

Weight Gain Following Kangaroo Mother Care in Low Birth Weight Infants at Bayu Asih General HospitalFitri Rahmawati¹, Rudi Karmi¹, Damai Yanti¹¹STIKes Budhi Luhur Cimahi, Indonesia**ABSTRACT**

Kangaroo Mother Care (KMC) supports thermoregulation, breastfeeding, and physiological adaptation in low birth weight (LBW) infants. This study evaluated changes in body weight following a seven-day KMC program in the Neonatal Unit of Bayu Asih General Hospital, Purwakarta, from January to February 2026. A pre-experimental one-group pretest-posttest design was used with total sampling of 15 stable LBW infants. Most infants were born at 35 or 36 weeks of gestation (5 infants [33.3%] in each gestational age group). Mothers performed nurse-supervised KMC for 1–2 hours daily. Infant body weight was measured using a calibrated digital scale before the intervention and on day 7. The mean baseline body weight was $1,625.0 \pm 152.4$ g, with a median of 1,550 g. After KMC, the mean body weight increased to $1,805.3 \pm 169.9$ g, with a median of 1,725 g. The mean weight gain was 180.3 g, the median difference was 175 g, the relative increase was 11.3%, and the average daily weight gain was approximately 25 g/day. The Wilcoxon signed-rank test demonstrated a statistically significant difference between pre- and post-intervention body weight ($p = 0.001$). An exact paired 95% confidence interval and rank-based effect size could not be calculated because the retained analysis output did not include the standard deviation of the paired differences or the Wilcoxon Z statistic. Kangaroo Mother Care was associated with short-term body weight gain in stable LBW infants. However, causal interpretation should be made cautiously because of the absence of a control group and the potential influence of unmeasured feeding practices and other co-interventions.

Keywords: kangaroo mother care, low birth weight infants, weight gain

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INTRODUCTION

Low birth weight (LBW) is defined as a birth weight below 2,500 g regardless of gestational age. LBW infants are vulnerable to hypothermia, infection, respiratory instability, feeding difficulties, impaired growth, and neonatal mortality because of physiological immaturity and limited metabolic reserves (Okwaraji et al., 2024; Irawan et al., 2024). The World Health Organization (WHO) recommends Kangaroo Mother Care (KMC), which consists of prolonged skin-to-skin contact and support for breast milk feeding, as a core intervention for preterm or LBW infants (WHO, 2022; WHO, 2025).

From the perspective of Callista Roy's Adaptation Model, the infant is an adaptive system responding to focal and contextual stimuli. The abrupt transition from the intrauterine to the extrauterine environment is particularly demanding for LBW infants because of immature thermoregulation and limited brown adipose tissue. Hypothermia increases metabolic energy expenditure, thereby reducing the energy available for growth. KMC provides a positive environmental stimulus through maternal warmth, containment, tactile stimulation, and support for physiological stability (Aini, 2018; WHO, 2025).

Evidence from randomized trials and systematic reviews indicates that KMC reduces mortality and hypothermia while supporting breastfeeding and growth. Immediate KMC improved survival among LBW infants in a large multicenter trial, and recent systematic reviews have reported greater daily weight gain compared with conventional care (WHO Immediate KMC Study Group, 2021; Sivanandan & Sankar, 2023; Gong *et al.*, 2025). Skin-to-skin contact may also enhance maternal confidence, mother–infant bonding, breast milk production, and feeding continuity through neuroendocrine and behavioral mechanisms (Hutabarat & Aryaneta, 2019; Kurniawati *et al.*, 2020; Pranoto *et al.*, 2024).

Although the overall benefits of KMC are well established, its effectiveness may vary according to the daily duration of KMC, staff supervision, feeding adequacy, infant maturity, and the availability of neonatal care resources. Evidence is therefore still needed to evaluate how a short, intermittent, nurse-supervised KMC protocol performs in a regional hospital setting. To our knowledge, no previous unit-level evaluation of a standardized seven-day KMC protocol has been conducted in the Neonatal Unit of Bayu Asih General Hospital, Purwakarta. Therefore, this study evaluated changes in body weight following a seven-day KMC program consisting of 1–2 hours of daily skin-to-skin contact among clinically stable LBW infants. The study aimed to determine whether infant body weight differed before and after the seven-day KMC program.

