

Original Article

Effectiveness of Hindmilk Feeding on Weight Gain Among Low-Birth-Weight Infants



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ABSTRACT

Background: Low Birth Weight (LBW) infants are at high risk of morbidity and growth problems. Hindmilk, which is rich in fat and calories, is proposed to improve weight gain, but evidence remains limited. This study examined the effect of hindmilk feeding on weight gain in LBW infants.

Methods: This pre-experiment design and was reported in accordance with the TREND guideline. A total of 15 LBW infants admitted to the Perinatology Unit of Malinau Hospital were recruited using purposive sampling. The independent variable was hindmilk feeding, while the dependent variable was infant weight gain. Data were collected using the Standardised Human Observation Sheet (SHOS) and analysed using the paired sample t-test.

Results: The findings showed a significant increase in infant body weight after the hindmilk intervention compared with baseline measurements. The mean body weight after intervention was higher than before intervention, with a statistically significant difference ($p = 0.001$). These results indicate that hindmilk feeding contributed positively to weight gain among LBW infants.

Conclusion: Hindmilk feeding significantly improved weight gain among LBW infants at Malinau Hospital. Therefore, hindmilk feeding may be recommended as an effective nutritional intervention for the management of LBW infants, particularly in resource-limited and remote healthcare settings.

Keywords: Low Birth Weight; Hindmilk; Weight Gain; Breastfeeding; Neonatal Nutrition.

Implications for Practice:

- Patient care: Implement hindmilk feeding education for mothers of low-birth-weight infants to enhance caloric intake and promote optimal weight gain.
- Clinical decisions: Encourage healthcare providers to prioritise and monitor hindmilk feeding practices as part of individualised nutrition management for vulnerable neonates.
- Healthcare policies: Integrate hindmilk feeding guidelines into hospital protocols and breastfeeding programs to standardise care

Implications for Practice:

and improve neonatal outcomes.

Introduction

Low birth weight (LBW) remains a major global public health concern, including in Indonesia. LBW infants are defined as newborns weighing less than 2,500 grams at birth, commonly resulting from preterm birth or intrauterine growth restriction. Infants born with LBW are at a substantially higher risk of developing

complications such as respiratory distress, hypothermia (body temperature $<35^{\circ}\text{C}$), hypoglycemia (blood glucose <70 mg/dL), infections, and gastrointestinal disorders that may impair growth and development.

Based on the Low Birth Weight Estimates, approximately 14–17% of newborns globally are classified as LBW, with projections indicating stagnation through 2025, affecting nearly 20 million infants annually ([World Health Organization, 2023](#)). Similarly, 15.5% of all live births worldwide in 2023 were LBW infants ([World Health Organization, 2022](#)). In Indonesia, the Ministry of Health reported an LBW prevalence of 10.5% in 2023, while the Basic Health Research Survey (*Riskesmas*) 2022 reported a prevalence of 10.2% ([Ministry of Health, 2022](#)). Without appropriate nutritional interventions, LBW infants are at increased risk of long-term growth failure, including stunting and delayed motor development, as well as serious medical complications such as sepsis and necrotizing enterocolitis ([Chilot et al., 2023](#); [Kim, 2025](#)). These conditions also contribute to increased healthcare costs due to prolonged hospitalization and intensive medical care ([Blencowe et al., 2019](#)).

Optimal nutritional management is a critical strategy to improve weight gain and clinical outcomes in LBW infants. One evidence-based nutritional approach is the administration of hindmilk, which is breast milk expressed at the end of a feeding session. Hindmilk contains 5–10% higher fat content than foremilk, providing a higher caloric density of approximately 22–24 kcal/oz, which is essential for meeting the elevated metabolic requirements of LBW infants ([Alshaikh et al., 2023](#); [Kim, 2025](#)). Clinical evidence demonstrated that regular hindmilk feeding resulted in 15–20% faster weight gain, with an average increase of 20–30 g/day compared to standard breastfeeding. Beyond its nutritional value,

