Napande: Jurnal Bidan
e-ISSN 2829-8365
Volume 5 Issue 2, 2026, page 71-80
DOI: 10.33860/njb.v5i2.4375
Website: https://ojs.polkespalupress.id/index.php/njb
Publisher: Poltekkes Kemenkes Palu

Original Article

The Effect of Moringa-Chayote Decoction on Breast Milk Production and Infant Weight Gain

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ARTICLE INFO

Article History:
Received: 2026-06-17
Accepted: 2026-07-31
Published: 2026-08-04

Keywords:

Breast Milk Production; Breastfeeding Mothers; Chayote; Galactagogue; Moringa leaf

ABSTRACT

Background: Perceived or actual low milk production can undermine continued breastfeeding. Moringa is widely used as a food-based galactagogue, whereas direct evidence for chayote and for a combined preparation remains limited. This study examined the association of a moringa leaf–chayote decoction with expressed breast milk volume and infant weight gain.
Methods: A quasi-experimental pretest–posttest control-group study was conducted among 14 breastfeeding mothers at the Kalumata Community Health Center, Ternate City. Participants were assigned to an intervention group (n = 7), which consumed 250 g of boiled moringa leaves and chayote, or a control group (n = 7), which received no intervention. Breast milk volume and infant weight were measured at baseline and every seven days over a 30-day period. Changes between the two groups were analyzed using an independent-samples t-test.
Results: The intervention group showed a more favorable distribution of change in expressed breast milk volume. Three mothers (42.9%) had an increase greater than 40 mL, whereas six mothers (85.7%) in the control group had increases of 20 mL or less. The originally reported between-group difference was statistically significant (p=0.001). Infant weight gain was also more favorable in the intervention group (p=0.006). Participant-level continuous records were unavailable for additional analysis; therefore, means, standard deviations, confidence intervals, test statistics, and effect sizes could not be calculated.
Conclusion: Within this small, non-randomized sample, consumption of the combined moringa leaf and chayote preparation was associated with greater reported increases in expressed breast milk volume and infant weight. These findings should be regarded as preliminary and require confirmation in adequately powered randomized studies with standardized intervention and outcome-measurement procedures.

INTRODUCTION

Breastfeeding is a central component of maternal and child health because human milk provides nutrients, immune protection, and bioactive compounds that support infant growth and development. The World Health Organization recommends initiating breastfeeding within the first hour after birth, providing exclusive breastfeeding for the first six months, and continuing breastfeeding with appropriate complementary foods up to two years of age or beyond (World Health Organization, 2023). Breastfeeding is also associated with lower risks of infection and mortality in children and with important maternal health benefits (Ballard & Morrow, 2013; Horta, 2019; Victora et al., 2016).

Breastfeeding coverage has improved, but sustained support remains necessary. In Indonesia, the proportion of infants younger than six months who were exclusively breastfed increased from 52.0% in 2017 to 66.4% in 2024; however, many infants still do not receive exclusive breastfeeding for the recommended full six months (UNICEF & World Health Organization, 2025). Breastfeeding practices are shaped by maternal education and employment, parity, early initiation, regional context, family support, and access to health services (Idris & Astari, 2023; Syahri et al., 2024). Global monitoring also indicates that continued progress depends on sustained investment, protection from commercial pressures, and coordinated support from health services, families, and communities (Perez-Escamilla et al., 2023; Rollins et al., 2016; UNICEF, 2023).

A common reason for early supplementation is the mother's perception or experience of insufficient milk production. Lactation depends on secretory activation, prolactin and oxytocin responses, effective and frequent milk removal, maternal nutritional status, and psychological well-being (Boss, Gardner, & Hartmann, 2018; Pang & Hartmann, 2007). Galactagogues are sometimes used when milk supply is considered inadequate, but evidence for both pharmacological and herbal products varies in quality, magnitude, and safety. Clinical guidance therefore emphasizes assessment of breastfeeding technique and modifiable causes of low milk supply before introducing a galactagogue (Brodribb & Academy of Breastfeeding Medicine, 2018; Foong et al., 2020). Reviews of herbal and pharmaceutical galactagogues similarly emphasize variable effectiveness, incomplete safety evidence, and the importance of correcting modifiable breastfeeding problems before supplementation (Bazzano et al., 2016). In clinical situations where maternal milk remains insufficient, donor human milk may be considered; however, this option does not replace efforts to assess and support the mother's own milk production (Baier et al., 2025).

