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Lactogenic Potential of Banana Flower (Musa spp.) on Breast Milk Production: A Systematic Review

Fitria Mushollini[1*], Apriliya Roza Werdani[2], Fitratur Rahmah Agustina[3], Samnil Astuti[4], Donal Ortega[5]

[1,2,3,4,5] Program Studi Gizi, Universitas Adzkia, Padang, Indonesia

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ABSTRACT/ ABSTRAK

ABSTRACT*. Inadequate breast milk production is a major contributor to the failure of exclusive breastfeeding. Banana flower (Musa spp.) has long been traditionally used as a galactagogue in Southeast Asia; however, its clinical effectiveness requires systematic evaluation. This systematic review aims to evaluate the lactogenic effects of banana flower on breast milk production based on available clinical evidence. A systematic search was conducted in ProQuest, ScienceDirect, and Portal Garuda databases for studies published between 2016 and 2026. The inclusion criteria comprised randomized controlled trials (RCTs) and quasi-experimental studies involving postpartum mothers. Results: Thirteen studies were identified for synthesis. The majority of quasi-experimental studies conducted in Indonesia reported a significant increase in breast milk volume ($p < 0.05$) following the consumption of fresh banana flower (200–300 g/day). In contrast, high-quality RCTs using encapsulated extracts demonstrated inconsistent findings, with some studies reporting no significant differences compared with placebo during the early postpartum period. These discrepancies may be attributed to variations in banana species (e.g., Musa balbisiana), processing methods, and dosage. Phytochemical compounds such as saponins and flavonoids present in banana flower are hypothesized to stimulate prolactin secretion. Conclusion: Banana flower shows promising potential as a natural galactagogue, particularly when consumed as a whole food. However, standardized RCTs with precise dosing are required to confirm its clinical applicability.*

Kata kunci:

Jantung Pisang, Laktogogum, Laktasi, Produksi ASI.

ABSTRAK. Rendahnya produksi ASI merupakan penyebab utama kegagalan ASI eksklusif. Jantung pisang (Musa spp.) telah lama digunakan secara tradisional sebagai laktogogum di Asia Tenggara, namun efektivitas klinisnya memerlukan evaluasi sistematis. Tinjauan sistematis ini mengevaluasi potensi laktogenik jantung pisang terhadap produksi ASI berdasarkan bukti klinis. Pencarian sistematis dilakukan pada *ProQuest*, *ScienceDirect*, dan Portal Garuda untuk studi terbitan 2016-2026. Kriteria inklusi meliputi *randomized controlled trials* (RCT) dan studi kuasi-eksperimental pada ibu nifas. Hasil: Tiga belas studi diidentifikasi untuk sintesis. Mayoritas studi kuasi-eksperimental di Indonesia melaporkan peningkatan volume ASI yang signifikan ($p < 0.05$) setelah konsumsi jantung pisang segar (200-300g/hari). Sebaliknya, RCT berkualitas tinggi yang menggunakan ekstrak kapsul menunjukkan temuan yang tidak konsisten, di mana beberapa melaporkan tidak ada perbedaan signifikan dibandingkan plasebo pada awal masa nifas. Perbedaan ini kemungkinan disebabkan oleh variasi spesies pisang (misal: Musa balbisiana), metode pengolahan, dan dosis. Senyawa fitokimia seperti saponin dan flavonoid dalam jantung pisang dihipotesiskan menstimulasi sekresi prolaktin. Kesimpulan: Jantung pisang menunjukkan potensi menjanjikan sebagai laktogogum alami, terutama dalam bentuk makanan utuh. Namun, diperlukan RCT terstandarisasi dengan dosis yang presisi untuk mengonfirmasi aplikasi klinisnya.

Corresponding Author:
Fitria Mushollini
Program Studi Gizi, Universitas Adzkia, Padang, Indonesia
Email: fitriamushollini123@adzkia.ac.id

INTRODUCTION

Exclusive breastfeeding is one of the most effective public health interventions for reducing infant morbidity and mortality globally. Nevertheless, the low coverage of exclusive breastfeeding remains a significant global health challenge. Evidence indicates that infants who are not exclusively breastfed have a 14-fold higher risk of death from pneumonia and a 10-fold higher risk of death from diarrhea compared to infants who receive optimal breastfeeding (Victora et al., 2016).