hindmilk contains bioactive components with immunomodulatory properties, including immunoglobulin A (IgA), lactoferrin, and human milk oligosaccharides, which support immune system maturation and reduce infection risk in preterm infants ([Azhar et al., 2024](#); [Gandikota et al., 2024](#); [Parker et al., 2026](#)). Furthermore, [Hair et al., \(2022\)](#) reported improved neurodevelopmental outcomes at six months of age among LBW infants receiving exclusive hindmilk compared to controls. These findings highlight hindmilk as a comprehensive nutritional intervention supporting both somatic and neurological development.

Despite strong global evidence, challenges remain in optimizing weight gain during the critical neonatal period while ensuring safety appropriate to gestational age ([Wang et al., 2021](#)). The World Health Organization emphasizes that precise nutritional strategies during the first 1,000 days of life are crucial for long-term outcomes, particularly for LBW infants weighing less than 2,000 grams, who are at higher risk of permanent neurological impairment ([Bergner et al., 2020](#); [Saavedra & Dattilo, 2022](#)). Hindmilk is especially beneficial due to its higher concentration of long-chain polyunsaturated fatty acids (LC-PUFAs), which are essential for brain development ([Destailats et al., 2025](#); [Noreen et al., 2024](#)), and its ability to meet the recommended energy intake of 120–150 kcal/kg/day for LBW infants ([Alur et al., 2020](#)).

Preliminary data from Malinau Hospital, a regional referral hospital in North Kalimantan, indicated a 15% increase in LBW cases over the past three years, with neonatal mortality reaching 25% ([Dinas Kesehatan Kaltara, 2023](#)). Interviews with healthcare providers revealed an average of 14 LBW infants per month, with length of hospitalization largely dependent on weight gain and complication status. Infants

demonstrating consistent weight gain over three consecutive days, supported by hindmilk expression education and stable body temperature, were eligible for discharge. Interviews with mothers further suggested variability in weight gain outcomes depending on whether hindmilk separation was implemented. Although a cost-effectiveness analysis by [Kim \(2025\)](#) demonstrated that hindmilk intervention could reduce neonatal care costs by up to 30% in developing countries, similar studies remain scarce in Indonesia. Moreover, the recommendations regarding hindmilk have not been fully integrated into national neonatal care guidelines, particularly in regional and border-area hospitals ([World Health Organization, 2022](#)).

Despite these promising findings, important gaps remain in the current literature. Most studies evaluating hindmilk interventions have been conducted in tertiary hospitals or highly resourced neonatal intensive care settings where specialized nutritional support, standardized feeding protocols, and comprehensive breastfeeding assistance are readily available. Consequently, whether these findings can be generalized to hospitals operating under different healthcare conditions remains unclear. Evidence examining hindmilk feeding within regional, border, and remote healthcare settings remains limited, particularly in Indonesia. This gap is scientifically important because healthcare facilities in regional and remote areas often differ substantially from tertiary hospitals in terms of neonatal care infrastructure, availability of specialized healthcare personnel, breastfeeding support systems, maternal education, and nutritional management practices. Such differences may influence both the implementation and effectiveness of hindmilk interventions under real-world conditions. Therefore,

evidence from regional referral hospitals is needed to provide context-specific understanding regarding the applicability of hindmilk-based nutritional strategies in healthcare environments that are currently underrepresented in the literature.

Malinau Hospital serves as the main referral center for neonatal care in Malinau Regency, North Kalimantan. Understanding the impact of hindmilk feeding is therefore essential to inform context-specific nutritional strategies for LBW infants in this setting. Accordingly, this study aims to analyze the effect of hindmilk feeding on weight gain among low-birth-weight infants at Malinau Hospital. It is hypothesized that LBW infants receiving hindmilk feeding will demonstrate significantly greater weight gain compared to infants receiving standard breastfeeding care.

