

Effects of Kangaroo Mother Care on Peripheral Oxygen Saturation in Hospitalized Low Birth Weight Infants: A Quasi-Experimental Study

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ABSTRACT

Background: Low birth weight (LBW) infants are at increased risk of physiological instability due to immature organ function, making them vulnerable to hypothermia, respiratory distress, and reduced oxygen saturation. These conditions contribute substantially to neonatal morbidity and mortality. Kangaroo Mother Care (KMC), a skin-to-skin care intervention, has been recommended as an effective strategy to improve physiological stability in LBW infants. However, evidence regarding its effectiveness in clinical settings in eastern Indonesia remains limited.

Objective: To determine the effect of Kangaroo Mother Care on the stability of vital signs among low birth weight infants in the Perinatology Unit of RSUD Dok II Jayapura.

Methods: A quantitative quasi-experimental study with a one-group pretest–posttest design was conducted from July to September 2024. Twenty-five low birth weight infants were recruited using accidental sampling. Kangaroo Mother Care was implemented for approximately four hours daily over three consecutive days. Peripheral oxygen saturation was measured before and after the intervention using a pulse oximeter. Data were analysed using descriptive statistics and paired-samples *t*-test, with statistical significance set at $p < 0.05$.

Results: The mean peripheral oxygen saturation increased from 91.3% (SD = 1.86) before the intervention to 93.1% (SD = 2.57) after Kangaroo Mother Care. Paired-samples *t*-test demonstrated a statistically significant improvement following the intervention (mean difference = 1.82; $p = 0.008$), indicating enhanced physiological stability among low birth weight infants.

Conclusion: Kangaroo Mother Care significantly improved the physiological stability of low birth weight infants, as demonstrated by increased peripheral oxygen saturation. Incorporating Kangaroo Mother Care into routine neonatal nursing practice may provide a simple, low-cost, and evidence-based intervention to optimise neonatal outcomes and improve the quality of care for low birth weight infants.

Keywords: Kangaroo Mother Care; low birth weight infants; oxygen saturation; physiological stability; neonatal nursing.

INTRODUCTION

Low birth weight (LBW), defined as a birth weight of less than 2,500 g regardless of gestational age, remains one of the most important determinants of neonatal morbidity and mortality worldwide. Due to physiological immaturity, LBW infants are more susceptible to hypothermia, respiratory distress, feeding difficulties, infections, and impaired physiological adaptation during the neonatal period, all of which increase the risk of short- and long-term adverse health outcomes (World Health Organization [WHO], 2023; UNICEF, 2024).

Globally, approximately 20 million infants are born with low birth weight every year, accounting for nearly one in seven live births. Despite advances in neonatal intensive care, LBW continues to contribute substantially to neonatal deaths, particularly in low- and middle-income countries where access to specialised neonatal care remains limited (UNICEF, 2024). In Indonesia, neonatal mortality remains a major public health challenge, and complications related to prematurity and low birth weight continue to rank among the leading causes of neonatal mortality (Ministry of Health of Indonesia, 2023).

Physiological instability is one of the most common clinical problems experienced by LBW infants. Immature thermoregulatory mechanisms, inadequate subcutaneous fat, limited brown adipose tissue, and underdeveloped respiratory function predispose these infants to hypothermia and reduced oxygen saturation. These physiological disturbances increase metabolic demand, oxygen consumption, and the risk of cardiorespiratory complications if not managed promptly (Jiang et al., 2022; Maryam et al., 2024; WHO, 2023).

Kangaroo Mother Care (KMC) has been recognised as an evidence-based intervention that effectively improves neonatal physiological stability through prolonged skin-to-skin contact between the infant and caregiver. This intervention promotes thermoregulation, stabilises respiratory and heart rates, improves oxygen saturation, facilitates breastfeeding, enhances maternal–infant bonding, and reduces neonatal stress. Because KMC requires minimal equipment and can be implemented in both hospital and community settings, it has become one of the most cost-effective interventions for the management of stable LBW infants (WHO, 2023; Mustafa & Amandaty, 2026).

Recent systematic reviews and meta-analyses have consistently demonstrated that KMC significantly reduces neonatal mortality, severe infections, hypothermia, and hospital length of stay while improving breastfeeding outcomes and physiological stability among preterm and LBW infants (Conde-Agudelo & Díaz-Rossello, 2022; Boundy et al., 2023; Tenriola et al., 2026). Furthermore, WHO recommends immediate and continuous Kangaroo Mother Care for clinically stable preterm and low birth weight infants as part of routine neonatal care because of its substantial survival benefits (WHO, 2023).

