[2]
[1]Department of Nursing, RSUD Kota Tangerang, Jl. Pulau Putri Raya, Klp. Indah, Tangerang, Banten 15117 Indonesia
[2]Department of Nursing, Universitas Muhammadiyah Jakarta, Jl. K.H. Ahmad Dahlan, Cireundeu, Tangerang Selatan, Banten 15419 Indonesia
*neng.mursiah@yahoo.com

ABSTRACT
Prematurely born babies often face a range of complex issues such as body temperature instability, cardiovascular problems, fluctuations in blood pressure and heart rate, and respiratory disorders. Improper positioning exacerbates these challenges by compromising their underdeveloped homeostatic mechanisms, leading to physiological instability. Purpose: This study aimed to investigate the impact of the quarter-prone position on the hemodynamic status and sleep duration of premature infants.Methods: A quantitative approach was employed using a quasi-experimental research design with a pre-post control group. The study was conducted at one of urban hospitals in Indonesia over a one-month period from February to July 2023. Thirty-two participants were divided into intervention and control groups. Data analysis using univariate and bivariate analysis Independent T-Test. Results: There are no statistically significant differences among the control and intervention groups (p-value > 0.005). that there is significant statistical difference among two group at post-test at all variables (p-value : 0.00) Discussion The quarter-prone position, in conjunction with environmental factors like noise and lighting, influences the respiratory rate, heart rate, oxygen saturation, and sleep duration of premature infants. Nurses are encouraged to implement the quarter-prone position in caring for premature babies to enhance nursing quality and improve their overall quality of life. This approach is supported by its potential impact on the growth and developmental outcomes of premature infants in the long term.

Keywords: heart rate; oxygen saturation; premature; respiration; sleep duration; quarter prone position

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INTRODUCTION

The total of 13.4 million preterm baby in 2020 indicate that this case is still a global health burden and strongly associated with short and long-term effects (Ohuma, E. O, et al, 2023). The increasing trend of neonatal mortality between1990-2019 emphasize evidence the crucial issue worldwide which need to be addressed (Cao, G., Liu, J., & Liu, M. (2022). Premature babies are vulnerable to various health problems during their developmental stages including sleep disorder. Sleep is essential for premature babies because influence experience cognitive development and physical growth (Tham, E. K., Schneider, N., & Broekman, B. F. (2017). Sleep disorders in premature babies can cause brain damage, leading to delays in brain maturation and resulting in impaired neurodevelopment and functional connectivity (Bennet, L., Walker, D. W., & Horne, R. S. (2018). Premature babies are very sensitive to stimuli that can cause stress, which can affect changes in hemodynamic status and sleep duration (Park, J. (2020). Furthermore, positioning errors can result in changes in physiological status

(increased respiratory rate, pulse rate, and decreased oxygen saturation), impaired comfort and quality of sleep, drinking intolerance, hip joint deformity, and bleeding in the brain (Peng, et al., 2014; Werth, et al, 2016)

Positioning premature babies correctly can improve sleep quality and clinical outcomes, such as enhanced lung function, by optimizing breathing strategies. Studies have shown that positioning premature infants in special or intensive care units can lead to increased oxygen saturation and higher tidal volume (Gouna et al., 2013; Madlinger-Lewis et al., 2014) One developmental care practice is the quarter prone position. Premature babies placed in the quarter prone position exhibit lower respiratory frequency and higher oxygen saturation compared to those in the supine position (Hough et al., 2012). This finding is supported by Yin et al. (2016), who demonstrated that the quarter prone position stabilizes respiratory and pulse frequencies, and increases the duration of quiet sleep while reducing active sleep compared to infants not placed in this position (Tane, R., Rustina, Y., & Waluyanti, F. T., 2019). The quarter prone position induces a tonic labyrinthine reflex, which reduces sudden movements and limb paralysis. Therefore, this study aims to explore the effectiveness of the quarter prone position on hemodynamic status and sleep duration in premature infants