METHODS

This study employed a pre-experimental one-group pretest-posttest design. The study was conducted in the Neonatal Unit of Bayu Asih General Hospital, Purwakarta, Indonesia, from January to February 2026.

The study population comprised all low birth weight (LBW) infants hospitalized during the study period. Total sampling was used, and no *a priori* sample size calculation was performed because all infants who met the eligibility criteria within the fixed recruitment period were included. A total of 15 infants were enrolled. The inclusion criteria were a birth weight of 1,500 g to less than 2,500 g, preterm birth, hemodynamic and cardiorespiratory stability, no requirement for respiratory support, and exclusive breastfeeding. Infants were excluded if they did not meet these stability and feeding criteria or did not complete the seven-day intervention and measurement protocol.

Mothers performed Kangaroo Mother Care (KMC) after receiving bedside instruction and a supervised demonstration from neonatal nurses. During each session, the infant wore only a diaper and cap and was positioned upright between the mother's breasts in direct skin-to-skin contact. The infant was then secured and covered to maintain warmth. KMC was performed for 1–2 hours once daily for seven consecutive days. Nurses supervised infant positioning, provided technical guidance, and documented session completion and duration using a daily adherence checklist.

Body weight was measured using a calibrated digital infant scale. Measurements were performed by a designated nurse or researcher at approximately the same time each day, preferably before feeding, with the infant wearing minimal clothing or only a dry diaper. The retained records did not confirm whether the same individual performed every measurement or whether the scale was recalibrated daily; therefore, these factors were considered potential

measurement limitations. All infants received exclusive breastfeeding; however, breast milk volume and feeding frequency were not quantified. In addition, concurrent routine neonatal care was not experimentally standardized or included as a covariate in the analysis.

Participant characteristics were summarized using frequencies and percentages. Body weight was summarized as the mean $\pm$ standard deviation and median (minimum–maximum). The Shapiro–Wilk test indicated that the data were not normally distributed ($p < 0.05$); therefore, paired pre- and post-intervention body weights were compared using the Wilcoxon signed-rank test with a significance level of $p < 0.05$. The retained statistical output included the p -value but did not include the Wilcoxon Z statistic or the standard deviation of the paired differences. Consequently, an exact rank-based effect size and paired 95% confidence interval could not be calculated without the original paired dataset or complete statistical output.

Ethical approval was obtained from the Health Research Ethics Committee of STIKes Budi Luhur Cimahi (No. 08/D/KEPK-STIKes/I/2026) before data collection. Written informed consent was obtained from each participating mother, parent, or legal guardian.

RESULTS

Fifteen low birth weight (LBW) infants completed the seven-day Kangaroo Mother Care (KMC) program. The available participant characteristics are summarized in Table 1.

Table 1. Selected Characteristics of LBW Infants and Mothers

Characteristic	Category	n (%)
Postnatal age	11 days	4 (26.7)
	Other ages	11 (73.3)
Maternal age	20-35 years	9 (60.0)
	<20 or >35 years	6 (40.0)
Gestational age	35 weeks	5 (33.3)
	36 weeks	5 (33.3)
	Other gestational ages	5 (33.3)

Body weight increased after the intervention. Table 2 presents the pre-post distributions, absolute and relative changes, and the paired test result.

Table 2. Body Weight Before and After Seven Days of KMC

Measure	Before KMC	After KMC	Change / test result
n	15	15	-
Median (minimum-maximum), g	1,550 (1,500-2,000)	1,725 (1,670-2,300)	+175 g*
Mean $\pm$ SD, g	1,625.0 $\pm$ 152.4	1,805.3 $\pm$ 169.9	+180.3 g**
Relative increase	-	-	11.3%
Average daily gain	-	-	25.0 g/day
Wilcoxon Signed Rank Test	-	-	p = 0.001
Paired 95% confidence interval	-	-	Not estimable***
Rank-based effect size	-	-	Not estimable***

*Difference between medians. ** Difference between means, equivalent to the mean paired change because the same 15 infants were measured twice. *** The retained output did not include the paired-difference variance or Wilcoxon Z statistic.

The Wilcoxon signed-rank test demonstrated a statistically significant difference in infant body weight before and after the seven-day KMC program (p = 0.001). Because the study employed a one-group pretest-posttest design without a control group, the observed improvement should be interpreted as an association with the intervention period rather than definitive evidence of a causal effect.