The World Health Organization (WHO) has set a target that at least 50% of infants receive exclusive breastfeeding for the first six months of life by 2025. However, evidence from the field shows that many mothers discontinue breastfeeding earlier than recommended, one of the contributing factors being difficulties in breast milk production (WHO, 2021). In Indonesia, a decline in exclusive breastfeeding rates is often observed as infants grow older due to various lactation barriers. Data from the 2023 Indonesian Health Survey (Survei Kesehatan Indonesia/SKI) show that the proportion of infants aged 0–5 months who received exclusive breastfeeding reached 68.6%, but this figure decreased significantly to 55.5% among infants aged 6 months (Kemenkes RI, 2023). This condition indicates that lactation barriers are increasingly experienced by mothers as the infant's age increases.

One of the most frequently reported lactation barriers among breastfeeding mothers is the perception of insufficient milk supply (PIMS). This condition may trigger anxiety, lead to early cessation of breastfeeding, and result in the premature introduction of infant formula earlier than recommended (Jumhati, 2025; Siagian et al., 2023). To address this issue, the use of galactagogues or lactogenic agents has become a widely practiced strategy across various cultures. Galactagogues are defined as substances that stimulate and increase breast milk production (Maydianasari et al., 2024). Currently, the use of natural galactagogues has gained increasing research attention, as they are considered more economical and associated with fewer side effects for both mothers and infants compared to synthetic galactagogues (Siagian et al., 2023).

In Southeast Asia, the utilization of traditional plant-based ingredients as galactagogues has been part of local wisdom for centuries. One prominent example is the banana flower (Musa spp.). In Indonesia, banana flower from the Musa balbisiana variety (locally known as *pisang batu* or *klutuk*) has been traditionally believed to increase breast milk volume and improve the nutritional status of postpartum mothers (Thagunna et al., 2023).

Banana flower (Musa paradisiaca) is a local food ingredient that contains various secondary metabolites, such as flavonoids, polyphenols, and saponins, which are potentially associated with lactogenic effects (Maydianasari et al., 2024). These compounds are reported to act by increasing prolactin hormone levels and stimulating alveolar cells in the mammary glands, thereby enhancing breast milk production (Siagian et al., 2023). However, given the variability in findings regarding the effectiveness of banana flower as a galactagogue, a systematic review is required to synthesize the available scientific evidence and to validate its potential as a food-based lactogenic solution (Maydianasari et al., 2024).

Biochemically, the lactogenic potential of banana flower is associated with its active phytochemical content. Several studies have reported that saponins, flavonoids, and alkaloids present in banana flower act as stimulants of the anterior pituitary gland, enhancing the

secretion of prolactin the primary hormone involved in breast milk synthesis (Amornlerdpison et al., 2021; Wahyuningsih et al., 2017). Nevertheless, global-level studies demonstrate variability in outcomes, particularly when compared with empirical findings and small-scale local studies in Indonesia, which generally report positive effects (Foong et al., 2020).

Recent Randomized Controlled Trials (RCTs) using standardized banana flower extracts have reported inconsistent lactogenic effects compared with placebo, particularly during the early stages of lactation. These divergent findings may be attributable to heterogeneity in processing methods, plant varieties, and administered dosages. To date, no systematic synthesis has comprehensively evaluated clinical evidence across diverse study designs to clarify the lactogenic potential of banana flower. Therefore, this systematic review aims to critically assess the effectiveness of banana flower on breast milk production and to identify key factors influencing its lactogenic efficacy based on the current clinical literature.

