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The effect of kangaroo mother care on weight gain in infants with low birth weight

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Abstract

Low Birth Weight (LBW) infants are newborns weighing less than 2,500 grams. Infants aged one month or younger, especially those with LBW, face high health risks that can be fatal without proper care. Kangaroo Mother Care (KMC) is a method of caring for low birth weight or premature infants through direct skin-to-skin contact between the mother and the baby, which has been proven to facilitate breastfeeding and improve infant outcomes. This study aimed to analyze the effectiveness of the KMC method on weight gain among low birth weight infants at Dr. Soedarso Regional General Hospital, Pontianak, West Kalimantan. A quasi-experimental design with a pretest-posttest approach was used, involving 40 mothers as respondents. Data were analyzed using a One-Way ANOVA test. The results showed that KMC performed for four hours resulted in a mean weight gain difference of 471.5 grams, with a statistically significant effect ($F = 10.476$; $p = 0.000$). It can be concluded that the Kangaroo Mother Care method is effective in increasing the body weight of low birth weight infants, with the four-hour duration providing the most optimal results.

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INTRODUCTION

Low birth weight (LBW) infants are newborns whose weight at birth is less than 2,500 grams. These neonates experience significant physiological transitions from intrauterine to extrauterine life and undergo maturation in nearly all organ systems. Infants aged up to one month, especially those with LBW, are among the groups most vulnerable to health complications, and without proper management, these conditions can be fatal (Kementerian Kesehatan Republik Indonesia, 2018). General management of LBW infants after birth includes maintaining normal body temperature, ensuring adequate fluid intake, and preventing infections. LBW infants are highly susceptible to hypothermia due to thin subcutaneous fat reserves and immature thermoregulation centers in the brain (Perez, Van der Meer, & Singer, 2019). One of the recommended interventions to maintain a stable body temperature is Kangaroo Mother Care (KMC), or skin-to-skin contact, in which the baby is continuously held against the mother's chest to maintain warmth and promote bonding (WHO, 2003).

The care of LBW infants is often complex and generally requires incubator treatment, which is costly and depends on the availability of trained health professionals. However, incubator facilities are frequently limited compared to the number of LBW infants requiring care. Several studies have demonstrated that KMC is not only an alternative to incubators but also provides benefits that incubator care cannot offer (IDAI, 2013; Halimah, & Surtiati, 2022). The KMC method, characterized by direct skin-to-skin contact between mother and infant, utilizes maternal body heat to regulate the infant's temperature and has been proven to facilitate breastfeeding, thereby improving both its duration and quantity (United Nations Children's Fund and World Health Organization, 2004). This approach is particularly beneficial for families with limited access to advanced healthcare facilities, as it is simple, cost-free, and feasible for mothers to perform independently (Hassan, Hussien, & Mahdi, 2024).

Globally, LBW remains a major public health issue. The World Health Organization (WHO) estimates that approximately 20 million babies are born each year with LBW, representing about 15.5% of all live births, with 95.6% of these cases occurring in developing countries. The incidence of LBW in developing nations (16.5%) is more than twice that in developed countries (7%), and LBW remains the leading contributor to neonatal mortality. Epidemiological data indicate that infants with LBW are about 20 times more likely to die than those with normal birth weight, accounting for a large portion of the four million annual neonatal deaths (UNICEF, 2023). In Indonesia, the prevalence of LBW ranges from 2% to 17.2% and contributes to 29.2% of neonatal mortality (AKN). The 2017 Indonesian Demographic and Health Survey (SDKI) reported an AKN of 15 per 1,000 live births, placing Indonesia eighth globally in neonatal mortality rates ((Kementerian Kesehatan Republik Indonesia, 2018).

Previous studies have highlighted the positive impact of KMC on infant growth and health outcomes. Research by Silvia et al. (2015) demonstrated a weight gain of 28.30 grams in infants receiving KMC, confirming its effect on improving LBW infant weight. Similarly, Wahyuni and Arifah found that LBW infants who received KMC for 2 hours gained an average of 32.14 grams, whereas those receiving KMC for 4 hours gained 167.86 grams. Statistical tests, including the Kolmogorov-Smirnov, Levene, and ANOVA analyses confirmed the significance of these findings ($p = 0.000$). Additional evidence from a meta-analysis across five countries indicated that skin-to-skin care (SSC) had a significant positive effect on exclusive breastfeeding duration during the first 3–4 months (Sharma, 2016). However, despite extensive studies on KMC, there remains no established standard regarding the optimal duration and timing of KMC application for maximum effectiveness in LBW infants (Muliani & Lisnawati, 2018; Handayani et al., 2021; Sivanandan & Sankar, 2023; Hassan, Hussien, & Mahdi, 2024; Dewi, Indarwati, & Sustieni, 2025).