METHOD

This study employed a quasi-experimental approach with two groups: a control group and an intervention group. It utilized a pre-test and post-test design. Convenience sampling was applied. The study was conducted at one of urban hospitals in Indonesia over a one-month period from February to July 2023. The inclusion criteria were premature babies with a gestational period less than 37 weeks, stable condition and without oxygen support. Exclusion criteria are preterm baby with malformation congenital and with infectious diseases. A total of 32 premature babies, divided into two groups, agreed to participate. Instruments included observation forms to record respiratory rate, heart rate, oxygen saturation and sleep duration. Researcher used digital watch, bedside monitor, nest, lux meter and sound level meter. The intervention lasted for 3 hours for three days. In the intervention group, the researcher positioned premature babies in the intervention group using the quarter prone position, which involved placing a rolled cloth under the side of the head. Simultaneously, the baby's right or left arm and leg were positioned as if hugging the roll, while maintaining an almost prone (stomach-down) position. The baby's hands were flexed close to the mouth, and the feet were positioned near the stomach. Additionally, a second rolled cloth was wrapped around the legs in a "U" shape for support. In the control group, regular care was implemented. Data were analyzed using Independent T-Test. Ethical permission for this research was obtained from the Ethics Committee of the University of Muhammadiyah Jakarta Number: 0436/F.9-UMJ/IV/2023 at April 12th , 2023.

RESULTS

Table 1.
Demographic Characteristics of Preterm Baby (n= 32)

Gestation (week)	32.88±1.78	29-35	32.5±1.09	30-35	0.16
Chronological Age	34.13±0.34	34-35	33.52±0.54	33 - 35	0.09
Birth Weight	1936.88±446.51	1170-2480	1832.5±331.21	1240-2280	0.13
Newborn Weigh	1908.13±415.98	1190-2400	1891.25±319.04	1300-2300	0.11

Table 1, there are no statistically significant differences among the control and intervention groups (p-value > 0.005). However, the average gestational age is similar between groups, but in terms of chronological age, the intervention group is older compared to the control group. Regarding birth weight, infants in the intervention group (1936.88±446.51) are heavier than

those in the control group (1832.5±331.21). This trend is also observed in newborn weight, where infants in the intervention group (1908.13±415.98) weigh more than those in the control group (1891.25±319.04). In terms of gender, boys constitute 56.2% of the intervention group, whereas in the control group, girls make up 56.2%.

Table 2.
The difference of hemodynamic and sleep duration among intervention and control

Variables	t	Mean Diff	95% CI	p-value
Respiratory Rate				
Pre Day 1	0.21	0.44	-3.83 - 4.71	0.84
Post Day 3	14.34	16.63	24.26 - 28.99	0.00*
Heart Rate				
Pre Day 1	-1.79	-3.62	-7.75 - 0.49	0.08
Post Day 3	18.41	29.06	25.84 - 32.29	0.00*
Oxygen Saturation				
Pre Day 1	-1.62	-0.38	-0.85 - 0.09	0.11
Post Day 3	-8.89	-2.25	-2.27 - (-1.73)	0.00*
Sleep Duration				
Pre Day 1	-1.22	-0.31	-0.84 - 0.21	0.23
Post Day 3	-2.78	-0.75	-1.3 - (-0.19)	0.00*

Table 2 shows that there is a decrease of respiratory rate and heart rate among groups of intervention and control. In addition, there is a increase of oxygen saturation and sleep duration at those group. However, at intervention group show greater difference compared to control group. In Table 3 bivariate analysis, the higher mean difference appear in post-test at day 3 in respiratory rate and heart rate and lower difference expressed in oxygen saturation and sleep duration. This data indicate that infant hemodynamic more stable than before and longer sleep duration. From t-test, it can be seen that there is significant statistical difference among two group at post-test at all