Methods

Study Design

This study employed a pre experiment design to evaluate the effect of hindmilk feeding on weight gain among low birth weight (LBW) infants. This study was selected because random allocation of hospitalized neonates was not feasible within the clinical care setting, and ethical considerations limited withholding nutritional support from eligible infants. In this design, participants were assessed before the intervention (pretest), received hindmilk feeding as the intervention, and were subsequently assessed after the intervention (posttest) to determine changes in weight gain.

Because weight gain among LBW infants may be influenced by multiple clinical and nutritional factors, including gestational age, feeding frequency, illness severity, hydration status, thermoregulation, maternal milk production, and concurrent nutritional care, relevant variables were documented and monitored throughout the study period

whenever feasible to characterize participants and reduce potential confounding effects. However, complete control of all influencing factors was not possible within the clinical setting. The study procedures and reporting were developed in accordance with the Transparent Reporting of Evaluations with Nonrandomized Designs (TREND) statement ([Haynes et al., 2021](#)).

Participants

The study was conducted in the Bougenville Ward of Malinau Hospital between May and June 2025. Participants consisted of 15 LBW infants recruited using purposive sampling based on predefined eligibility criteria. Sample size was determined according to the availability of eligible participants during the study period and the feasibility of recruitment within the hospital setting.

Inclusion criteria were: (1) infants with birth weight <2500 g, (2) receiving exclusive or predominant breastfeeding, (3) treated in level II neonatal care without respiratory support at 7 days of age, and (4) mothers willing to provide written informed consent. Exclusion criteria included major congenital anomalies, severe infections, malabsorption syndrome, or neonatal intensive care unit (NICU) treatment exceeding 7 days.

Eligible infants were identified through daily screening of inpatient medical records by the research team in collaboration with ward nurses. Parents or legal guardians of eligible infants received an explanation regarding study objectives, procedures, benefits, and risks before informed consent was obtained. Baseline characteristics potentially associated with infant weight gain, including gestational age, feeding status and frequency, neonatal clinical condition, and relevant comorbidities, were obtained from medical records and documented before intervention initiation.

All enrolled participants completed the intervention and follow-up period; therefore, no dropouts or missing outcome data occurred during the study.

Instruments

The instrument was used to systematically record study variables, including infant characteristics, clinical condition, feeding information, hindmilk feeding records, and serial body weight measurements. The observation sheet included demographic and clinical information routinely documented in hospital medical records, such as gestational age, sex, feeding status, and relevant neonatal clinical conditions.

The primary outcome variable was infant body weight before and after the hindmilk feeding intervention, measured in grams using calibrated neonatal digital scales routinely used in the neonatal ward. Hindmilk feeding data, including frequency and volume administered, were also recorded in daily monitoring forms.

Since the observation sheet was an established hospital-based clinical monitoring form used in routine clinical practice rather than a newly developed research instrument, additional validity and reliability testing by the researchers was not performed. The instrument was designed primarily for routine clinical monitoring and did not comprehensively capture all factors potentially influencing infant weight gain, such as thermoregulation status, hydration status, maternal milk production, or other concurrent nutritional variables. Therefore, these variables were not included in subsequent analyses.

Intervention

The intervention consisted of hindmilk feeding administered for three consecutive days. The intervention was based on the physiological rationale that hindmilk

contains higher fat and caloric content compared with foremilk, which may contribute to improved energy intake and weight gain among LBW infants.

Breast milk expression was performed by trained mothers under supervision of neonatal nurses. The initial 10–15 minutes of milk expression were discarded as foremilk, followed by an additional 10–15 minutes of expression from the same breast to obtain hindmilk. Hindmilk was administered three times daily at 08:00, 11:00, and 14:00. The volume administered was standardized according to the infant's daily fluid and nutritional requirements as determined by the attending pediatrician.

The control group received standard breastfeeding management routinely implemented in the ward without hindmilk separation. Intervention fidelity was monitored daily using an observation checklist completed by the supervising nurse to ensure adherence to the feeding schedule, milk expression procedure, and administration technique. Infants were monitored for potential adverse events including vomiting, abdominal distension, diarrhea, or feeding intolerance throughout the intervention period. No adverse events related to the intervention were identified.