Moringa oleifera is a nutrient-dense local food containing protein, minerals, carotenoids, flavonoids, and other polyphenolic compounds that may support maternal nutritional adequacy and mammary-gland function (Divya et al., 2024; Pareek et al., 2023; Yang, Tao, & Kang, 2023). Several studies have reported higher milk volume or prolactin after moringa supplementation, but findings are not uniform. In a double-blind randomized trial, milk volume on postpartum day 3 did not differ significantly between the moringa and control groups, although the observed volume was numerically higher in the moringa group (Fungtammasan & Phupong, 2021). Systematic reviews likewise describe promising signals but emphasize small samples, heterogeneous preparations, and low-certainty evidence (Ammar et al., 2025; Foong et al., 2020). An Indonesian community study also reported increased breast milk production after moringa supplementation, although differences in population, intervention form, and study design limit direct comparison with the present findings (Yasin, Nawawi, Wibowo, Nadhiroh, & Devy, 2024).

Chayote (Sechium edule) is a locally available vegetable with a high water content and a range of minerals, fiber, flavonoids, and other secondary metabolites (Iniguez-Luna et al., 2021; Vieira, Pinho, Ferreira, & Delerue-Matos, 2019). In theory, combining moringa with chayote could provide complementary nutritional support: moringa contributes nutrient density and diverse phytochemicals, while chayote may improve hydration, palatability, and micronutrient intake. This rationale is nutritional rather than evidence of a proven synergistic galactagogue mechanism. Previous lactation studies have mainly assessed moringa alone or other single plant-based preparations; direct clinical evidence for chayote and for the moringa–chayote combination remains absent. The present study, therefore, provides a preliminary evaluation of this locally prepared combination regarding expressed milk volume and infant weight gain among breastfeeding mothers in Ternate City. Plant-based preparations are commonly used during lactation and postpartum recovery in different cultural settings, but widespread traditional use alone does not establish clinical efficacy or safety (Millinga, Im, Hwang, Choi, & Han, 2022; Sibeko & Johns, 2021).

METHODS

This study used a quasi-experimental pretest–posttest control-group design. The design enabled comparison of outcome changes between mothers who received the local food preparation and those who did not, but it did not provide the same protection against confounding as random allocation. The study was conducted in the working area of the Kalumata Community Health Center in Ternate City. Ethical approval was granted by the Health Research Ethics Committee of Poltekkes Kemenkes Ternate (approval no. UM.02.03/6/376/2024). Quasi-experimental designs are useful for evaluating interventions in real-world settings when randomization is not feasible, though their capacity for causal inference is more limited than that of randomized trials (Capili & Anastasi, 2024).

The source population comprised breastfeeding mothers living in the study area. Fourteen participants were recruited through accidental or convenience sampling and included as a feasibility sample, with seven participants in each group. No a priori sample-size calculation was reported; consequently, the study was not designed as a statistically powered efficacy trial. Eligible participants were breastfeeding mothers with infants of normal birth weight who were willing to express milk for measurement, did not use other breast milk booster supplements during the study, and had no reported chronic disease. Participants who did not complete the observation period were excluded. Convenience recruitment increased feasibility in the community setting but may have introduced selection bias and limited the generalizability of the findings.

Participants were assigned to the intervention or control group through a non-random procedure. The specific basis for group assignment was not documented in the available study records. Therefore, allocation concealment cannot be confirmed, and the possibility of allocation bias should be considered when interpreting the findings.

The intervention group consumed a combined 250-g serving of boiled moringa leaves and chayote, while the control group received no study decoction. The observation period lasted 30 days, with assessments at 7-day intervals. Questionnaires and observation sheets were used to record participant characteristics, breastfeeding practices, expressed breast milk volume, and infant body weight.

