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Sulistiani Khusna
B.App.Sc. Nursing, Applied Bachelor Study Program Banjarmasin Ministry of Health Politechnic, Indonesia
NICU Room Nurses Regional Hospital, Indonesia

Agustine Ramie
Associate Professor, Department of Child Nursing, Applied Bachelor Study Program, Banjarmasin Ministry of Health Polytechnic, Indonesia

Evy Marlinda
Assistant Professor, Department of Child Nursing, Applied Bachelor Study Program, Banjarmasin Ministry of Health Polytechnic, Indonesia

Corresponding Author:
Agustine Ramie
Associate Professor, Department of Child Nursing, Applied Bachelor Study Program, Banjarmasin Ministry of Health Polytechnic, Indonesia

The effect of nesting on the physiological responses of premature infants in a regional hospital in south Kalimantan Indonesia

Sulistiani Khusna, Agustine Ramie and Evy Marlinda

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Abstract
Premature infants are prone to have the instability issues, in terms of physiological factors, including body temperature, heart rate, respiratory rate, and oxygen saturation. Nesting is one of the developmental care strategies with an aim to support the stability of infant's physiological functions. This study aims to determine the effects of nesting on the physiological responses in premature infants at the Regional General Hospital in Banjarbaru City, South Kalimantan, Indonesia. This study used a quantitative method with a pre-experimental approach, specifically a one-group pretest-posttest design, and was analyzed using the Paired T-Test. The average physiological response measurements before the nesting were body temperature at 36.32 °C, respiratory rate of 51.7 breaths per minute, oxygen saturation of 96.62%, and heart rate of 137.75 beats per minute. The average physiological response measurements after the nesting were body temperature at 36.62 °C, respiratory rate of 48.29 breaths per minute, oxygen saturation of 97.56%, and heart rate of 136 beats per minute. This study concludes that the use of nesting affects the infant's body temperature, respiratory rate, and oxygen saturation, but there is no effect on the heart rate.

Keywords: Premature infant, physiological responses, nesting

Introduction
Indonesia is ranked fifth worldwide in the number of preterm birth cases [1]. A premature infant is defined as one born before 37 weeks of gestation [2]. Premature infants are vulnerable to the instability, in terms of physiological factors, including body temperature, respiratory rate, oxygen saturation, and heart rate. Nesting is one of the developmental care strategies with an aim of providing a comfortable environment, limiting excessive infant movement, supporting physiological stability, and supporting motor development. Nesting can be implemented by putting a rolled cloth in a circular shape under the sheet, allowing the infant to maintain a flexed posture in the supine, prone, or lateral position.
Several studies from various countries have shown that proper positioning of premature infants can improve their lung function, reduce stress and distress, enhance postural accuracy, support the development of autonomic functions, reduce gastroesophageal reflux, and improve their sleep quality [3]. Monitoring the physiological responses of premature infants before and after the nesting is essential to quickly identify any issues the infant may have. This action allows for quick evaluation of the accuracy in nesting arrangement and positioning, considering the indications and contraindications related to the infant's condition.

Objective
This study aims to determine the effects of nesting on the physiological responses of premature infants in a Regional Hospital in South Kalimantan, Indonesia

Hypothesis
The study hypothesis was tested at a significance level of 0.05.
H_a: The use of nesting affects the physiological responses (body temperature, respiratory rate, oxygen saturation, and heart rate) of premature infants.
H_o: The use of nesting has no effect on the physiological responses (body temperature, respiratory rate, oxygen saturation, and heart rate) of premature infants.

Material and method

This study was a quantitative study using a pre-experimental approach with a one-group pretest-posttest design.

Study setting

All premature infants treated from September 20, 2024 to October 30, 2024, at the Regional General Hospital of Banjarbaru City, South Kalimantan, Indonesia, were included in the study population.

Study sample and sample size

This study was conducted by including all population members, totaling 24 premature infants, while considering the inclusion and exclusion criteria.

Criteria for sample selection

Inclusion Criteria

- Premature infants with a gestational age of 28-37 weeks;
- Infants weighing over 1,000 grams; and
- Infants whose mothers are willing to participate.

Exclusion criteria

Premature infants with congenital abnormalities.

Data collection tool

The data collection tools in this study had two parts as follows:

Part 1: Demographic Characteristics of the Sample The demographic characteristics included gender, gestational age, medical diagnosis, birth weight, and weight at 1 day of age.

Part 2: Physiological Response Measurement Scale An observation format served for measuring body temperature, respiratory rate, oxygen saturation, and heart rate of the infant before and after the use of nesting.

