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Effect of Moringa oleifera Leaf Infusion on Breast Milk Flow Adequacy among Postpartum Mothers: A Quasi-Experimental

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Abstract

Background: Breast milk represents the optimal source of infant nutrition, supplying all nutrients essential for growth and development. The study evaluated the effect of *Moringa oleifera* leaf infusion on breast milk flow among postpartum mothers in the Tilango Public Health Center service area.
Methods: A quasi-experimental design employing a non-equivalent control group pre–posttest approach was implemented. 30 mothers (2–3 weeks postpartum) were selected via purposive sampling and assigned to either the intervention or control group. The intervention group received 150 ml of *Moringa oleifera* leaf infusion twice daily for seven days, while the control group received standard care without Moringa oleifera leaf infusion. Breast milk production was measured using an observation checklist and analyzed using the Wilcoxon test with a significance threshold of 0. Before the intervention, all participants in both groups demonstrated inadequate breast milk flow.
Result: Following the intervention, 86.7% of mothers in the intervention group achieved adequate milk production, compared to 6.7% in the control group. Statistical analysis indicated a significant improvement in the intervention group ($p = 0.001$).
Conclusion: *Moringa* oleifera leaf infusion was associated with improved breast milk flow in postpartum mothers, indicating potential as a supportive intervention. However, these findings should be considered preliminary due to the small, non-randomized sample.

Keywords: Moringa Oleifera, Postpartum, Breast Milk.

BACKGROUND

Breast milk (ASI) is the optimal source of nutrition for infants in the first six months of life, and exclusive breastfeeding is the global standard for improving infant and maternal health outcomes (1,2). The World Health Organization (WHO) has set a target of at least 50% exclusive breastfeeding coverage during this period, citing benefits such as reduced infectious morbidity and mortality, enhanced cognitive development, and long-term maternal health advantages, including lower risks of breast and ovarian cancer. Achieving this target requires ongoing support from health systems and communities (3,4).

Despite these recommendations, exclusive breastfeeding rates in many countries, including Indonesia, remain below optimal levels (5). National data show an upward trend, with coverage reaching about 66.4% in 2024, but this is still below the standard, and significant regional disparities persist (6). In Gorontalo Regency, exclusive breastfeeding coverage is approximately 42%, well below the national target of 80% (7). This gap highlights ongoing challenges and the need for targeted, locally relevant interventions to support lactation among postpartum mothers.

Several factors contribute to suboptimal exclusive breastfeeding, including limited maternal knowledge, inadequate family support, and restricted access to healthcare (8,9). To address this, various strategies have been used to enhance breast milk flow, such as traditional herbal galactagogues. *Moringa oleifera* leaves are widely used in Indonesian communities (10–12). They are rich in essential nutrients and contain bioactive compounds, including phytosterols and flavonoids, which may influence hormones involved in lactation. These compounds are thought to affect hormonal pathways related to milk production, particularly prolactin and oxytocin, though the exact mechanisms are not fully understood. Some clinical and experimental studies have found associations between Moringa supplementation and improved breastfeeding outcomes or hormonal changes (13,14). However, the evidence is limited and not conclusive. The potential galactagogue effect of Moringa oleifera should be interpreted with caution, and further well-designed clinical studies are needed to clarify its mechanism in human lactation.

The lactogenic potential of Moringa oleifera may involve several biological pathways. The leaves provide phytosterols, flavonoids, essential amino acids, iron, calcium, and vitamins that support maternal nutrition during lactation. Phytosterols may stimulate prolactin secretion, while flavonoids offer antioxidant properties that could reduce oxidative stress after childbirth. Adequate nutrition may facilitate lactogenesis II, and frequent breastfeeding stimulates oxytocin release, promoting milk ejection. However, these mechanisms require further clinical investigation.

Emerging evidence suggests *Moringa oleifera* may serve as a natural galactagogue. Several experimental and randomized controlled studies have reported increased breast milk volume among postpartum mothers who consumed *Moringa oleifera* supplements (15,16). While some clinical trials show increases that are not always statistically significant, the overall trend indicates a positive association with improved breastfeeding outcomes (10). Systematic reviews and quasi-experimental studies also show that Moringa oleifera, in forms such as tea, powder, and extract, is associated with enhanced breast milk flow (17–19).