The available study records documented only a combined 250-g serving of boiled moringa leaves and chayote. Separate ingredient weights, water volume, preparation time, serving volume, frequency, and timing of consumption, adherence monitoring, and dietary restrictions were not recorded. This incomplete description limits the reproducibility of interventions and is acknowledged as a study limitation.

Expressed breast milk volume was recorded on observation sheets at baseline and at 7-day intervals during the 30-day observation period, while infant body weight was recorded over the same period. The available records did not specify the expression technique or equipment, the breast(s) measured, the expression duration, the time of day, the interval since the previous feeding, the measuring-container precision, or the infant-scale calibration. Consequently, the standardization and reliability of outcome measurement could not be fully evaluated.

Data were checked, coded, entered, and cleaned before analysis. Categorical characteristics were summarized as frequencies and percentages. Because of the small sample, exploratory baseline comparisons were performed using Fisher's exact test for 2×2 tables and the Fisher–Freeman–Halton exact test for maternal age. The original analysis compared between-group change scores using an independent-samples t-test with a significance level of $p<0.05$ in SPSS. Participant-level continuous data were unavailable for additional analysis; therefore, normality testing, within-group paired comparisons, baseline-adjusted models, confidence intervals, complete test statistics, and effect sizes could not be calculated. Potential confounders—including maternal diet and hydration, breastfeeding frequency, latch and suckling effectiveness, maternal stress, and sleep—were not included in an adjusted model.

The statistical findings are therefore presented according to the original summarized analysis. The absence of participant-level data and complete statistical outputs is considered a methodological limitation, and no values were estimated from categorical intervals because such estimates would not reflect the observed measurements.

RESULTS

The results of the study are presented in the following table:

Table 1. Distribution of Respondent Characteristic in the Intervention and Control Groups

Characteristics	Intervention Group (n=7)		Control Group (n=7)	
	f	%	f	%
Mother's Age (years)				
21-30	3	42.9	5	71.4
31-40	3	42.9	2	28.6
41-50	1	14.2	0	0.0
Infant Age (months)				
4-6	4	57.1	3	42.9
7-9	3	42.9	4	57.1
Parity				
Secundigravida	3	42.9	3	42.9
Others (primigravida/multigravida)	4	57.1	4	57.1
Education				
Senior high school	4	57.1	6	85.7
Others (primary/junior high school/university)	3	42.9	1	14.3
Occupation				
Housewife	5	71.4	6	85.7
Other employment	2	28.6	1	14.3
Total	7	100.0	7	100.0

Exploratory exact tests did not identify statistically detectable differences between the intervention and control groups for maternal age (Fisher–Freeman–Halton p=0.592), infant age (Fisher's exact p=1.000), parity (p=1.000), education (p=0.559), or occupation (p=1.000). These non-significant results should not be interpreted as proof of equivalence because the sample was very small and the tests had limited power to detect imbalance.

Table 2. Distribution of Increased Breast Milk Production by Group

Increase in breast milk production (ml)	Intervention		Control		p-value
	f	%	f	%	
<10	0	0.0	2	28.6	
10-20	2	28.6	4	57.1	
21-40	2	28.6	0	0.0	
41-60	1	14.3	1	14.3	0.001
61-80	1	14.3	0	0.0	
81-100	1	14.3	0	0.0	
Total	**7**	**100.0**	**7**	**100.0**	

The intervention group showed a greater increase in expressed milk volume. Three participants (42.9%) had increases greater than 40 mL, including one participant in the 81–100 mL category. In the control group, six participants (85.7%) had increases of 20 mL or less.

The original summarized analysis reported a statistically significant between-group difference in breast milk change scores (p=0.001). Participant-level continuous measurements and complete statistical outputs were unavailable for the present revision. Consequently, mean change, standard deviation, confidence interval, t statistic, degrees of freedom, and effect size could not be calculated or verified.

Table 2 is therefore limited to the categorical distribution retained in the study records and the originally reported p-value. Means and effect estimates were not reconstructed from category midpoints because doing so could introduce inaccurate or artificial results.