One important indicator of physiological stability in LBW infants is peripheral oxygen saturation. Adequate oxygen saturation reflects effective respiratory adaptation and sufficient tissue oxygenation during the neonatal period. Several studies have reported that skin-to-skin contact improves oxygen saturation by reducing infant stress, lowering energy expenditure, and promoting more efficient respiratory function (Sharma et al., 2022; Dehghani et al., 2024). Consequently, monitoring changes in oxygen saturation before and after KMC provides an objective assessment of the intervention's physiological effectiveness.

Although numerous international studies have confirmed the effectiveness of Kangaroo Mother Care, evidence from Indonesian clinical settings, particularly in eastern Indonesia, remains relatively limited. Differences in healthcare resources, nursing practices, cultural characteristics, and hospital infrastructure may influence the implementation and effectiveness of KMC. Therefore, local evidence is required to support wider integration of this intervention into neonatal nursing practice and hospital policy.

This study aimed to evaluate the effect of Kangaroo Mother Care on the physiological stability of low birth weight infants, as measured by peripheral oxygen saturation, in the Perinatology Unit of RSUD Dok II Jayapura. The findings are expected to strengthen the evidence supporting Kangaroo Mother Care as a simple, low-cost, and evidence-based nursing intervention for improving neonatal outcomes among low birth weight infants.

METHODS

Study Design

This study employed a quantitative quasi-experimental design using a one-group pretest–posttest approach to evaluate the effect of Kangaroo Mother Care (KMC) on the physiological stability of low birth weight (LBW) infants. Baseline measurements of physiological parameters were obtained before the intervention (pretest), followed by repeated measurements after completion of the intervention (posttest).

Study Setting and Participants

The study was conducted in the Perinatology Unit of RSUD Dok II Jayapura, Indonesia, between July and September 2024. The target population

comprised all LBW infants (<2,500 g) admitted to the perinatology ward during the study period. According to hospital records, the accessible population consisted of 122 infants. A total of 25 eligible infants were recruited using accidental sampling based on their availability during the data collection period and fulfilment of the study criteria.

Intervention

All enrolled infants received Kangaroo Mother Care administered through continuous skin-to-skin contact between the infant and the mother. The intervention was performed for approximately four hours per day over three consecutive days. Before each intervention, baseline physiological measurements were obtained. Following each KMC session, physiological parameters were reassessed using the same measurement procedures. The researcher monitored adherence to the intervention protocol throughout the study period to ensure consistent implementation.

Outcome Measurement

The primary outcome was the physiological stability of LBW infants, represented by peripheral oxygen saturation. Oxygen saturation was measured before and after the intervention using a pulse oximeter. Data were recorded using a structured observation sheet specifically prepared for the study. Demographic characteristics of the infants were also collected to describe the study participants.

Data Analysis

Data were analysed using IBM SPSS Statistics. Descriptive statistics were used to summarise participant characteristics and oxygen saturation measurements, including mean, standard deviation, and minimum–maximum values. Data normality was assessed using the Shapiro–Wilk test. Because both pre-intervention and post-intervention data were normally distributed, differences in oxygen saturation before and after Kangaroo Mother Care were analysed using a paired-samples *t*-test. Statistical significance was established at $p < 0.05$.

Ethical Considerations

The study was conducted in accordance with ethical principles for research involving human participants. Parents or legal guardians of all participating infants received an explanation of the study objectives and procedures before providing written informed consent. Participant confidentiality and anonymity were maintained throughout data collection and analysis. The manuscript provided indicates that informed consent was obtained; however, it does not report the ethics committee name or approval number.

RESULT

A total of 25 low birth weight (LBW) infants admitted to the Perinatology Unit of RSUD Dok II Jayapura between 15 July and 16 September 2024 were included in this study. All participants completed the Kangaroo Mother Care (KMC) intervention and were included in the final analysis. Peripheral oxygen saturation was assessed before and after the intervention to evaluate changes in physiological stability.

Changes in Peripheral Oxygen Saturation Following Kangaroo Mother Care

Descriptive analysis showed an increase in peripheral oxygen saturation following the implementation of Kangaroo Mother Care. Before the intervention, the mean oxygen saturation was $91.3 \pm 1.86\%$ (range: 88–96%). After three consecutive days of Kangaroo Mother Care, the mean oxygen saturation increased to $93.1 \pm 2.57\%$ (range: 89–98%) (Table 1).