Dr. Soedarso Regional General Hospital, as a top-tier referral hospital in West Kalimantan, has reported an increasing trend in LBW cases, from 21.93% in 2017 to 25.44% in 2018 (RSUD Dr. Soedarso, 2018). A preliminary study conducted in September 2018 identified 21 LBW cases, of which only 15 received KMC, while the hospital had only eight available incubators. This condition indicates a need for alternative methods such as KMC to enhance infant survival and promote weight gain through effective breastfeeding. Despite the known benefits of KMC, studies specifically examining its duration-related effectiveness on weight gain in LBW infants, particularly in the context of Dr. Soedarso Regional General Hospital, are still limited. Therefore, this study aims to analyze the effectiveness of the Kangaroo Mother Care (KMC) method on weight gain in low birth weight infants at Dr. Soedarso Regional General Hospital, Pontianak, West Kalimantan.

METHOD

This study employed a quasi-experimental design with a pretest-posttest approach to measure the effectiveness of the Kangaroo Mother Care (KMC) method based on the duration of its application among mothers who gave birth to low birth weight (LBW) infants. The duration of KMC was observed in two types of care: intermittent and continuous. These two groups were then compared to determine the difference in weight gain among LBW infants after receiving KMC treatment. The quasi-experimental approach was selected to allow observation of changes in the dependent variable (infant weight gain) following controlled variations in the independent variable (duration of KMC).

The study population consisted of all mothers who delivered LBW infants at Dr. Soedarso Regional General Hospital, Pontianak, West Kalimantan. The sample included at least 40 LBW cases that met the inclusion criteria, with 10 infants assigned to each duration group of KMC implementation. Data collection focused on infant weight measurements before and after KMC application to determine weight gain associated with different care durations. Statistical analysis was performed using a One-Way ANOVA test to identify significant differences in mean weight gain between the KMC duration groups, thereby assessing the effectiveness of the method in promoting weight gain among LBW infants.

RESULTS AND DISCUSSION

Table 1. Frequency Distribution of Mean Weight Gain in LBW infants during the implementation of KMC at Dr. Soedarso General Hospital in Pontianak.

Duration of KMC (in hours)	**Mean Weight Gain per Day (in kg)**							**Average increase per hour**
	4	**5**	**6**	**7**	**8**	**9**	**10**	
1	1.806.00	1.820.00	1.831.00	1.834.50	1.823.00	1.839.50	1.846.00	1.829
2	2.273.00	2.284.00	2.289.00	2.289.00	2.299.50	2.314.00	2.320.00	2.296
4	1.801.50	1.796.00	1.791.00	1.801.00	1.805.00	1.816.00	1.819.00	1.804
6	2.143.00	2.155.50	2.177.00	2.187.00	2.203.00	2.220.00	2.233.50	2.188
Average Weight gain per day	2006	2014	2022	2028	2033	2047	2055	2006

Table 1 shows that the results of the frequency distribution analysis indicate that the average weight gain in LBW infants in hours is greater at 2 hours of KMC (2296 grams) compared to 1, 4, and 6 hours of KMC. The average weight gain weight gain based on days shows that on day 10, the weight gain is greater (2055 grams).

Table 2. The results of the analysis using *One-Way ANOVA*.

(I) KMC Group by Hour	(J) KMC Group by Hour	Mean Difference (I-J)	F	p-value
1 hour	2 hours	467.000*	10.476	.000
	4 hours	4.500		
	6 hours	337.000*		
2 hours	1 hour	467.000*		
	4 hours	471.500*		
	6 hours	130.000		
4 hours	1 hour	4.500		
	2 hours	471.500*		
	6 hours	341.500*		
6 hours	1 hour	337.000*		
	2 hours	130.000		
	4 hours	341.500*		

Table 2 shows that the duration of KMC implementation based on hours indicates that the most significant mean difference is in the 4-hour KMC implementation, with a mean difference of 471.5. Thus, KMC implementation is more effective based on the F-value of 10.476 and p-value of 0.000.

Table 3. Effectiveness of KMC Duration on Weight Gain Based on Differences in Total Mean Values by Hour and Day in BBLR at Dr. Soedarso General Hospital.

Day	Mean Square	F	Sig
4	572.927.292	10.476	.000
5	593.607.292	10.617	.000
6	617.186.667	11.461	.000
7	607.910.625	11.254	.000
8	653.352.292	12.623	.000
9	658.782.292	12.975	.000
10	671.545.625	13.502	.000

Table 3 shows that the duration of KMC implementation based on days indicates that the most significant total mean is KMC implementation on day 10 (7 days), with a total mean of 671.545.625. Thus, KMC implementation is more effective based on the F-value of 13.502 and p-value of 0.000.