Although several studies have examined Moringa oleifera supplementation for lactation, there is limited evidence on the use of Moringa oleifera leaf infusion in primary healthcare settings in Gorontalo. Few studies have evaluated this intervention with a comparison group among postpartum mothers with inadequate breast milk flow. This study aims to assess the effect of *Moringa oleifera* leaf infusion on the adequacy of breast milk flow among postpartum mothers at the Tilango Public Health Center, as part of broader efforts to improve exclusive breastfeeding coverage in Gorontalo Province.

METHODS

Study Design

A quasi-experimental design utilizing a nonequivalent control group pretest–posttest approach was employed.

Sample/Participants

This preliminary quasi-experimental study included a limited number of respondents. No formal sample size calculation was conducted; the sample size was determined by the availability of eligible postpartum mothers during the study period. The study population consisted of 150 postpartum mothers in the working area of Tilango Public Health Center. Thirty participants were selected using purposive sampling based on predetermined inclusion and exclusion criteria. Inclusion criteria comprised postpartum mothers willing to participate, breastfeeding at 2–3 weeks postpartum, and experiencing inadequate breast milk flow. Eligible participants were aged 20–30 years, had a singleton healthy infant, no maternal chronic disease, and no postpartum complications. Exclusion criteria included mothers with nipple-related problems, those taking medications to enhance breast milk flow, and those unwilling to consume *Moringa oleifera* leaf infusion.

Intervention

The study included both an intervention group and a control group to evaluate the intervention's effect. Baseline measurements (pre-test/O1) were collected through direct interviews and observations using indicators of breast milk flow. The intervention was administered over seven consecutive days. Moringa oleifera leaf infusion was prepared using a standardized procedure. Fresh, stalkless Moringa leaves (20 grams) were selected, washed under clean running water, and steeped in 150 mL of water heated to approximately 90°C for 15 minutes in a covered pot. All infusions were prepared by the research team following the same protocol to ensure consistency. Pre-test measurements of breast milk flow were conducted for all participants prior to the intervention. The intervention group received 150 mL of Moringa oleifera leaf infusion twice daily (morning and evening) for seven consecutive days. Adherence was monitored through direct supervision or visual confirmation of intake. The control group received standard postpartum care provided by the health center and did not receive the Moringa leaf infusion during the study period. Data were collected through direct observation and structured recording using a checklist, then compiled for analysis.

Instruments

The instruments for this study were developed according to the research variables, operational definitions, and measurement scales. The intervention instrument included a measuring cup to ensure accurate administration of *Moringa oleifera* leaf infusion. Breast milk flow was assessed using an observation checklist designed to measure indicators of adequate milk flow.

Data Collection

The research was conducted in the working area of Tilango Public Health Center, Tilango District, Gorontalo Regency.

Data Analysis

Nonparametric statistical tests were used for data analysis because the outcome variable was measured on an ordinal scale and the small sample size did not meet the assumptions of normality. The Wilcoxon signed-rank test and Mann–Whitney U test were performed at a significance level of $\alpha = 0.05$. The Wilcoxon signed-rank test assessed within-group differences between pre-test and post-test

measurements, while the Mann–Whitney U test compared differences between the intervention and control groups. Results are presented in both tabular and narrative formats.

Ethical Consideration

Ethical approval was obtained from the relevant institutional ethics committee (Ethics Approval Number: No.078/KEPK-FIKES/VIII/2025). Written informed consent was obtained from all participants prior to data collection.

RESULT AND DISCUSSION

RESULT

Characteristics of Participants

The baseline characteristics of participants are presented in Table 1. Overall, the intervention and control groups showed a relatively similar distribution of age, educational level, and employment status.