DISCUSSION

The median body weight increased from 1,550 g to 1,725 g after seven consecutive days of KMC, and the Wilcoxon test showed a statistically significant pre-post difference. The observed gain of approximately 25 g/day corresponds to about 15.4 g/kg/day when calculated from the mean baseline weight of 1,625 g. This represents steady short-term growth in a clinically vulnerable population and is consistent with the importance of adequate nutritional support for preterm and LBW infants (Embleton *et al.*, 2023).

The finding is biologically plausible within Callista Roy's Adaptation Model. KMC functions as a supportive focal stimulus that improves the infant's capacity to adapt to the extrauterine environment. Direct skin-to-skin contact transfers maternal heat and may reduce the metabolic demands of thermoregulation. When temperature and cardiorespiratory stability are maintained, a greater proportion of available energy can support tissue growth rather than heat production (Aini, 2018; WHO, 2025).

KMC may also promote growth through nutritional and behavioral pathways. Close skin-to-skin contact can facilitate breastfeeding cues, maternal oxytocin and prolactin responses, milk ejection, maternal confidence, infant comfort, reduced crying, and more stable sleep. These mechanisms may improve energy intake and reduce unnecessary energy expenditure, although milk volume was not measured in the present study (Hutabarat & Aryaneta, 2019; Kurniawati *et al.*, 2020; Pranoto *et al.*, 2024).

The observed absolute gain of 25 g/day was lower than the 30.2 g/day reported by Herawati and Anggraini (2020). A plausible explanation is that the present protocol provided KMC for only 1–2 hours per day, whereas weight gain may vary according to the duration of KMC exposure, baseline maturity, feeding adequacy, and the infant's clinical condition. Conversely, the recent

meta-analysis by Gong *et al.* (2025) reported an incremental advantage of 4.52 g/day for KMC compared with conventional care. That estimate is not directly comparable with the present 25 g/day because the meta-analysis quantified the between-group treatment effect, whereas this study reported absolute within-group growth over time. This distinction reinforces the need to avoid interpreting the observed pre-post change as the isolated causal effect of KMC.

The results are consistent with Indonesian studies reporting improved temperature stability, physiological function, breastfeeding support, and body weight during KMC (Siswanti *et al.*, 2023; Irawan *et al.*, 2024; Novita *et al.*, 2024; Dewi *et al.*, 2025). Nevertheless, variation across studies is expected because protocols differ in KMC duration, initiation time, maternal participation, feeding practices, gestational age, baseline birth weight, and hospital resources. Therefore, the present study contributes local implementation evidence for a short, nurse-supervised seven-day KMC protocol rather than establishing a universal estimate of treatment effect.

Several limitations require cautious interpretation. The sample was small and was drawn from a single neonatal unit during a fixed two-month study period. The one-group pretest-posttest design could not distinguish KMC-associated changes from natural postnatal growth, exclusive breastfeeding, routine neonatal care, or improvements in clinical stability. Breast milk volume, feeding frequency, and concurrent therapies were not quantified or controlled. Daily formal scale recalibration and the consistent use of the same assessor for body weight measurements were not fully documented. Finally, the archived statistical output did not retain the information required to calculate an exact paired 95% confidence interval or a rank-based effect size. Future studies should employ a controlled study design, standardize weighing procedures and co-interventions, quantify feeding intake, and retain complete paired-data outputs to enable more comprehensive statistical reporting.

CONCLUSION

A seven-day, nurse-supervised Kangaroo Mother Care (KMC) program was associated with a statistically significant increase in body weight among clinically stable low birth weight (LBW) infants in the Neonatal Unit of Bayu Asih General Hospital, Purwakarta. These findings support the potential clinical value and feasibility of implementing KMC as part of routine neonatal care in this setting. However, because the study employed a one-group pretest-posttest design without a comparison group and did not control for feeding and other concurrent interventions, the findings should be interpreted as an association rather than definitive evidence of a causal effect.

RECOMMENDATION

The neonatal unit is encouraged to implement Kangaroo Mother Care (KMC) using standardized protocols that include caregiver education, appropriate infant positioning, nursing supervision, adherence documentation, and standardized body weight measurement procedures. Future research should employ controlled study designs with larger sample sizes and longer follow-up periods while quantifying breast milk intake, standardizing concurrent neonatal care, and reporting complete paired confidence intervals and effect sizes to strengthen the quality and generalizability of the evidence.

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