Data Collection

Data collection was conducted in the Perinatology Unit of Malinau Hospital using both primary and secondary data sources. Primary data were collected through direct observation and anthropometric measurements, while secondary data were obtained from participants' medical records.

Participants were selected according to predefined inclusion and exclusion criteria. Mothers received an explanation regarding the study objectives and procedures, and written informed consent was obtained before participation. Baseline body weight measurements (pretest) were obtained and

recorded before the intervention using a digital infant scale. The researcher assisted mothers during the breast milk expression process. Milk expressed during the first 10–15 minutes was separated as foremilk, while milk expressed during the subsequent 10–15 minutes from the same breast was collected as hindmilk.

Hindmilk was administered according to the infant's nutritional requirements three times daily at 08:00, 11:00, and 14:00 for three consecutive days using a feeding tube or pipette depending on the infant's condition. The volume of hindmilk administered was measured using a sterile syringe with 1 mL accuracy and recorded in daily observation forms.

Following completion of the intervention period, post-intervention body weight measurements (posttest) were performed using the same digital infant scale to evaluate changes in infant body weight. To minimize measurement bias, standardized procedures for body weight measurement and data recording were applied consistently throughout the study. Data extracted from medical records were cross-checked for completeness and consistency, and all collected data underwent verification and quality control procedures before statistical analysis.

Data Analysis

Data were analyzed using SPSS version 26.0. Descriptive statistics were used to summarize participant characteristics and outcome variables. Normality testing was conducted using the Shapiro–Wilk test, demonstrating normal distribution for both pretest ($p = 0.184$) and posttest ($p = 0.253$) data.

The effectiveness of hindmilk feeding on infant weight gain was analyzed using a paired sample *t*-test with a significance level of $p < 0.05$ and 95% confidence interval (95% CI). Effect size was calculated using Cohen's *d* to determine the magnitude of

intervention effects. Due to the relatively small sample size and the limited availability of routinely collected clinical variables, adjustment using multivariable analysis was not feasible. Therefore, findings were interpreted cautiously while considering the potential influence of uncontrolled confounding factors.

Ethical Considerations

This study received ethical approval from the Health Research Ethics Committee of *Institut Teknologi Kesehatan dan Sains Wiyata Husada Samarinda* under approval number No. 97/ITKES-WHS/KEPK/EC/2025. Ethical approval was valid from August 07, 2025 to August 07, 2026. The study was conducted in accordance with the ethical principles of the Declaration of Helsinki. Written informed consent was obtained from all parents or legal guardians prior to participation. Participant confidentiality was maintained by anonymizing all collected data, restricting database access to the research team, and reporting findings in aggregate form without identifying individual participants.

Results

Table 1 presents the demographic and clinical characteristics of the neonates included in this study. A total of 15 infants he demographic data of 15 respondents, the majority of the infants were male, accounting for 8 infants (53%), while female infants accounted for 7 infants (47%). Regarding age, most infants were 7 days old, with 9 infants (60%), followed by 8 days old with 4 infants (27%), and 9 days old with 2 infants (13%).

In terms of birth weight, the majority of infants were classified as having Low Birth Weight (LBW) between 1500–2500 grams, totaling 13 infants (87%). Meanwhile, 2 infants (13%) were categorized as having

Very Low Birth Weight (VLBW) between 1000–1500 grams. There were no infants classified as Extremely Low Birth Weight (ELBW) below 1000 grams. For feeding type, all infants (100%) received breast milk as their source of nutrition.

