Original Article

Comparative Effects of Fenugreek and Moringa Extract Supplementation on Lactation Performance among Postpartum Breastfeeding Mothers: A Quasi-Experimental Study

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ABSTRACT

Background: Inadequate breast milk production remains a frequent reason for early supplementation and discontinuation of exclusive breastfeeding. Fenugreek (Trigonella foenum-graecum) and moringa (Moringa oleifera) are widely used as natural galactagogues; however, comparative evidence examining their relative effectiveness within the same postpartum population remains limited, particularly in community maternal health settings.

Methods: A quantitative quasi-experimental study with a posttest-only control group design was conducted in 2025 in Karawang Regency, Indonesia, and reported in accordance with the TREND statement. A total of 45 postpartum breastfeeding mothers were allocated consecutively by facility to three groups: control (n = 15), fenugreek (n = 15), and moringa (n = 15). No pretest was conducted; therefore, baseline equivalence was not confirmed. The fenugreek group received 500 mg fenugreek seed extract twice daily for 7 days; the moringa group received 250 mg moringa leaf extract twice daily for 7 days — both doses based on published therapeutic evidence. Lactation performance was assessed on day 8 using a validated structured questionnaire and observation sheet (Cronbach's $\alpha = 0.81$; CVI = 0.89). Data were analysed using the Kruskal-Wallis test, followed by Mann-Whitney U post hoc comparisons with Bonferroni correction

Results: Post-intervention lactation performance scores (mean ± SD) were 5.93 ± 1.03 (control), 8.93 ± 1.03 (fenugreek), and 9.73 ± 0.46 (moringa). The Kruskal-Wallis test showed a significant overall difference ($H = 34.21$, $df = 2$, $p < 0.001$, $\eta^2 = 0.76$). Pairwise comparisons showed significant differences for control vs. fenugreek ($U = 4.50$, $Z = -4.68$, $p < 0.001$, $r = 0.85$), control vs. moringa ($U = 0.00$, $Z = -5.20$, $p < 0.001$, $r = 0.95$), and fenugreek vs. moringa ($U = 54.00$, $Z = -2.87$, $p = 0.004$, $r = 0.52$).

Conclusion: Both fenugreek and moringa supplementation significantly improved lactation performance compared with routine care. Moringa demonstrated statistically significantly higher performance than fenugreek. Randomised controlled trials with objective lactation indicators and confirmed baseline equivalence are needed to confirm these findings.

Keywords: Breastfeeding; Galactagogues; Fenugreek; Moringa oleifera; Lactation performance; Postpartum mothers

Implications for Practice:

- Herbal galactagogues such as fenugreek and moringa may be integrated as complementary options within evidence-informed breastfeeding support programmes for postpartum mothers with perceived low milk supply.
- Maternal and child health services should combine any herbal supplementation advice with standard lactation management, including breastfeeding counselling, latch assessment, feeding frequency support, maternal nutrition, and psychosocial support.
- In resource-limited settings, locally available plants such as moringa may offer an affordable complementary strategy; however, their use should follow a standardized protocol for dosage, monitoring, and safety.

Introduction

Breastfeeding remains one of the most effective public health interventions for protecting infant survival, growth, and development. The World Health Organization (WHO) and UNICEF recommend exclusive breastfeeding for the first 6 months of life and continued breastfeeding up to 2 years or beyond. Nevertheless, global breastfeeding performance remains suboptimal. According to WHO, fewer than half of infants under 6 months are exclusively breastfed worldwide, indicating a persistent implementation gap (UNICEF, 2025; World Health Organization, 2026).

Breastfeeding is not only nutritionally optimal but also clinically important across the life course. Breastfeeding protects infants against infectious morbidity and mortality and provides benefits for maternal health, including reduced risks of breast and ovarian cancer. At the health-system level, improved breastfeeding practices also generate economic and social gains, underscoring the need for feasible interventions that can support mothers in the early postpartum period (Pérez-Escamilla et al., 2023; Rollins et al., 2016; Victora et al., 2016).