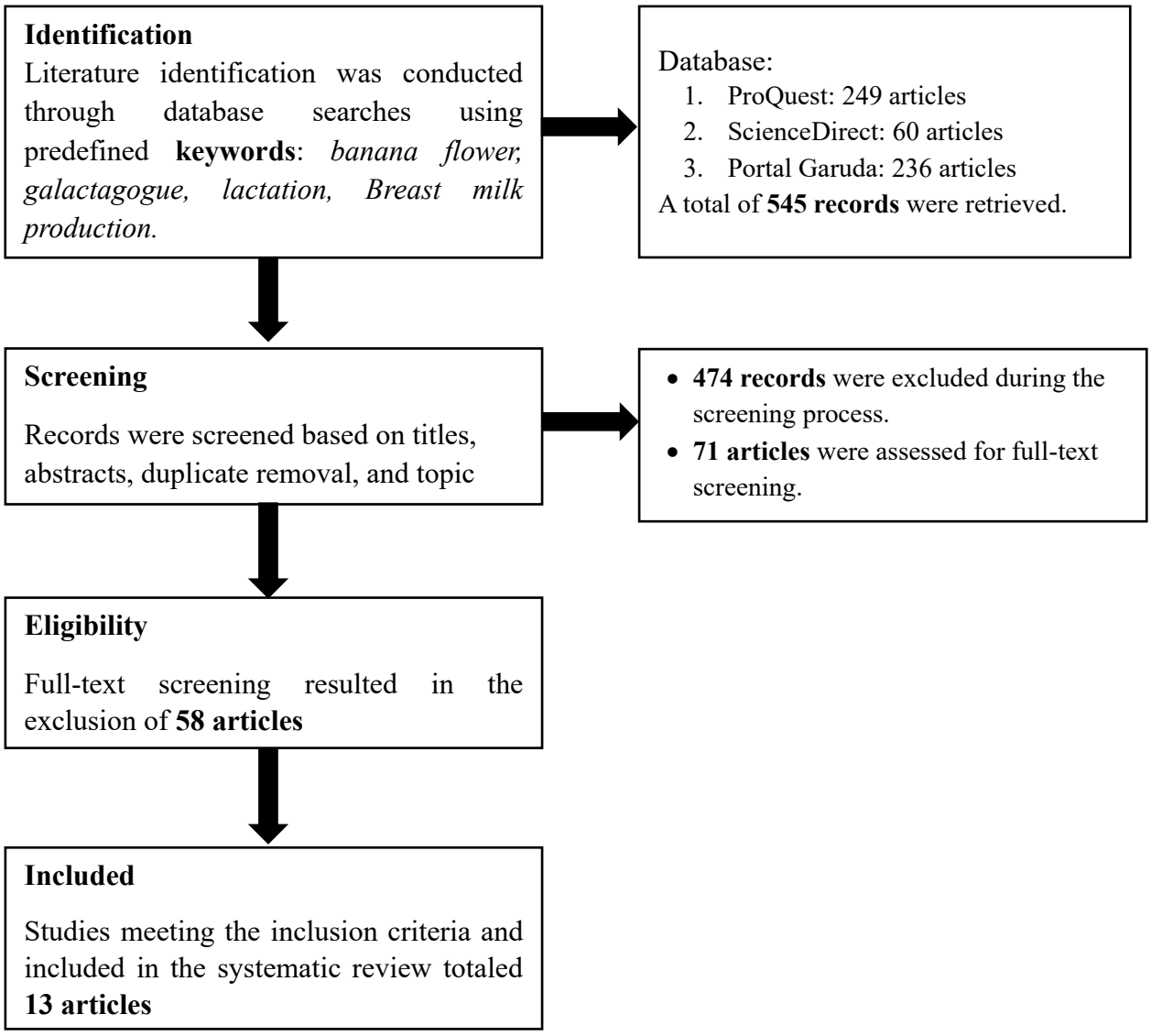
RESEARCH METHOD

This study employed a systematic review design and was conducted and reported in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines to examine the lactogenic potential of banana flower on breast milk production among breastfeeding mothers. This approach was selected to ensure a comprehensive, transparent, and systematic synthesis of scientific evidence derived from relevant intervention studies.

A comprehensive literature search was conducted across multiple scientific databases, including ProQuest, ScienceDirect, and the Indonesian national database Portal Garuda. Publications from the past ten years (2016–2026) were included to ensure the relevance of the most recent clinical evidence. The search strategy was developed based on the PRISMA framework, using database-specific keyword combinations adapted to the characteristics and search engines of each database. The search terms were as follows: International databases: (“Banana flower” OR “Banana flower” OR “Musa spp.”) AND (“Breast milk” OR “Lactation” OR “Milk production” OR “Galactagogue”); National database: (“*Jantung pisang*” OR “*Musa spp*.”) AND (“*ASI*” OR “*Produksi ASI*” OR “Ibu menyusui”).