Table 1. Distribution Frequency Data Demografi

Demographic Data	Category	n (%)
Gender	Male	8 (53%)
	Female	7 (47%)
Child's Age	7 days	9 (60%)
	8 days	4 (27%)
	9 days	2 (13%)
Birth Weight	Low Birth Weight (1500–2500 g)	13 (87%)
	Very Low Birth Weight (1000–1500 g)	2 (13%)
	Extremely Low Birth Weight (<1000 g)	0 (0%)
Type of Feeding	Breast Milk	15 (100%)

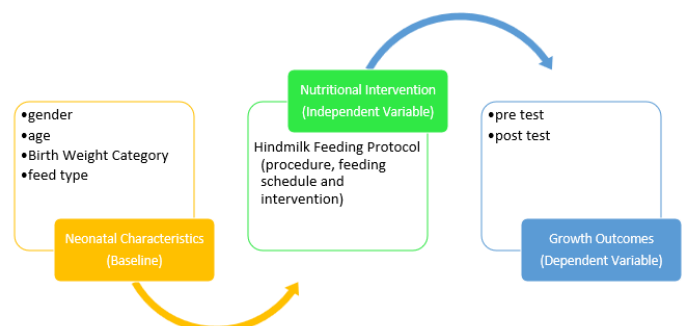


Figure 1. Workflow Diagram of Effectiveness of Hindmilk Feeding

Table 2. Shapiro–Wilk Normality Test

Variable	Statistic (W)	p-value
Pretest (Body weight before)	0.938	0.378
Posttest (Body weight after)	0.941	0.413
Difference (Posttest–Pretest)	0.880	0.059



Table 2 shows the results of the Shapiro–Wilk normality test. The test was conducted due to the relatively small sample size ($n < 50$). The p-value for the difference between pretest and posttest body weight was 0.059, which is greater than 0.05, indicating that the data were normally distributed. Based on this result, parametric analysis using a paired sample t-test was considered appropriate for further analysis.

Table 3. Distribution of Infant Body Weight Before and After Hindmilk feeding

Variable	Mean (g)	Std. Dev (g)	Minimum (g)	Maximum (g)
Pretest (Body weight before)	2082.14	353.99	1400	2510

Table 4. Paired Sample t-Test Statistics

Variable	Mean	Std. Dev	Std. Error Mean	Minimum	Maximum	p-value
Pretest (Body weight before)	2082.14	353.99	94.61	1400	2510	0.001
Posttest (Body weight after)	2143.57	364.64	97.45	1440	2590	
Difference (Posttest–Pretest)	61.43	51.57	13.78	20	140	

Table 4 shows the results of the paired sample t-test analysis. A statistically significant difference was observed between pretest and posttest body weight

Variable	Mean (g)	Std. Dev (g)	Minimum (g)	Maximum (g)
Posttest (Body weight after)	2143.57	364.64	1440	2590
Difference (Posttest–Pretest)	61.43	51.57	20	140

Table 3 shows the distribution of infant body weight before and after hindmilk feeding. The mean body weight at baseline was 2082.14 g (SD = 353.99), with values ranging from 1400 g to 2510 g. After the intervention period, the mean body weight was 2143.57 g (SD = 364.64), with values ranging from 1440 g to 2590 g. The mean difference between pretest and posttest measurements was 61.43 g (SD = 51.57).

measurements ($p = 0.001$). The mean body weight increased from 2082.14 g at baseline to 2143.57 g after the intervention period.

Table 5. Confidence Interval and Effect size ($n = 15$)

Variable Comparison	Mean Difference (Post–Pre)	SD of Difference	95% CI of Mean Difference	t(df=14)	p-value	Cohen's d	Effect Size Interpretation
Posttest vs Pretest body weight	61.43	51.57	[31.88, 90.98]	4.46	0.001	1.19	Large

Table 5 shows the mean difference, confidence interval, t-statistic, and effect size for the change in body weight ($n = 15$). The mean difference between posttest and pretest was 61.43 g, with a 95% confidence interval of 31.88 to 90.98. The Cohen's d value was 1.19, indicating a large effect size. Overall, the analysis demonstrated a statistically significant difference in infant body weight before and after the intervention period. An increase in mean

body weight was observed from pretest to posttest measurements, accompanied by a large effect size based on Cohen's d. These findings describe the changes observed during the study period without implying causal inference.