Table 1. Characteristics of Participants (n=30)

Characteristics	Intervention Group		Control Group	
	n	(%)	n	(%)
Age				
No risk	12	80	9	60
Risk	3	20	6	40
Education				
High	3	20	6	40
Low	12	80	9	60
Employment				
Housewife	11	73.3	15	100
Honorary Workers	2	13.3	-	
Self-employed	1	6.7	-	
Government employees	1	6.7	-	

In the intervention group, 12 participants (80%) were in the non-risk age category, and 3 participants (20%) were in the risk age category. In the control group, 9 participants (60%) were in the non-risk age category, and 6 participants (40%) were in the risk age category. Educational level was also predominantly low in both groups, with 12 participants (80%) in the intervention group and 9 participants (60%) in the control group classified as having a low level of education. Regarding employment status, most participants in the intervention group were housewives (73.3%), followed by honorary workers (13.3%), self-employed individuals (6.7%), and government employees (6.7%). All participants in the control group were housewives. (Table 1)

Table 2. Breast Milk Flow Among Breastfeeding Mothers Before and After the Intervention in the Intervention Group

Breast Milk Flow	Intervention Group				Control Group			
	Before		After		Before		After	
	n	(%)	n	(%)	n	(%)	n	(%)
Adequate	-	-	13	86.7	-	-	1	6.7
Inadequate	15	100	2	13.3	15	100	14	93.3
Total	15	100	15	100	15	100	15	100

Breast milk flow in the intervention group changed following administration of *Moringa oleifera* leaf infusion. Prior to the intervention, all participants (n = 15; 100%) were classified as having inadequate breast milk flow. After seven days, 13 participants (86.7%) demonstrated adequate breast milk flow, whereas 2 participants (13.3%) continued to exhibit inadequate flow (Table 2). The control group showed minimal change during the observation period. Initially, all 15 participants (100%) had inadequate breast milk flow. After observation, 14 participants (93.3%) remained in this category, while only 1 participant (6.7%) achieved adequate breast milk flow, as shown in Table 2.

Table 3. Pretest and Posttest Scores of Breast Milk Flow in the Intervention Group

	Breast Milk Flow			
	Mean(SD)	Mean Difference	Min-Max	P value
Pretest	3.73(1.033)	3.74	2-5	0.001
Posttest	7.47(1.246)		5-9	

Table 4. Pretest and Posttest Scores of Breast Milk Flow in the Control Group

	Breast Milk Flow			
	Mean(SD)	Mean Difference	Min-Max	P value
Pretest	3.73(1.033)	0.27	2-5	0.102
Posttest	4.00(0.845)		3-6	

Table 5. Comparison of Post-Intervention Breast Milk Flow Between Intervention and Control Groups

Posttest	Mean Rank	P value
Intervention	22.67	0.001
Control	8.33	

In the intervention group, the mean breast milk flow score increased from 3.73 ± 1.033 at pretest to 7.47 ± 1.246 at posttest. The minimum score rose from 2 to 5, and the maximum score increased from 5 to 9. The mean difference was 3.74. The Wilcoxon test indicated a statistically significant difference between pretest and posttest scores (p = 0.001) (Table 3). In contrast, the control group exhibited only a slight increase in mean breast milk flow score, from 3.73 ± 1.033 at pretest to 4.00 ± 0.845 at posttest. The minimum score increased from 2 to 3, and the maximum score rose from 5 to 6. The mean difference was 0.27. The Wilcoxon test indicated no statistically significant difference between pretest and posttest scores (p = 0.102) (Table 4). A posttest comparison between the two groups using the Mann–Whitney test revealed a statistically significant difference in breast milk flow scores. The intervention group had a mean rank of 22.67, while the control group had a mean rank of 8.33. This difference was statistically significant (p = 0.001) (Table 5).

DISCUSSION

This study found that *Moringa oleifera* leaf infusion was associated with improved breast milk flow among postpartum mothers. The intervention group experienced greater improvement than the control group. However, due to the non-randomized quasi-experimental design, these results indicate an association rather than a confirmed causal effect. Differences in baseline characteristics between groups may also have influenced the outcomes. Maternal age may influence lactation outcomes, as most participants were within the optimal reproductive age range (20–35 years), which is associated with stable endocrine function and effective lactation. Adequate prolactin and oxytocin activity in this age group may support milk synthesis and ejection (20–23). However, this study did not specifically assess

the relationship between maternal age and breast milk flow, so no conclusions can be drawn about its independent effect.