The inclusion criteria comprised experimental research articles with a control or comparator group, available in full text, and published within the past ten years. The study population included postpartum or lactating mothers who received interventions involving banana flower in various forms, such as cooked vegetables, tea, extracts, or supplements.

The exclusion criteria encompassed review articles, editorials, case reports, and animal-based (in vivo) studies. The article selection process was conducted in a stepwise manner in accordance with the PRISMA flow, beginning with the identification of records through database searching, followed by title screening, abstract review, and full-text assessment based on the predefined inclusion and exclusion criteria. Studies that met the eligibility criteria were included in the final synthesis and analyzed descriptively, with particular attention to participant characteristics, forms of banana flower interventions, and reported effects on breast milk production in each study.



Picture 1. PRISMA Flow Diagram

RESULTS

Table 1. Experimental Research Results with Control/Comparison Group

Author & Year	Study Design	Subject	Intervention (Dose & Duration)	Comparator	Main Findings
Sitti Hubbaya et al (2016)	Quasi-Experimental with Equivalent Time Sample Design	60 post-partum mothers	Kepok banana flower consumed as part of the daily diet during the observation period	-	There is an increase in the volume and flow of breast milk
Patrin & Rizki (2019)	Pra-Experimental (Two Group Pre test Post Test)	32 breastfeeding mothers	One serving of banana flower vegetable (Once daily for 7 days)	Control group	Both interventions were effective; however, the banana flower

					group showed more consistent improvements in milk flow scores ($p < 0.001$).
Masmuni et al (2020)	Quasi-Experiment (Pre-post Nonequivalent Control)	122 breastfeeding mothers	Consumption of banana flower for 7 days (Dose not specified)	Control group	A significant difference in breastfeeding frequency was observed after banana flower consumption ($p < 0.05$)
Manalu dkk. (2020)	Quasi-Experiment (Two Group Post-test Only)	30 breastfeeding mothers	Vegetable of Kepok banana flower (200g/day for 7 days)	Control group	Breast milk production in the intervention group was substantially higher than in the control group.
Haryati Astuti (2020)	Quasi-Experiment (Post-test with Control)	14 breastfeeding mothers	Vegetable of banana flower (once daily for 7 days)	Katuk leaf vegetable	The proportion of mothers categorized as having 'adequate milk flow' reached 64.3%, with effectiveness comparable to katuk leaves.
Nordin et al (2020)	Eksperimental study with control group	54 working breastfeeding mothers	Lactogenic biscuits containing 30% banana flower flour (5 biscuits/day for 14 days)	Control biscuits containing 100% wheat flour (5 biscuits/day for 14 days)	The intervention group showed a statistically significant increase in expressed breast milk volume compared with the control group on day 14 ($p < 0.05$).
Susanham & Sunisa (2022)	Randomized Controlled Trial (RCT)	60 post-cesarean section mothers	Banana flower juice (Three times daily for 3 days)	Water	The intervention group demonstrated significantly higher milk flow rates ($p = 0.017$) and breast milk volume on days 2 and 3.
Nurmiaty et al. (2023)	Quasi-Experiment (Two Group Pre-Post Test)	40 breastfeeding mothers	Vegetable of Kepok banana flower (Once daily for 7 days)	Oxytocin massage	Significant increases in prolactin hormone levels were observed in both groups ($p<0,001$).
Yuliani et al (2023)	Quasi-Experiment (Post-test with Control)	22 breastfeeding mothers	200 g twice daily (400g/day for selama 7 days)	Control group	A significant increase in breast milk volume was observed ($p < 0.001$), with higher mean increases in the intervention