Discussion

The present study found an increase in infant body weight following the hindmilk feeding intervention, as demonstrated by higher post-intervention mean body weight compared with baseline values. This finding indicates that hindmilk feeding was associated with a favorable short-term change in infant weight during the intervention period. Considering that body weight is commonly used as an early indicator of nutritional response in infancy, the observed change may suggest improved nutritional adequacy after the intervention. Within the context of the present study, the increase in body weight represents the primary measurable outcome and therefore constitutes the principal basis for interpreting the potential effectiveness of hindmilk feeding.

The magnitude of weight change observed in this study may be related to the nutritional properties of hindmilk, particularly its higher energy density relative to earlier milk fractions. Previous research explained that the fat concentration in hindmilk increases progressively as the breast empties because milk fat globules become more concentrated toward the end of feeding ([Bowornkitiwong et al., 2023](#); [Brockway et al., 2024](#)). Since fat provides a substantial proportion of energy requirements during infancy, increased exposure to higher-energy milk may contribute to greater caloric intake and subsequently support weight gain. However, because the present study did not directly assess milk composition, caloric intake, or nutrient metabolism, these mechanisms should be interpreted as plausible explanations rather than direct evidence generated from the study findings.

The findings of this study are consistent with previous studies reporting that

hindmilk fortification or targeted hindmilk feeding improves weight gain among preterm and low-birth-weight infants. A prospective comparative study reported that selective hindmilk feeding significantly improved weight gain, body length, and head circumference among preterm low-birth-weight infants ([Gandikota et al., 2024](#)). Similarly, a study found that hindmilk feeding increased growth velocity among very preterm infants with suboptimal growth, particularly after two weeks of intervention ([Bala et al., 2024](#)). Another study demonstrated that hindmilk consistently contains a higher creatinocrit and fat concentration than foremilk, supporting its role in improving infant nutritional intake ([Bowornkitiwong et al., 2023](#); [Ongprasert et al., 2020](#)). These studies support the current findings that hindmilk feeding may be an effective nutritional strategy for promoting infant growth. In addition, a research reported that bioactive growth factors and nutritional components in human milk were associated with infant weight and BMI development from birth through early childhood ([Galante et al., 2020](#)). This evidence further strengthens the biological rationale that breast milk composition, including fat-rich hindmilk, contributes significantly to infant growth trajectories.

However, contradictory findings have also been reported in previous literature. Some studies and breastfeeding discussions suggest that the distinction between foremilk and hindmilk may not always produce clinically significant differences in infant growth, particularly in healthy term infants with adequate breastfeeding frequency. Community discussions and breastfeeding observations have indicated that overall milk intake, feeding frequency, and maternal milk supply may sometimes have greater influence on infant weight gain than hindmilk exposure alone ([Juharji et al., 2022](#); [Marafie et al., 2025](#)). Differences in

study outcomes may be caused by variations in sample size, intervention duration, infant characteristics, and healthcare settings. Studies involving small populations or shorter intervention periods may fail to detect significant anthropometric changes. Furthermore, maternal nutritional status, breastfeeding techniques, and frequency of breast emptying can affect milk fat composition and contribute to inconsistent findings across studies.

From a practical perspective, the potential benefits of hindmilk feeding identified in the present study may have implications for breastfeeding support strategies, particularly in resource-limited settings. Effective implementation may require adequate maternal education and lactation support to ensure appropriate breastfeeding practices. Previous reports have suggested that breastfeeding knowledge, counseling access, and feeding practices may influence maternal adherence and infant nutritional outcomes. However, these factors were not evaluated in the present study and therefore require further investigation before conclusions regarding their contribution can be established.