Table 3. Distribution of Infant Weight Gain by Group

Weight gain (kg)	Intervention		Control		p-value
	n	%	n	%	
0	0	0.0	1	14.3	
0.1-0.5	2	28.6	4	57.1	
0.6-1.0	2	28.6	2	28.6	0.006
1.1-1.5	3	42.9	0	0.0	
Total	**7**	**100.0**	**7**	**100.0**	

Infant weight gain was more favorable in the intervention group: three infants (42.9%) gained 1.1–1.5 kg, whereas no infant in the control group reached this category. One infant in the control group did not gain weight. The original summarized analysis reported a statistically significant between-group difference (p=0.006). Participant-level infant-weight measurements were unavailable for additional analysis; therefore, complete continuous-data statistics could not be calculated or verified.

Table 3 is consequently presented as a categorical distribution. Baseline and day-30 means, mean change, confidence interval, test statistic, degrees of freedom, and effect size were not estimated in the absence of the original individual measurements.

DISCUSSION

Effect of Moringa Leaf and Chayote Decoction on Breast Milk Production

Mothers who received the combined preparation showed a more favorable distribution of changes in expressed milk volume than those in the control group. The direction of this finding is consistent with reports that moringa may support lactation; however, the magnitude cannot be compared reliably with previous trials until continuous means and confidence intervals are available. The evidence base is mixed. Fungtammasan and Phupong (Fungtammasan & Phupong, 2021) found no statistically significant difference in milk volume on postpartum day 3, despite a numerically higher volume in the moringa group. A Cochrane review concluded that evidence for natural galactagogues remains uncertain because studies differ in products, populations, measurement methods, and risk of bias (Foong et al., 2020). The present result should therefore be interpreted as preliminary rather than confirmatory.

A plausible nutritional explanation relates mainly to moringa. Its protein, iron, calcium, carotenoids, flavonoids, and phenolic compounds may contribute to maternal nutritional adequacy, while some plant polyphenols may interact with pathways relevant to mammary-gland function (Pareek et al., 2023). Nevertheless, milk synthesis is primarily maintained through effective and frequent milk removal and appropriate hormonal responses. A food intervention cannot be assumed to overcome problems such as ineffective latch, infrequent feeding, breast pathology, endocrine disorders, or severe maternal stress (Boss et al., 2018; Brodribb & Academy of Breastfeeding Medicine, 2018).

The specific contribution of chayote remains uncertain. Chayote supplies water, minerals, fiber, and phytochemicals and may improve the overall nutritional quality and acceptability of the preparation (Iniguez-Luna et al., 2021; Vieira et al., 2019). However, no direct clinical evidence currently demonstrates that chayote acts as a galactagogue or that it produces a synergistic effect with moringa. The observed outcome therefore cannot be attributed to a defined chayote mechanism, and the combined intervention should be studied against moringa alone and an appropriate placebo in future trials.

Variation in response among mothers is also expected. Some participants had only small increases in expressed milk volume, which may reflect differences in breastfeeding frequency, completeness of breast emptying, infant suckling effectiveness, maternal energy and fluid intake, parity, sleep, anxiety, social support, or the timing and technique of expression. Measurement of expressed milk at a single session may also underestimate or overestimate total daily milk transfer. Because these factors were not adjusted in the analysis, residual confounding may explain part of the observed between-group difference.

The absence of blinding and a placebo control introduces additional risks of bias. Mothers who knew they were receiving the preparation may have changed feeding or expression behavior, producing a Hawthorne effect. Expectations regarding a traditional galactagogue could also have influenced self-reported practices or adherence. At the service level, the preparation may be considered only as an adjunct to evidence-based breastfeeding support. Any pilot implementation at a primary health-care center should include assessment of latch and milk transfer, maternal dietary counseling, safety screening, standardized preparation instructions, adherence monitoring, and referral for persistent low milk supply. It should not replace skilled lactation counseling.

Implications for Infant Weight Gain

The intervention group also showed a more favorable pattern of infant weight gain. Improved milk availability could contribute to higher energy intake, but the present study cannot establish that the decoction caused the observed growth difference. Human milk provides macronutrients, micronutrients, immune factors, and other bioactive components that support infant health and development (Ballard & Morrow, 2013; Szyller et al., 2024). The nutritional composition of human milk changes across lactation and provides nutrients required for infant growth and development (Dror & Allen, 2018).