Data collection method

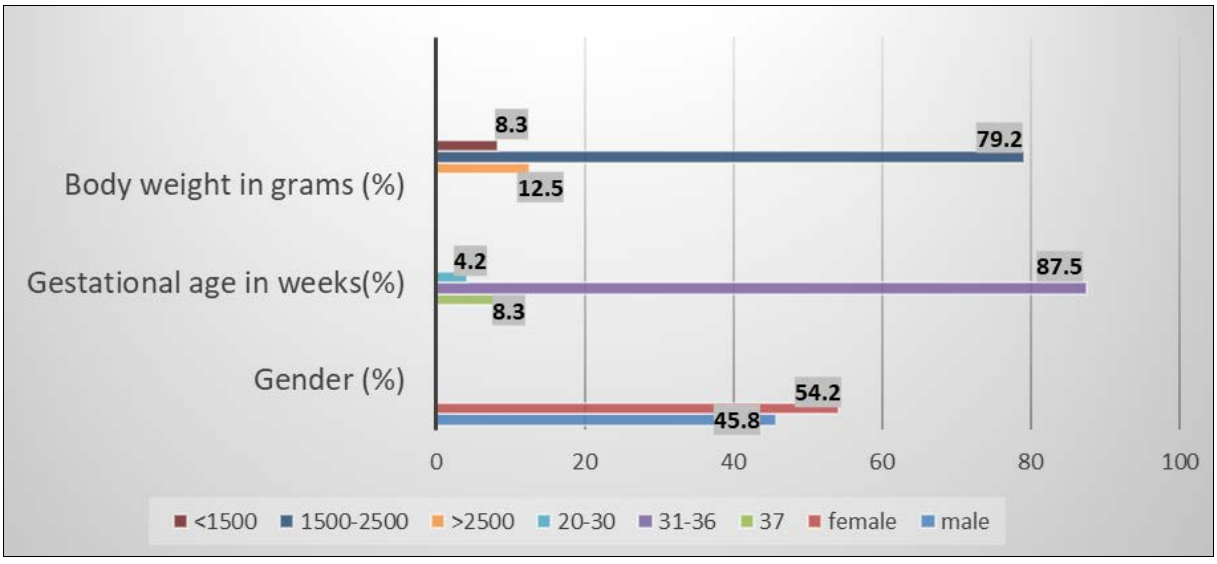
After obtaining institutional ethical approval from the Banjarmasin Ministry of Health Polytechnic with the number 852/KEPK-PKB/2024 and formal administrative approval from the Regional General Hospital and the Health Department of Banjarbaru City, South Kalimantan, the researchers provided an explanation prior to the study and the obtained written consent (the informed consent) from 24 parents (mothers of infants) who met the sample criteria. Data were collected through observation which was conducted twice for each sample. The first measurement was taken immediately after birth and 30 minutes after the nesting. The second measurement was taken the following day at 06:00 a.m. when the infant was without the nesting and 30 minutes after the use of nesting. To ensure an accurate timing of 30 minutes after the use of nesting, a countdown timer alarm was used.

Data analysis

In accordance with the objective of this study, the sample's characteristics and physiological responses were analyzed using the descriptive statistics (frequency, percentage, mean, and standard deviation). A normality test using the Shapiro-Wilk test was conducted to confirm the conformity of data with a normal distribution, followed by an inferential data analysis using the Paired T-Test to determine the differences in physiological responses (body temperature, respiratory rate, oxygen saturation, and heart rate) of premature infants before and after the use of nesting.

Results

Sample Characteristics Data



Graph 1: Sample Characteristics

Test of Differences in Physiological Responses before and after Nesting

Table 1: Analysis Results of Differences in Physiological Responses before and after Nesting

No.	Physiological Response	Before Nesting					After Nesting				
		Mean	Median	Standard deviation	Min-max	95% CI	Mean	Median	Standard deviation	Min-max	95% CI
1	Body temperature	36.32	36.35	0.23402	35.8 - 36.8	36.22 - 36.42	36.62	36.65	0.14812	36.3 - 36.8	36.56 - 36.68
2	Respiratory rate	51.7	51.25	6.12	40.5 - 63.5	49.12 -54.29	48.29	47.5	5.61	39.5 - 61.0	45.92 - 50.66
3	Oxygen Saturation	96.62	97	1.62	94 - 99	95.93 -97.31	97.56	97.75	1.44	94 - 99.5	96.95 - 98.18
4	Heart rate	137.75	139.0	12.03	119 - 167.5	132.67 - 142.83	136	135.75	10.43	115 - 159	131.6 - 140.4

Table 1 shows differences in the physiological responses of premature infants, including body temperature, respiratory rate, oxygen saturation, and heart rate, before and after the use of nesting.