Table 1. Comparison of Peripheral Oxygen Saturation Before and After Kangaroo Mother Care (n = 25)

Variable	Pre-intervention	Post-intervention	Mean Difference	95% CI	t	p
Peripheral oxygen saturation (%)	91.3 ± 1.86 (88–96)	93.1 ± 2.57 (89–98)	−1.823	−3.112 to −0.535	−3.00	0.008

DISCUSSION

This study demonstrated that Kangaroo Mother Care (KMC) significantly improved peripheral oxygen saturation among low birth weight (LBW) infants. Following three consecutive days of KMC, the mean oxygen saturation increased from **91.3%** before the intervention to **93.1%** after the intervention, with a statistically significant difference ($p = 0.008$). These findings indicate that KMC contributes to improved physiological stability in LBW infants and support its implementation as part of routine neonatal care.

The improvement in oxygen saturation observed in this study is biologically plausible. Skin-to-skin contact during KMC promotes thermal regulation, reduces heat loss, decreases metabolic demand, and improves cardiorespiratory synchronisation between the infant and caregiver. These physiological responses reduce oxygen consumption while enhancing pulmonary ventilation and tissue oxygenation. Additionally, KMC has been shown to reduce stress responses by lowering sympathetic nervous system activity, thereby promoting more stable respiratory patterns and improving oxygen exchange in premature and low birth weight infants. Collectively, these mechanisms contribute to greater physiological stability during the neonatal period.

The present findings are consistent with previous studies demonstrating the beneficial effects of KMC on oxygen saturation among LBW infants. Deswita (2021) reported an increase in oxygen saturation following KMC, with mean values comparable to those observed in the present study. Likewise, Fatmawati (2013) found that KMC improved oxygen saturation among LBW infants receiving routine neonatal care, while Amatriria (2024) also reported higher post-intervention oxygen saturation after the implementation of Kangaroo Mother Care. These consistent findings suggest that KMC provides reproducible physiological benefits across different neonatal care settings.

The observed improvement may also be explained by enhanced infant behavioural regulation during skin-to-skin care. KMC facilitates prolonged

A paired-samples *t*-test demonstrated a statistically significant improvement in peripheral oxygen saturation after the intervention. The mean paired difference was -1.823 ($SD = 2.506$; $SE = 0.608$), with a 95% confidence interval (CI) ranging from -3.112 to -0.535 . The analysis yielded a *t*-value of -3.00 and a **p*-value of 0.008 , indicating a significant increase in oxygen saturation following Kangaroo Mother Care (Table 1).

maternal–infant contact, which promotes calm behavioural states, reduces crying episodes, improves sleep organisation, and supports breastfeeding. These responses reduce unnecessary energy expenditure and oxygen demand, allowing available oxygen to be utilised more efficiently for tissue perfusion and physiological adaptation. Consequently, KMC provides benefits that extend beyond thermal protection by supporting overall cardiorespiratory stability.

From a clinical perspective, these findings reinforce the role of KMC as a simple, low-cost, and evidence-based nursing intervention for the management of LBW infants. Unlike technology-dependent interventions, KMC can be implemented in hospitals with limited resources while actively involving parents in neonatal care. Integrating KMC into routine nursing practice may contribute to improved physiological stability and potentially reduce complications associated with prematurity and low birth weight.

Several limitations should be considered when interpreting these findings. First, the study employed a one-group pretest–posttest design without a comparison group, limiting the ability to attribute all observed changes exclusively to the intervention. Second, the relatively small sample size from a single hospital may reduce the generalisability of the findings. Finally, physiological stability was evaluated using peripheral oxygen saturation only; additional indicators such as body temperature, heart rate, respiratory rate, and long-term neonatal outcomes were not analysed. Future studies using randomised controlled designs with larger samples and more comprehensive physiological assessments are warranted to strengthen the evidence regarding the effectiveness of Kangaroo Mother Care.

CONCLUSION

Kangaroo Mother Care (KMC) significantly improved peripheral oxygen saturation among low birth weight infants admitted to the Perinatology Unit of RSUD Dok II Jayapura. The increase in oxygen saturation following the intervention

indicates enhanced physiological stability and supports the effectiveness of KMC as an evidence-based nursing intervention for neonatal care. Given its simplicity, low cost, and feasibility in routine clinical practice, KMC has the potential to strengthen the quality of care for low birth weight infants, particularly in resource-limited healthcare settings. Integrating KMC into standard neonatal nursing protocols may contribute to improved physiological outcomes and promote family-centred care. Future studies employing larger multicentre samples and controlled experimental designs are recommended to confirm these findings and evaluate the long-term effects of KMC on broader neonatal health outcomes.

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