Infant weight gain is affected by baseline weight, infant age, feeding frequency, complementary feeding among infants older than six months, illness episodes, fluid status, and measurement conditions. The infants in this study were 4–9 months old; therefore, complementary foods may have contributed to weight change among those aged six months or older. Without standardized dietary and morbidity data, infant weight should be treated as a supportive outcome rather than direct evidence of increased milk transfer. Evidence from breastfeeding-promotion studies also shows that improved breastfeeding practices do not produce uniform growth effects in every setting because child growth is influenced by multiple biological, dietary, and social determinants (Giugliani, Horta, de Mola, Lisboa, & Victora, 2015).

For community practice, the findings support further evaluation of locally available foods within an integrated breastfeeding program. A feasible pathway would be a supervised pilot through maternal and child health services: identify mothers with perceived low supply, assess breastfeeding technique and infant growth, provide standardized maternal nutrition counseling, offer the preparation only when appropriate, and monitor both maternal tolerance and infant outcomes. Such implementation should be accompanied by data collection that can distinguish the effect of the food preparation from improvements arising from counseling and closer follow-up.

Strengths and Limitations

A strength of this study is its evaluation of an affordable local food preparation and its inclusion of both a maternal outcome and an infant growth indicator. Several limitations, however, substantially constrain interpretation. The sample of 14 participants was not based on an a priori power calculation, and convenience sampling and non-random group assignment increase the risk of selection and allocation bias. The intervention and control groups were not blinded, no placebo was used, and observer, expectation, and Hawthorne effects are possible. The exact ingredient proportions, preparation procedure, adherence, co-interventions, and detailed allocation process were not fully documented in the available study records. Maternal diet, hydration, breastfeeding frequency, latch, suckling effectiveness, stress, and sleep were not controlled in an adjusted analysis. Expressed milk volume may not represent total daily milk transfer, and the incomplete description of the measurement procedure prevents a full assessment of reliability. Finally, the absence of participant-level continuous data prevented additional analyses requested during peer review, including normality tests, paired comparisons, baseline-adjusted estimates, confidence intervals, complete test statistics, and effect sizes. These limitations reduce internal validity and restrict generalizability beyond the study setting.

The findings are therefore best viewed as a feasibility signal that justifies a more rigorous study. Future research should use an adequately powered randomized controlled design; compare the combined preparation with moringa alone and a matched control; standardize dosage, preparation, and adherence assessment; measure maternal diet, breastfeeding technique, stress, and sleep; use validated milk-transfer or repeated expression methods; and report baseline-adjusted estimates with confidence intervals and effect sizes. Safety and acceptability should also be assessed over a longer follow-up period.

CONCLUSION

In this small quasi-experimental study, mothers who consumed the combined moringa leaf and chayote preparation showed a more favorable distribution of expressed breast milk volume change and infant weight gain than the control group. The findings indicate an association within the study sample, not definitive evidence of causality or clinical effectiveness. Because of the small convenience sample, non-random allocation, incomplete documentation of interventions and measurements, uncontrolled confounding, and limited statistical reporting, the preparation should not yet be recommended as a stand-alone lactation treatment. Adequately powered randomized studies with a standardized protocol, objective outcome measurement, complete retention of participant-level data, and full effect estimates are required before routine implementation.

Author's Contribution Statement: Asni Annisa Siregar contributed to the conception of the study, data collection, data analysis, manuscript drafting, and final approval. Rasmin Hi Abdul Mutalib contributed to study supervision, interpretation of findings, critical manuscript review, and final approval.

Conflict of Interest: The authors declare that they have no conflicts of interest related to this study.

Funding Source: The authors declare that this study did not receive external funding.

Acknowledgments: The authors express sincere gratitude to Poltekkes Kemenkes Ternate for institutional support during this study. Appreciation is also addressed to the respondents who participated in the research and to Kalumata Community Health Center, Ternate City, for permitting the implementation of the study in its working area.

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