Table 2: Statistical Test of Differences in Physiological Responses before and after Nesting

Physiological Response	Mean	Std deviation	Std. error mean	95% confidence interval of the difference		t	df	Sig. (2-tailed)
				Lower	Upper			
Body temperature before and after nesting	-0.3000	0.21059	0.04299	-0.38892	-0.21108	-6.979	23	0.000
Respiratory rate before and after nesting	3.41667	5.34600	1.09125	1.15925	5.67408	3.131	23	0.005
Oxygen saturation before and after nesting	-0.9375	1.64391	0.33556	-1.63166	-0.24334	-2.794	23	0.01
Heart rate before and after nesting	1.7500	9.38778	1.91627	-2.21411	5.71411	0.913	23	0.371

Table 2 shows the differences in the average physiological responses of premature infants (body temperature, respiratory rate, oxygen saturation, and heart rate) before and after the use of nesting. The results of the Paired T-Test indicated a significant difference (p<0.05) in physiological responses, specifically in body temperature, respiratory rate, and oxygen saturation. However, heart rate showed no significant difference, with a p-value greater than 0.05.

Discussion

This study found differences in physiological responses before the use of nesting, with an average body temperature of 36.32 °C, a respiratory rate of 51.7 breaths per minute, and an oxygen saturation of 96.62%. After the use of nesting, there was a change in the average values, with body temperature increasing to 36.62 °C, respiratory rate decreasing to 48.29 breaths per minute, and oxygen saturation increasing to 97.56%. However, heart rate only showed a slight decrease in the average value from 137.75 beats per minute to 136 beats per minute. The use of nesting in premature infants, which promoted a flexed posture, played a crucial role in enhancing body temperature stability.

Minimizing the infant's body surface exposure to the surrounding environment, through a flexed posture during the nesting, helped the reduction of heat loss through conduction and convection, allowing for preserving a more stable body temperature [4, 5]. When an infant was in a flexed position, there was an increase in blood circulation to the periphery and the brain, which helped the distribution of warmth throughout the body [5, 6]. The flexed position also reduced the metabolic demands of premature infants, further supporting better temperature stability [6]. This posture mimicked the fetal position in the womb, which was crucial for the neuromuscular development. Nesting in a flexed position provided comfort for the infants, improved sleep quality, and reduced stress levels, leading to a lower cortisol production, which positively affected their thermoregulation stability [5].

In this study, infants were positioned in a right physiological lateral flexion posture, which provided a sense of calm and comfort. The right lateral position, combined with the use of nesting, can be an effective alternative for maintaining the respiratory rate of premature infants, particularly in reducing the risk of gastroesophageal reflux (GER). Premature infants placed in the right lateral position exhibited lower respiratory rates and higher oxygen saturation levels, compared to those positioned supine [7].

The nesting allowed for maintaining premature infants in a more physiological posture, specifically a flexed position, including a right physiological lateral flexion [4]. The right lateral position enhanced the lung's function, thereby improving oxygen's saturation levels [8]. The right lung has a larger volume for consisting of three lobes, while the left lung has only two lobes. This results in a greater surface area for the gas exchange, leading to the increased oxygen saturation when infants are in the right lateral position. In contrast, in the left lateral position, the heart and mediastinum may exert pressure on the left lung, potentially impairing its function and reducing oxygen saturation levels [9].

In this study, heart rate did not show a significant difference, possibly due to a combination of several factors, including the immature functional condition of premature infants, respiratory instability in some respondents caused by asphyxia, and the infants' adaptive ability to the new environment, in relation to the 30-minute duration after the nesting application. Differences in respondents' health conditions and duration of the nesting use may yield the varying results.

The nesting has been proven to increase total sleep duration and quiet sleep time, which are crucial for recovery and physiological stability in the premature infants (10). Improved sleep quality can enhance autonomic regulation, leading to a more stable heart rate. The nesting has been associated with lower heart rates [11]. However, nesting is not the sole factor to affect the changes in heart rate. Several factors can affect heart rate during the nesting, including the infant's physiological condition, body position within the nest, the ongoing nursing and medical interventions, and nutritional status.

The nesting is a completely safe nursing procedure and a

non-medical intervention that supports brain maturation and development [12, 13]. This technique improves and stabilizes physiological parameters in premature infants, particularly heart rate, respiratory rate, and oxygen saturation, while also facilitating deep sleep, enhancing comfort, and improving neurobehavioral organization. However, a strict monitoring is essential to ensure the proper positioning of each premature infant based on their individual condition.

Conclusions

Based on these findings, it can be concluded that the nesting has a significant effect on body temperature, respiratory rate, and oxygen saturation in the premature infants, despite not having any significant impact on heart rate. The flexed posture facilitated by the nesting plays a crucial role in enhancing the stability of body temperature in the premature infants by reducing heat loss, improving blood circulation, conserving energy, promoting neuromuscular development, and minimizing stress responses.

The right physiological lateral flexion position with the nesting enhances lung function, thereby increasing oxygen saturation and stabilizing respiratory rate. Changes in the heart rate, following the nesting application may appear minimal or statistically insignificant in certain experimental settings. However, in general, maintaining a physiological flexed position with the nesting is essential for ensuring the cardiorespiratory stability of premature infants. Therefore, these findings can be utilized by nurses in the neonatal care unit to improve the treatment of premature infants**.**

Conflict of Interest

There is no conflict of interest

Financial Relationships

Not available

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