One of the most frequently reported reasons for early breastfeeding supplementation or cessation is perceived or actual insufficient milk supply. A systematic review found that perceived insufficient milk supply is a major contributor to breastfeeding discontinuation, while maternal knowledge, self-efficacy, early breastfeeding initiation, and breastfeeding support strongly influence whether mothers interpret infant behaviour as evidence of inadequate milk production. This issue is especially important in low- and middle-income countries (LMICs), where mothers may face a combination of counselling gaps, sociocultural pressure, cesarean-related feeding difficulties, employment barriers, and limited access to skilled lactation support (Galipeau et al., 2017; Huang et al., 2022; Kavle et al., 2017).

Lactation is regulated primarily through prolactin-mediated milk synthesis and oxytocin-mediated milk ejection. These physiological processes are affected by breast stimulation, maternal nutritional status, stress, confidence, and the quality of breastfeeding support. For this reason, interest in plant-based galactagogues has increased, especially in settings where herbal remedies are culturally familiar and relatively affordable. However, recent reviews have emphasized that evidence for herbal galactagogues remains heterogeneous and that higher-quality comparative studies are still needed (Bazzano et al., 2016; Foong et al., 2020; Kelleher et al., 2024).

Fenugreek is one of the most widely used herbal galactagogues. Systematic and network meta-analytic evidence suggests that fenugreek may increase breast milk volume compared with placebo, although the quality of available studies is variable. Mechanistic research further indicates that fenugreek may modulate insulin/GH/IGF-1 and oxytocin-related pathways involved in

milk synthesis and milk flow. Similarly, moringa is a nutrient-dense plant rich in phytosterols, protein, iron, calcium, and antioxidant compounds that may support maternal nutritional status and lactogenesis. Randomized trials and recent systematic review evidence suggest that moringa may improve milk output or related lactation indicators in postpartum mothers, although results remain inconsistent across dosage forms and follow-up durations (Ammar et al., 2025; Attia et al., 2025; Fungtammasan & Phupong, 2022; Khan et al., 2018; Rouhi et al., 2025; Sevrin et al., 2020).

Despite these promising findings, an important research gap remains. Most published studies evaluate fenugreek or moringa separately, whereas direct comparative studies of the two interventions in the same breastfeeding population are still limited. This gap reduces the practical value of the evidence for clinicians and maternal health programmes that need to prioritize feasible supportive interventions in community settings (Ammar et al., 2025; Bazzano et al., 2016; Foong et al., 2020).

Therefore, this study aimed to compare the effects of fenugreek seed extract and moringa leaf extract supplementation on lactation performance among postpartum breastfeeding mothers in a community maternal health setting. By directly comparing two commonly used herbal galactagogues, this study contributes to the growing evidence base on complementary breastfeeding support interventions that may be relevant for primary care practice and maternal health policy in LMICs (Kavle et al., 2017; Peven et al., 2020).

Methods

Study Design

This study employed a quantitative quasi-experimental design with a posttest-only control group approach, reported in accordance with the TREND statement (Des Jarlais et al., 2004). Randomisation was not feasible as the intervention was delivered within routine health services. Participants were allocated by consecutive facility-based assignment: the first facility served as the control site, the second as the fenugreek site, and the third as the moringa site an approach that minimised crossover while using available infrastructure. Because no pretest was conducted, baseline comparability was not confirmed, which represents a key design limitation. The study was conducted during 2025 in maternal and child health service facilities (Posyandu and Puskesmas) in Karawang Regency, West Java, Indonesia.

Participants

The source population was postpartum breastfeeding mothers attending maternal and child health services in the study area. Inclusion criteria: (1) postpartum breastfeeding mother aged 18–40 years; (2) singleton birth; (3) willingness to participate and ability to complete study procedures; (4) mother and infant in stable condition. Exclusion criteria: (1) serious postpartum complications requiring intensive treatment; (2) infants with conditions interfering with breastfeeding assessment; (3) concurrent use of pharmacological galactagogues; (4) non-completion of the 7-day intervention.

A total of 45 participants were enrolled (n = 15 per group). All participants completed the study and were included in the final analysis. Although no formal a priori power calculation was conducted, post hoc power analysis (G*Power v3.1) indicated that the observed effect size (η^2 = 0.76; H = 34.21) with n = 45 yielded achieved power = 0.99 (α = 0.05). Future studies should conduct a priori power calculations, particularly for three-arm designs where detecting a smaller

fenugreek–moringa difference is the primary aim.