					group.
Kurniawati et al (2023)	Quasi Experimental (Nonequivalent Control Group)	22 breastfeeding mothers	One serving of banana flower pizza daily for 7 days	Control group	Mean breast milk volume increased from 99.09 ml to 131.82 ml in the intervention group ($p < 0,001$).
Hastuti et al (2024)	True Experimental (Pre-Post Test)	32 post-partum mothers	200 g sauteed banana flower (once daily for days).	Oxytocin massage	Mean breast milk volume increased by 90.375 cc in the banana flower group; effectiveness was statistically comparable to oxytocin massage ($p = 0.519$).
Rungruengsirichok & Phupong (2024)	Randomized, Double-Blind, Placebo-Controlled Trial (RCT)	70 mothers with preterm infants	Banana flower extract capsules (36 mg/day for 14 days)	Placebo	No significant differences in breast milk volume between intervention and placebo groups on day 7 ($p = 0.73$) or day 14 ($p = 0.60$)
Zelharsandy & Soleha (2024)	Quasi-experimental study with a control group design	30 breastfeeding mothers	Vegetable of banana flower (One portion for 7 days)	Control group	The mean breast milk production score in the intervention group (6.87) was significantly higher than that of the control group (3.73) ($p = 0.001$).

***Source**: (Aisya et al., 2020; Astuti, 2020; Patrin & Rizki, 2019; Hastuti et al., 2024; Hubaya et al., 2016; Kurniawati et al., 2023; Manalu et al., 2020; Nordin et al., 2020; Nurmiaty et al., 2023; Rungruengsirichok & Phupong, 2024; Yimyam & Pattamapornpong, 2022; Yuliani et al., 2023; Zelharsandy & Soleha, 2024)*

Based on the synthesis of the experimental and quasi-experimental studies included in this review, the majority of the evidence indicates that banana flower consumption (Musa spp.) exerts a positive effect on breast milk production among breastfeeding mothers. These effects were reported across multiple outcome indicators, including increased breast milk volume, improved milk flow, higher breastfeeding frequency, and elevated prolactin hormone levels.

Most of the included studies employed quasi-experimental designs with control or comparator groups, while a smaller number adopted randomized experimental designs. Interventions were administered in various forms, including vegetable of banana flower, juice, capsule extracts, and innovative processed products (e.g., pizza and lactogenic biscuits), with intervention durations ranging from 3 to 14 days. The most commonly reported dosage for fresh or processed food-based interventions ranged between 200 and 400 g per day.

Studies utilizing experimental designs demonstrated heterogeneous findings. Hastuti et al. (2024) reported that the consumption of 200 g of sautéed banana flower for six days significantly increased breast milk volume, with effectiveness statistically comparable to

oxytocin massage as a comparator intervention. Similar findings were reported by Susanham and Sunisa (2022), who observed significant increases in both breast milk volume and milk flow among post–cesarean section mothers following the administration of banana flower juice for three days. These findings suggest that banana flower may be effective even in clinical contexts associated with a higher risk of delayed lactation.

In contrast, a randomized double-blind placebo-controlled trial employing standardized banana flower extract capsules did not demonstrate significant differences between the intervention and placebo groups on either day 7 or day 14. This finding indicates that the lactogenic efficacy of banana flower may be influenced by factors such as dosage, formulation, and the bioavailability of active compounds.

Overall, quasi-experimental studies reported more consistent positive outcomes. Several studies demonstrated significant increases in breast milk volume and production scores among mothers consuming banana flower compared with control groups. Additionally, increases in prolactin hormone levels were observed in both banana flower intervention groups and oxytocin massage comparator groups, reinforcing the role of banana flower in the hormonal regulation of lactation. Some studies also reported a significant increase in the proportion of mothers classified as having adequate milk flow following banana flower intervention, with effectiveness comparable to other herbal galactagogues such as katuk leaves (*Sauropus androgynus*).

Innovative banana flower–based food products, including pizza and lactogenic biscuits, also yielded promising results. Studies involving working breastfeeding mothers showed that consumption of lactogenic biscuits formulated with banana flower flour for 14 days significantly increased expressed breast milk volume compared with wheat flour–based control products. These findings suggest that banana flower retains its lactogenic properties even after food processing.