Table 3.
The Effect of Quarter Prone on of hemodynamic and sleep duration

Variables	Intervention		Control	
	Mean±SD	Min-Max	Mean±SD	Min-Max
Respiratory Rate				
Pre Day 1	65.25±5.67	58 - 78	65.69±6.16	55 - 82
Post Day 3	45.75±3.55	40 - 52	62.38±2.98	59 - 72
Heart Rate				
Pre Day 1	164.44±6.24	158 - 176	160.81±5.12	152 - 172
Post Day 3	131.25±5.36	120 - 139	160.31±3.34	155 - 169
Oxygen Saturation				
Pre Day 1	95.13±0.72	94 - 96	94.75±0.58	94 - 96
Post Day 3	97.69±0.48	97 - 98	95.44±0.89	94 - 97
Sleep Duration				
Pre Day 1	15.44±0.81	14 - 16	15.13±0.62	14 - 16
Post Day 3	17.63±0.5	15 - 18	16.88±0.96	15 - 18

DISCUSSION

The results of this study similar with (Kuraesin, I., Sari, R. S., & Sari, F. R. (2021) that stated that all preterms babies had a gestational age of 29 – 36 weeks and the average age of premature babies is <37 weeks. The quarter prone position is highly recommended for premature babies because it optimally improves lung function compared to the supine position. The result of this study implemented quarter prone position shows the lower respiratory rate and heart indicate baby calmer. Regarding of this change, supported by Montgomery et al. (2014), who theorized advantages to the prone position by enhancing

synchronous movement of the chest and abdominal respiratory muscles. Additionally, positioning in the prone orientation maximizes ventilation distribution to the posterior lungs, facilitated by gravity pulling the tongue anteriorly, thereby improving airway patency and facilitating effective gas exchange in the lungs and body tissues. Furthermore, findings in this research align with Susanthy, M., & Rustina, Y (2022) which concludes that the prone position is more effective in enhancing physiological functions, improving sleep quality, and reducing stress levels in premature babies compared to the supine position.

Excessive lighting in the treatment room can overstimulate premature babies, leading to instability in their physiological functions. Prolonged exposure to excessive lighting may also contribute to retinopathy of prematurity (Utario, Y., Rustina, Y., & Waluyanti, F. T. (2017) . Research by previous study indicates that premature babies should ideally receive light intensity not exceeding 10 lux. Low-intensity light at this level has been statistically linked to decreased respiratory rate and increased oxygen saturation in prematurely born infants (Sari, I. Y., Prawesti, I., & Kusumawati, A. I. (2022). Premature babies with low birth weight require an environment that mimics the conditions of the womb to support their physiological needs. Exposing these infants to strong environmental stimuli, such as bright lighting, can lead to adverse effects on their health. These effects are evident in changes to their vital signs, including decreased oxygen saturation, increased pulse rate, and altered respiratory patterns. The NICU environment poses particular challenges for low birth weight (LBW) babies, characterized by noise and continuous strong lighting, which can disrupt their adaptation. Additionally, factors such as light, sound, electromagnetic fields, radiation, medications, and chemicals present potential hazards for infants in the NICU. The physical environment, encompassing light, temperature, sound, and radiation, thus becomes a critical factor that can impact the normal development of neonates (Lebel, V., Aita, M., Johnston, C., Héon, M., & Dupuis, F. (2017).

While conducting the research, researchers continued to focus on providing premature babies with the prone position, paying particular attention to factors concerning potential adverse outcomes for premature infants. Specifically, they emphasized maintaining a midline head position—either central or lateral—and raising the incubator head by 30° to prevent Intraventricular Hemorrhage (IVH).

CONCLUSION

This research on the quarter prone position represents an initial study in integrating it into nursing practices. Therefore, there is an opportunity for ongoing empirical testing of the quarter prone position's effectiveness. Evaluating the application of the quarter prone position could provide valuable data on enhancing baby comfort, stabilizing hemodynamic status, and improving sleep duration.

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