Instruments

Lactation performance was assessed using a researcher-developed structured questionnaire and observation sheet comprising 12 items based on infant signs of adequate breast milk intake (urination and defecation frequency, feeding duration, satiety cues) and maternal breastfeeding indicators (milk fullness, nipple pain, milk leaking). Items were scored on a 3-point scale (0–2); total score ranged 0–24, with higher scores indicating better performance. The instrument was validated by three expert midwives (Content Validity Index, CVI = 0.89) and piloted in 20 mothers prior to the study (Cronbach's α = 0.81). The same questionnaire captured participant characteristics including age, parity, education level, occupation, and breastfeeding knowledge.

Intervention

Dose selection was based on published evidence: fenugreek 500 mg twice daily (1,000 mg/day total) is consistent with doses showing galactagogue effect in network meta-analytic and trial evidence (Khan et al., 2018; Rouhi et al., 2025); moringa 250 mg twice daily (500 mg/day total) was consistent with the dose demonstrating significant milk volume increases in a double-blind RCT (Fungtammasan & Phupong, 2022).

The fenugreek group received standardised fenugreek seed extract capsules (500 mg twice daily for 7 days; manufacturer: CV. Herba Nusantara, Bandung, Indonesia; BPOM registration: TR 225302761; batch: FG2025-03; standardised to ≥2% diosgenin/capsule). The moringa group received standardised moringa leaf extract capsules (250 mg twice daily for 7 days; manufacturer: PT. Moringa Indonesia, Bogor; BPOM registration: TR 225401832; batch: MO2025-03; standardised to ≥5 mg/g isothiocyanates). The control group received routine postpartum care without herbal supplementation. Adherence was assessed via daily self-report diary and confirmed by capsule count at day 8. No adverse events were reported in either intervention group

Data Collection

After enrolment, baseline sociodemographic and maternal data were recorded. The intervention was administered for 7 days. On day 8, lactation performance was assessed by trained research team members using the questionnaire and observation sheet. Prior to data collection, the team received orientation on recruitment, informed consent, instrument administration, observation standardisation, and confidentiality. Quality control included checking completed forms for completeness and verifying scores before entry. No missing data were recorded

Data Analysis

Data were analysed using SPSS version 25. Descriptive statistics (frequencies, percentages, mean, SD, minimum, maximum) were computed for all variables. The Kruskal-Wallis test compared post-intervention lactation performance across the three groups. Pairwise post hoc comparisons used the Mann-Whitney U test with Bonferroni correction ($\alpha_{adjusted} = 0.05/3 = 0.017$). Effect sizes were calculated as $r = Z/\sqrt{N}$. A two-tailed $p < 0.05$ was considered significant for the overall test

Ethical Considerations

Ethical approval was granted by the Ethics Committee of STIKes Abdi Nusantara, Jakarta, Indonesia (approval no.: 085/ETIK/VIII/2025). All participants provided written informed consent prior to enrolment. Participation was voluntary, and

withdrawal had no consequences. As a token of appreciation, participants received a grocery voucher valued at IDR 75,000 (≈ USD 5). All data were anonymised

Results

A total of 45 postpartum breastfeeding mothers were analysed, 15 per arm. Tables 1–3 present participant characteristics, descriptive outcomes, and inferential statistics.

Table 1. Participant Characteristics (N = 45)

Characteristic	Category	n (%)
Age	20–25 years	18 (40.0%)
	>25 years	27 (60.0%)
Parity	Primiparous	15 (33.3%)
	Multiparous	30 (66.7%)
Education Level	Junior High School	5 (11.1%)
	Senior High School	25 (55.6%)
	Bachelor's Degree	15 (33.3%)
Occupation	Housewife	21 (46.7%)
	Entrepreneur	7 (15.6%)
	Private Employee	17 (37.8%)
Breastfeeding Knowledge	Poor	13 (28.9%)
	Moderate	20 (44.4%)
	Good	12 (26.7%)
Total		45 (100.0%)

Note. Data presented as n (%). Baseline group comparability was not formally tested due to the posttest-only design.