DISCUSSION

Lactogenic Potential of Banana Flower on Breast Milk Production

The findings of this systematic review indicate that banana flower (*Musa spp.*) demonstrates a relatively consistent lactogenic potential in enhancing breast milk production among breastfeeding mothers. The majority of the included studies reported significant improvements across multiple lactation indicators, including breast milk volume, milk flow, breastfeeding frequency, and hormonal parameters following banana flower administration in various forms (Hastuti et al., 2024; Manalu et al., 2020; Zelharsandy & Soleha, 2024). These findings support the role of banana flower as a natural galactagogue with potential effectiveness in promoting lactation, particularly during the early postpartum period.

The effectiveness of banana flower is further supported by comparisons with established nonpharmacological interventions. Several experimental studies demonstrated that increases in breast milk volume among mothers consuming banana flower were statistically comparable to those achieved through oxytocin massage, a commonly used intervention to stimulate milk production (Hastuti et al., 2024; Nurmiaty et al., 2023). In addition, the effectiveness of banana flower in improving milk flow was reported to be comparable to other herbal galactagogues, such as katuk leaves, which have long been utilized in lactation practices in Indonesia (Astuti, 2020). This comparable efficacy highlights banana flower as a viable, accessible, and cost-effective food-based galactagogue alternative.

From a physiological perspective, the lactogenic effects of natural galactagogues can be explained through their influence on hormonal regulation and mammary gland function. Lactation is regulated by the coordinated action of prolactin and oxytocin, whereby prolactin stimulates milk synthesis in alveolar cells, while oxytocin mediates the milk ejection (let-down) reflex via contraction of myoepithelial cells (Lawrence & Lawrence, 2016; Victora et al., 2016). Natural galactagogues are known to modulate these neuroendocrine pathways, thereby supporting both milk production and release.

Banana flower contains several bioactive phytochemicals, including flavonoids, saponins, and polyphenols, which have been reported to enhance prolactin secretion through modulation of dopaminergic activity—dopamine being a physiological inhibitor of prolactin release (Amornlerdpison et al., 2021). Furthermore, these compounds may indirectly support oxytocin reflex stability by improving maternal nutritional status and reducing stress responses, both of which are known to impair milk ejection (Victora et al., 2016; Ystrom, 2012). Thus, banana flower appears to exert its lactogenic effects through multifactorial mechanisms, acting directly on hormonal regulation and indirectly by optimizing maternal physiological conditions.

Despite the predominance of positive findings, not all studies reported significant effects. A randomized double-blind placebo-controlled trial using standardized banana flower extract capsules found no significant differences between the intervention and placebo groups up to day 14 (Rungruengsirichok & Phupong, 2024). This result suggests that the lactogenic efficacy of banana flower may be strongly influenced by formulation and bioavailability, with whole-food or traditionally processed preparations yielding more consistent effects than isolated extract forms. Such variability underscores the importance of considering intervention form when interpreting the clinical effectiveness of natural galactagogues.

Dose, Formulation, and Clinical Effectiveness

Building on the observed lactogenic potential of banana flower described in the preceding section, dosage and formulation emerge as critical modifiers of clinical effectiveness. Across the included studies, significant lactation outcomes were most consistently reported when banana flower was administered at daily doses equivalent to 200 - 400 g in fresh or food-based forms, consumed regularly throughout the intervention period (Hastuti et al., 2024; Manalu et al., 2020; Yuliani et al., 2023). Notably, higher intake levels particularly 400 g/day were associated with greater increases in breast milk volume compared with control groups, suggesting a dose-dependent effect (Yuliani et al., 2023).

This dose–response relationship is biologically plausible within the framework of hormonal regulation of lactation. Breast milk synthesis is primarily governed by prolactin secretion from the anterior pituitary, which responds to neuroendocrine stimuli and adequate nutritional input (Lawrence & Lawrence, 2016). Sufficient intake of natural galactagogues appears necessary to reach a threshold of hormonal stimulation capable of enhancing the responsiveness of mammary alveolar cells to prolactin. Conversely, suboptimal dosing may fail to elicit a meaningful biological response, resulting in limited or non-significant clinical effects (Victora et al., 2016). This mechanism may partially explain the heterogeneity observed across studies.