Several limitations of this study should be acknowledged. First, the relatively small sample size limits the generalizability of the findings. Second, the absence of a control group makes it difficult to determine whether weight gain was solely attributable to hindmilk feeding or influenced by other factors. Third, the duration of intervention was relatively short, which may not fully reflect long-term growth outcomes. Moreover, several potential confounding variables, including maternal nutritional status, infant morbidity, breastfeeding frequency, and complementary feeding practices, were not fully controlled. These factors may have influenced the observed results and should be considered in future

investigations employing larger randomized controlled designs with extended follow-up periods.

Overall, the findings of the present study suggest that hindmilk feeding may represent a potentially beneficial nutritional intervention for improving short-term infant weight gain. Further studies with larger samples, controlled designs, and longer follow-up periods are required to determine the magnitude and sustainability of these effects.

Implications and limitations

The findings of the present study provide preliminary implications for neonatal nutritional care and breastfeeding management. The observed increase in body weight following hindmilk administration suggests that variations in breast milk composition during feeding may contribute to short-term nutritional responses, particularly among low-birth-weight (LBW) infants. These results highlight that feeding dynamics may play a relevant role in early neonatal nutrition, beyond the quantity of intake alone. However, these findings should be interpreted cautiously due to the limited sample size, short intervention period, and methodological constraints. Therefore, the results should be considered preliminary and not yet sufficient to support changes in clinical practice, but rather as an initial basis for further investigation into hindmilk-based nutritional strategies.

Despite these contributions, several limitations should be acknowledged. The single-center design and small sample size limit generalizability, while the lack of randomization and a control group introduces potential bias and reduces internal validity. The short three-day intervention period further limits interpretation, as observed weight changes may reflect short-term physiological adaptations rather than sustained growth

effects. Measurement variability and uncontrolled confounding factors, including maternal nutrition, breastfeeding practices, and infant health status, may also have influenced the results. In addition, the absence of long-term follow-up restricts conclusions regarding the durability of the effect. Accordingly, the findings should be interpreted as indicating an association between hindmilk feeding and short-term weight change rather than a causal relationship, and further randomized controlled studies with larger samples and longer follow-up are needed.

Relevance to Practice

The findings highlight that hindmilk feeding can be implemented as an effective, simple, and low-cost intervention in neonatal care to promote weight gain among LBW infants. Nurses, midwives, and other healthcare providers should incorporate education on hindmilk expression and proper breastfeeding techniques into routine counseling for mothers, emphasizing the importance of allowing infants to fully empty one breast before switching. Healthcare institutions, particularly in regional or resource-limited settings, can develop and implement structured hindmilk feeding protocols to standardize care and improve neonatal outcomes. By adopting these practices, healthcare providers may help accelerate infant weight gain and potentially reduce the length of hospital stays.

Conclusion

Based on the results and discussion presented above, it can be concluded that the present study observed an increase in infant body weight following hindmilk feeding intervention, suggesting a potential association between hindmilk administration and short-term weight improvement among low-birth-weight (LBW) infants. Within the context of these

findings, the observed changes indicate that variations in breast milk composition during feeding may contribute to early nutritional responses in this population. However, considering the relatively small sample size, short intervention duration, and methodological limitations of the study, these findings should be interpreted as preliminary evidence rather than confirmation of effectiveness. The present findings provide an initial contribution to understanding the potential role of hindmilk in supporting short-term nutritional responses among LBW infants. Further studies using larger study populations, randomized controlled designs, and longer follow-up periods are needed to clarify the magnitude, sustainability, and clinical relevance of the observed effects before broader clinical application can be considered.

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CrediT Authorship Contributions Statement

Aries Abiyoga: Conceptualization, methodology design, data analysis, literature review, supervision and critical revision of the manuscript.

Tuti Meihartati: Conceptualization, methodology design, validation of findings and manuscript drafting.

Denny Kristiani: Conceptualization, data collection, validation of findings and manuscript drafting.

Murti Bandung: Supervision, validation of findings, critical revision of the manuscript, proofread.

Conflicts of Interest

There is no conflict of interest.

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