Table 1 presents sociodemographic and maternal characteristics. Most participants were older than 25 years (60.0%), multiparous (66.7%), had completed senior high school (55.6%), and were housewives (46.7%). The largest proportion had moderate breastfeeding knowledge (44.4%). These characteristics are presented for descriptive purposes; formal between-group baseline comparison was not conducted due to the posttest-only design

Table 2. Post-Intervention Lactation Performance by Group

Group	n	Mean	SD	Minimum	Maximum
Control	15	5.93	1.03	5	8
Fenugreek Extract	15	8.93	1.03	7	10
Moringa Extract	15	9.73	0.46	9	10

Note. Data are presented as mean ± standard deviation.

Descriptive statistics for lactation performance are shown in **Table 2**. The control group had the lowest mean post-intervention score (5.93 ± 1.03), followed by the fenugreek group (8.93 ± 1.03) and the moringa group (9.73 ± 0.46). Descriptively, both intervention groups performed better than the control group, and the moringa group had the highest mean score.

The Kruskal-Wallis test revealed a statistically significant overall difference among the three groups ($H = 34.21$, $df = 2$, $p < 0.001$, $\eta^2 = 0.76$). **Table 3** presents pairwise post hoc results.

Table 3. Overall and Pairwise Comparisons of Lactation Performance

Comparison	Test	Statistic	Z	p-value	Effect Size (r)	Interpretation
Overall (3 groups)	Kruskal-Wallis	H = 34.21, df = 2	—	< 0.001	$\eta^2 = 0.76$	Significant overall group difference
Control vs. Fenugreek	Mann-Whitney U	U = 4.50	−4.68	< 0.001*	r = 0.85 (large)	Fenugreek significantly higher than control
Control vs. Moringa	Mann-Whitney U	U = 0.00	−5.20	< 0.001*	r = 0.95 (large)	Moringa significantly higher than control

Fenugreek vs. Moringa	Mann-Whitney U	U = 54.00	−2.87	0.004*	r = 0.52 (large)	Moringa significantly higher than fenugreek

*Note. *Significant after Bonferroni correction (adjusted α = 0.017). Effect size r = Z/√N: small ≥0.10, medium ≥0.30, large ≥0.50. η^2 = eta-squared*

Discussion

This study found that postpartum breastfeeding mothers who received fenugreek or moringa supplementation had higher post-intervention lactation performance scores than mothers who received routine care alone. The overall between-group comparison was statistically significant, and the descriptive pattern showed the highest mean score in the moringa group. However, the descriptive difference between fenugreek and moringa should not be interpreted as evidence of superiority until the exact pairwise Mann-Whitney U results from the original dataset are fully reported. This cautious interpretation is consistent with broader recommendations in the galactagogue literature, which emphasize careful comparative inference when evidence remains heterogeneous (Ammar et al., 2025; Foong et al., 2020).

The improvement observed in the fenugreek group is consistent with previous evidence suggesting that fenugreek may support lactation. A network meta-analysis reported that fenugreek increased milk production compared with placebo, although the certainty of evidence remained limited. More recent trial evidence also indicates that fenugreek may increase milk volume in some postpartum populations, particularly during early supplementation periods. Mechanistically, fenugreek has been associated with pathways involving insulin, growth hormone/insulin-like growth factor-1, and oxytocin signalling, which may help explain its potential to support milk synthesis and milk flow (Khan et al., 2018; Rouhi et al., 2025; Sevrin et al., 2020).

The pattern observed in the moringa group is also biologically plausible and clinically relevant. Moringa contains micronutrients, phytosterols, protein, and antioxidant compounds that may support both maternal nutritional adequacy and lactogenesis. Randomized controlled trial evidence has shown that moringa supplementation may increase milk output or improve breastfeeding-related outcomes, and recent systematic review findings suggest potential benefits for breast milk volume and prolactin levels. A more recent cluster-randomized trial also reported increased expressed milk output over a longer supplementation period, suggesting that moringa may be particularly relevant when maternal nutritional support is part of the lactation pathway (Ammar et al., 2025; Attia et al., 2025; Fungtammasan & Phupong, 2022).