In addition to dosage, product variation and mode of delivery substantially influenced outcomes. Several studies demonstrated that banana flower–based food innovations—including pizza and lactogenic biscuits—significantly improved breast milk volume compared with control products, both in community settings and among working mothers

(Kurniawati et al., 2023; Nordin et al., 2020). These findings reinforce earlier observations that banana flower remains lactogenically active even after food processing, extending its applicability beyond traditional preparations.

The sustained effectiveness of these processed forms may be explained by the concepts of bioavailability and food matrix interactions. When consumed as whole foods or minimally processed products, phytochemicals such as flavonoids, saponins, and polyphenols are embedded within a complex nutritional matrix that supports gradual absorption and synergistic interaction with other nutrients (Amornlerdpison et al., 2021; Wahyuningsih et al., 2017). Furthermore, diversified food forms may enhance maternal adherence, a key determinant of success in nutrition-based lactation interventions, particularly during the early postpartum period (Victora et al., 2016).

In contrast, findings from studies employing low-dose capsule extracts were less favorable. A randomized double-blind placebo-controlled trial involving mothers of preterm infants found no significant differences between intervention and placebo groups (Rungruengsirichok & Phupong, 2024). This discrepancy likely reflects limitations related to reduced bioavailability, loss of synergistic food matrix effects, and insufficient dosing. Additionally, lactation challenges in mothers of preterm infants are inherently more complex, potentially attenuating responsiveness to nutritional galactagogues (Victora et al., 2016).

Taken together, these findings suggest that the clinical efficacy of banana flower as a galactagogue is context-dependent, shaped by dose adequacy, formulation, and adherence. Whole-food–based interventions delivered at sufficient doses appear to offer both biological and practical advantages over extract-based preparations, particularly within community-oriented maternal and child health programs.

Timing and Duration of Intervension

Across most studies, banana flower administration was initiated during the early postpartum period, a critical phase for the establishment and stabilization of breast milk production. Evidence indicates that supplementation during this period contributes to more rapid improvements in both breast milk volume and milk flow (Hubaya et al., 2016; Yimyam & Pattamapornpong, 2022). This finding is particularly relevant for mothers at increased risk of delayed onset of lactation, such as those undergoing cesarean delivery.

The most consistently reported intervention duration in the literature was seven consecutive days. The majority of studies employing this duration demonstrated significant increases in breast milk production compared with control groups (Manalu et al., 2020; Yuliani et al., 2023; Zelharsandy & Soleha, 2024). Shorter intervention periods, notably three days, were also reported to be effective in improving breast milk flow and volume among post–caesarean section mothers; however, the persistence of these effects beyond the immediate postpartum period has not yet been adequately evaluated (Yimyam & Pattamapornpong, 2022).

Longer intervention durations of up to 14 days yielded heterogeneous outcomes, depending on the formulation used. Functional food products, such as lactogenic biscuits, were associated with significant increases in breast milk volume following 14 days of consumption, whereas banana flower capsule extracts did not demonstrate significant differences compared with placebo over the same duration (Nordin et al., 2020; Rungruengsirichok & Phupong, 2024). Collectively, these findings highlight that the clinical effectiveness of banana flower–based interventions is influenced by a combined interplay of timing of administration, intervention duration, and product formulation.

CONCLUSION

Based on a systematic appraisal of the contemporary scientific literature, insufficient breast milk production remains a significant maternal health challenge. Accumulating evidence suggests that this condition may be effectively addressed through banana flower–based nutritional interventions (Musa spp.). Banana flower functions as a natural galactagogue rich in bioactive compounds, including saponins, flavonoids, and polyphenols, which have been shown to stimulate the secretion of prolactin and oxytocin, thereby increasing milk volume and accelerating the onset of lactation, including in clinically complex contexts such as post–caesarean section.

Overall, the synthesized evidence suggests that banana flower consumption is generally associated with beneficial effects on breast milk production, particularly when administered in fresh or food-based forms at adequate dosages and intervention durations. However, the variability in outcomes across studies—especially those employing standardized extracts—highlights the influence of methodological factors and formulation types on clinical effectiveness. This underscores the need for cautious interpretation of the findings and for greater standardization of interventions in future research.

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