Educational level may have influenced participants' breastfeeding knowledge, health literacy, and adherence to recommended practices. Although most participants had limited formal education, the study did not assess the effect of educational attainment on breast milk flow. Therefore, education should be considered a potential contextual factor rather than a confirmed determinant of the outcomes (24).

Employment status may have influenced breastfeeding practices. The predominance of housewives among participants may have facilitated more frequent breastfeeding, which stimulates the release of prolactin and oxytocin (22,25,26). However, this relationship was not formally analyzed, so employment status should be viewed as a potential contextual factor rather than a confirmed explanatory variable. Physiologically, these findings are consistent with the challenges of the early postpartum period, when breast milk flow may be reduced due to hormonal changes, fatigue, stress, and nutrition.27 *Moringa oleifera* leaves provide essential nutrients, including protein, iron, calcium, vitamins A and C, and amino acids, which support maternal nutrition during lactation (28–30). Bioactive compounds such as flavonoids and phytosterols may also influence lactation-related hormones, particularly prolactin (31). Together, these effects may facilitate lactogenesis II and improve milk production and ejection.

The present findings are consistent with previous studies reporting positive effects of *Moringa oleifera* on breast milk flow. Experimental and clinical evidence shows that moringa supplementation, whether as capsules, extracts, or infusions, is associated with increased milk volume and improved breastfeeding outcomes (13,15,17,28). Moringa is also recognized as a safe, locally available galactagogue, especially in resource-limited settings (10,11,27). This study contributes to the evidence by demonstrating similar effects in a primary healthcare context. The observed group suggests that natural postpartum adaptation alone may not be sufficient to substantially improve breast milk flow within the observed timeframe (15,28). In contrast, the significant difference observed between groups at posttest strengthens the inference that the intervention played a central role in the outcome (10,16).

The intervention's effectiveness may also reflect good adherence to the regimen and supportive factors such as breastfeeding frequency and maternal condition (29,31). However, these factors were not measured in detail and should be addressed in future research. *Moringa oleifera* leaf infusion is a practical, low-cost, non-pharmacological option to support lactation. Its local availability and ease of preparation make it suitable for integration into primary healthcare services, including breastfeeding counseling and postpartum care. Such integration may improve exclusive breastfeeding practices and reduce reliance on formula feeding.

Several limitations should be noted. First, the small sample size and limited setting may restrict generalizability. Second, the non-randomized quasi-experimental design may have introduced selection bias, and baseline differences between groups, especially in education and employment status, may have influenced outcomes. Third, breast milk flow was assessed subjectively, which may introduce measurement bias. Additionally, several potential confounding factors, such as breastfeeding frequency, infant sucking effectiveness, maternal hydration and diet, stress, fatigue, family support, parity, mode of delivery, maternal BMI or nutritional status, and use of breastfeeding counseling, were not measured or controlled for in the analysis. Therefore, these findings should be interpreted as showing an association rather than a definitive causal effect. Future studies should use randomized designs, larger and more diverse samples, objective measurement tools, and comprehensive assessments of confounding variables to strengthen the evidence based.

CONCLUSION

Moringa oleifera leaf infusion was associated with improved breast milk flow adequacy in postpartum mothers. Although this indicates potential as an accessible breastfeeding support, these findings are preliminary and should be interpreted with caution due to the small sample size and non-randomized purposive sampling.

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AUTHOR'S CONTRIBUTION STATEMENT

SM: Conceptualization, data collection, Formal analysis, Writing- Original Draft, Review & Editing. LS: Methodology, Manuscript review, validation. MRS ISL: Methodology, Manuscript review, validation.

CONFLICT OF INTEREST

None.

DECLARATION OF GENERATIVE AI AND AI-ASSISTED TECHNOLOGIES IN THE WRITING PROCESS

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DATA AVAILABILITY

The dataset generated and analyzed during the current study is available from the corresponding author upon request.

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