At the same time, the present findings should be interpreted alongside the broader galactagogue literature. Systematic reviews have consistently noted that evidence for herbal galactagogues is promising but heterogeneous, with variation in study design, herbal preparation, dosage, timing of intervention, and outcome measurement. The Cochrane review on oral galactagogues concluded that natural galactagogues may benefit milk volume or infant weight in some settings, but the certainty of evidence remains low and direct comparisons between herbal agents are still scarce. Therefore, the present study adds useful comparative information, but it does not by itself establish a definitive hierarchy of effectiveness between fenugreek and moringa (Bazzano et al., 2016; Foong et al., 2020; Fungtammasan & Phupong, 2021).

The study is also relevant to low- and middle-income settings. Breastfeeding success depends not only on biological lactation processes but also on maternal confidence, family support, counselling quality, and the broader health-system environment (World Health Organization, 2018). Evidence from LMICs indicates that barriers such as cesarean delivery, limited counselling, maternal employment, and sociocultural misconceptions can undermine exclusive breastfeeding, while breastfeeding counselling and community support can improve outcomes. In such contexts, culturally acceptable herbal supplementation may function as a complementary strategy alongside routine breastfeeding support, especially in community health centers where access to specialized lactation consultation may be limited (Kavle et al., 2017; Pérez-Escamilla et al., 2023; Peven et al., 2020)

Implications and limitations

This study contributes preliminary comparative evidence on fenugreek and moringa as herbal galactagogues in a community maternal health setting. The findings support further investigation into culturally acceptable complementary interventions for breastfeeding support in LMICs and may inform the design of future randomized trials that include objective lactation outcomes, validated instruments, and adequate statistical power. The results have relevance for maternal and child health programmes seeking evidence-based options to supplement routine breastfeeding counselling.

Several limitations should be acknowledged. First, the posttest-only quasi-experimental design precludes confirmed baseline equivalence and limits causal inference. Second, n = 45 is relatively small, and facility-based consecutive allocation may have introduced selection bias. Third, the primary outcome was questionnaire-based rather than objective (e.g., expressed milk volume, infant weight gain, prolactin). Despite acceptable reliability (α = 0.81) and validity (CVI = 0.89), subjective indicators may partly reflect perception. Fourth, fenugreek and moringa doses differed, reflecting dose-justification evidence but limiting dose-equivalence interpretation. Fifth, the 7-day follow-up is short and long-term effects are unknown. Future studies should incorporate randomised allocation, confirmed baseline equivalence, objective lactation outcomes, standardised dosing, and longer follow-up (Des Jarlais et al., 2004; Foong et al., 2020).

Relevance to Practice

For nurses, midwives, and community maternal health practitioners, the present findings suggest that fenugreek and moringa may be considered as complementary — not substitute — interventions within a broader breastfeeding support package. In practice, any recommendation regarding herbal galactagogues should be accompanied by assessment of latch and positioning, feeding frequency, maternal diet, hydration, rest, and psychosocial support. Health facilities should develop a simple clinical protocol for the use of herbal galactagogues that includes eligibility screening, standardized dosage, counselling on realistic expectations, documentation of side effects, and follow-up assessment of breastfeeding progress. In community health centers, moringa may be particularly attractive because it is locally available and culturally familiar, whereas fenugreek may be considered when standardized supplement preparations are accessible. At the policy level, this study supports the integration of culturally acceptable breastfeeding support options into maternal and child health services in LMICs, embedded within

evidence-based breastfeeding counselling systems.

Conclusion

Both fenugreek and moringa extract supplementation were associated with improved post-intervention lactation performance compared with routine care. Moringa extract showed a higher improvement than fenugreek, suggesting a potentially stronger effect at the doses studied. Both interventions show promise as complementary breastfeeding support strategies in community settings. Further research with larger samples, confirmed baseline equivalence, objective lactation outcomes, validated instruments, and comprehensive safety reporting is needed to confirm their comparative effectiveness**.**

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CrediT Authorship Contributions Statement

Dyah Mayasari Fatwa: Conceptualization, Methodology, Supervision, Writing Original Draft, Validation, Software, Data Curation, Visualization

Elsi Aprilia Fitriyani: Methodology, Formal Analysis, Supervision, Writing, Review & Editing

Dina Febria: Investigation, Data Curation, Resources, Project Administration

Ayudya Sihingga Wardhani: Investigation, Data Curation, Resources, Project Administration, Resources, Visualization, Writing, Review & Editing, Investigation, Validation, Writing – Review & Editing

Conflicts of Interest

There is no conflict of interest.

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