DISCUSSION

The results of the univariate analysis showed that the average weight gain in low birth weight (LBW) infants per hour indicated that the application of Kangaroo Mother Care (KMC) for two hours produced greater weight gain (2.296 grams) compared to KMC for one, four, or six hours. The average weight gain based on days also revealed that infants on the tenth day of KMC showed higher weight gain (2.055 grams). These findings align with previous studies suggesting that KMC should be initiated immediately after birth, either intermittently (for a minimum of one hour) or continuously (for 24 hours or longer). The timing and duration of KMC depend on the infant's behavioral response and the mother's physiological condition, with a minimum recommended duration of one hour. The application of KMC immediately after birth has been shown to positively affect breastfeeding duration and help maintain the infant's body temperature within a normal range (Hassan, Hussien, & Mahdi, 2024).

The neonatal period represents a critical phase in which optimal nutrition is essential for LBW infants to achieve adequate growth and development. LBW infants exhibit almost twice the growth rate per kilogram of body weight compared to full-term infants; thus, they require special and optimal nutritional management (Muliani, & Lisnawati, 2018). Due to limited nutrient reserves, unstable thermoregulation, immature organ function, and increased susceptibility to infections, these infants require careful nutritional and thermal support. Babies born prematurely with a birth weight above 2000 grams generally thrive on breast milk, while those below 2000 grams may require additional nutrients since breast milk alone may not meet their rapid growth demands.

The bivariate analysis results revealed that the most significant mean difference in weight gain was found in infants receiving KMC for four hours, with a mean difference of 471.5. Statistical analysis confirmed that KMC was effective, as indicated by an F-value of 10.476 and a p-value of 0.000. These findings are consistent with previous research demonstrating that KMC significantly improves growth and reduces morbidity in LBW infants. Furthermore, the KMC method is simple, cost-effective, and well accepted by mothers, allowing it to be continued at home (Sivanandan, & Sankar, 2023). Despite the proven benefits, there is still no universal standard regarding the most effective duration of KMC application for LBW infants. However, this method remains an affordable alternative to incubator care, significantly reducing the financial burden on both families and healthcare systems (Halimah, & Surtiati, 2022).

Nutritionally, the caloric content of breast milk for both full-term and premature infants is approximately 67 kcal/100 mL during the first 21 days of lactation. Formula milk with a similar density can be used for LBW infants, although formulas with higher concentrations (around 81 kcal/100 mL) are often preferred, as they deliver more calories in smaller volumes an advantage for infants with limited stomach capacity or fluid restrictions. Implementing an evidence-based feeding protocol allows infants to achieve full enteral feeding (~150–180 mL/kg/day) within approximately two weeks for those weighing 1000 grams and one week for infants weighing 1000–1500 grams. Rapid achievement of full enteral feeding helps reduce the need for vascular catheters, thereby minimizing sepsis and catheter-related complications (Dewi, Indarwati, & Sustieni, 2025).

The study also found that the duration of KMC implementation based on days showed the most significant total mean value on the tenth day (671,545.625), with an F-value of 13.502 and a p-value of 0.000. These findings are supported by Silvia, Putri, Gusnila (2015), who reported an average weight gain of 28.30 grams in LBW infants after receiving KMC. The infants who received KMC for two hours gained an average of 32.14 grams, while those who received KMC for four hours gained an average of 167.86 grams. Statistical analyses using Kolmogorov-Smirnov, Levene, and ANOVA tests confirmed that KMC had a significant effect on infant weight gain ($p = 0.000$). Furthermore, a meta-analysis by Sharma, (2016) from five different countries demonstrated that skin-to-skin contact (SSC) had a significant and positive impact on the success of exclusive breastfeeding during the first 3–4 months of life.

The infants weighing more than 1250 grams could be fed every three hours without significantly increasing the risk of food intolerance, apnea, hypoglycemia, or necrotizing enterocolitis (NEC), while reducing hospital stay duration. The timing, volume, and duration of feeding are recommended to begin with a minimum of 10–15 mL/kg/day during the first 24 hours of life. If breast milk or donor milk is unavailable within 24–48 hours, formula feeding may be considered, as early initiation of feeding did not show a significant increase in NEC incidence. Nevertheless, achieving full nutritional support in very low birth weight (VLBW) infants remains challenging due to immature gastrointestinal function, leading to energy and nutrient deficits during hospitalization and an increased risk of growth restriction (Perez, Van der Meer, & Singer, 2019).

Although the results of this study demonstrate that the KMC method is effective in increasing the weight of LBW infants, several limitations must be acknowledged. The study was conducted in a single hospital setting with a relatively small sample size, which may limit the generalizability of the findings. Moreover, potential confounding factors such as variations in maternal nutrition, breastfeeding frequency, and environmental temperature were not fully controlled. Future research should involve larger, multi-center studies and explore the long-term developmental outcomes of infants receiving KMC with different durations to establish standardized KMC protocols for optimal effectiveness.

CONCLUSION

It can be concluded that the Kangaroo Mother Care method is effective in increasing the body weight of low birth weight infants, with the four-hour duration providing the most optimal results.

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