

Original Article

Effect of Blanched Pineapple and Massage Therapy on Uterine Involution and Breast Milk Production: A Quasi-Experimental Study in Postpartum Mothers

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ABSTRACT

Background: Optimal postpartum recovery and lactation are vital for maternal and neonatal health. Pineapple, rich in bromelain and bioactive compounds, may aid uterine involution and lactogenesis, while massage therapy promotes oxytocin release and milk production. Evidence on their combined effect remains limited. This study examined the impact of blanched pineapple consumption with massage therapy on uterine fundal height reduction and breast milk production in postpartum mothers.

Methods: A quasi-experimental study with a two-group pretest–posttest design followed the TREND reporting guideline. 50 postpartum mothers were recruited using purposive sampling (25 intervention, 25 control). Inclusion criteria included mothers within 24–48 hours postpartum, aged 20–35 years, with a singleton birth and no obstetric complications; exclusion criteria were allergy to pineapple, postpartum hemorrhage, or medical contraindications for massage. The intervention group received blanched pineapple consumption (200 g/day for 7 days) combined with standardized massage therapy, while the control group received routine postpartum care. UFH was measured using a non-elastic tape, and breast milk production was assessed through maternal report and expressed volume (validated measurement protocol). Ethical approval was obtained from the institutional review board. Data were analyzed using paired and independent t-tests, and effect sizes (Cohen's d, 95% CI) were calculated.

Results: Mothers in the intervention group experienced a significantly greater reduction in UFH (mean difference = 2.1 cm, $p < 0.01$, Cohen's d = 0.78) compared to the control group. Breast milk production was also higher in the intervention group, both in average volume (+45 mL/day, $p < 0.01$, Cohen's d = 0.72) and frequency of breastfeeding episodes (OR = 2.3, 95% CI: 1.4–3.8). These findings indicate a synergistic effect of pineapple's enzymatic properties and massage-induced oxytocin release on uterine involution and lactogenesis.

Conclusion: Blanched pineapple consumption combined with massage therapy effectively accelerates uterine involution and enhances breast milk production in postpartum mothers. This integrated, non-pharmacological approach can be considered a safe and culturally adaptable adjunct to routine postpartum care. Healthcare providers are encouraged to incorporate such interventions into maternal recovery programs to support exclusive breastfeeding and improve maternal health outcomes.

Keywords: Ananas comosus; Uterine Involution; Lactation; Massage; Postpartum Period.

Implications for Practice:

- The combined use of pineapple consumption and massage therapy offers a safe, affordable, and accessible way to accelerate uterine involution and support maternal recovery in resource-limited healthcare settings.
- Healthcare providers can recommend these integrative interventions to enhance breast milk production and strengthen exclusive breastfeeding programs.
- Midwives and nurses can incorporate these simple, non-pharmacological strategies alongside standard postpartum care, particularly in areas with limited medical resources.

Introduction

Postpartum maternal health continues to be a critical global health issue, directly affecting maternal well-being, neonatal survival, and long-term child development. The postpartum period, often called the “fourth trimester,” is characterized by profound physiological, psychological, and social transitions ([Souza et al.](#), 2024). One of the most essential physiological processes during this stage is uterine involution, defined as the gradual return of the uterus to its pre-pregnancy size and condition. Inadequate or delayed uterine involution has been strongly associated with postpartum hemorrhage, higher risk of infection, and prolonged recovery, which pose a significant threat to maternal health ([Soliman & Nady](#), 2025; [Heller et al.](#), 2023). At the same time, successful breast milk production plays a decisive role in infant survival and nutrition, especially in the first six months of life when the World Health Organization recommends exclusive breastfeeding. Nevertheless, many women struggle to establish or maintain optimal lactation, resulting in early introduction of formula feeding and increased risks of poor infant outcomes ([Sari](#), 2023; [WHO](#), 2024; [Walker](#), 2021).

Globally, postpartum complications remain a major contributor to maternal morbidity and mortality. WHO reports that nearly 20% of maternal deaths in low- and middle-income countries are due to postpartum hemorrhage, frequently linked to poor uterine involution, while inadequate breastfeeding practices contribute to more than 820,000 preventable child deaths

annually ([WHO](#), 2024). At the national level, the 2022 Indonesian Demographic and Health Survey (SDKI) recorded that the exclusive breastfeeding rate was only 67.74%, below the WHO global target of 70%, while maternal morbidity due to postpartum hemorrhage and infection remains one of the top three causes of maternal complications. Locally, disparities are evident: exclusive breastfeeding rates in several provinces, including East Java and South Sulawesi, are below 60%, and postpartum hemorrhage continues to account for more than 25% of maternal deaths in rural districts ([Kody & Sukartiningsih](#), 2023; [Gayatri](#), 2021). These data highlight the urgent need for interventions that simultaneously address both maternal recovery and infant nutrition, particularly in resource-limited settings

Over the past decade, diverse non-pharmacological strategies have been explored to support postpartum recovery. Pineapple (*Ananas comosus*), with its bioactive compounds such as bromelain, vitamin C, manganese, and flavonoids, has been investigated for its anti-inflammatory, antioxidant, and circulatory properties ([Ali et al.](#), 2020; [Domínguez-Solís et al.](#), 2021). Bromelain, in particular, has been shown to modulate prostaglandins and enhance tissue repair, suggesting its potential role in accelerating uterine involution. Pineapple’s micronutrients are also hypothesized to support systemic circulation and hormonal balance, thereby indirectly promoting lactogenesis. Meanwhile, massage therapy has long been recognized as a culturally

acceptable, low-cost, and non-invasive intervention. By stimulating the parasympathetic nervous system, massage enhances oxytocin secretion, which facilitates uterine contractions and triggers the milk ejection reflex ([Elisa & Sylvina, 2023](#); [Seenak et al., 2021](#); [Agustia & Camelia, 2025](#)). Previous studies have reported positive effects of either pineapple consumption or massage therapy on postpartum recovery, though findings have been inconsistent across contexts and populations.

However, no study to date has comprehensively evaluated the combined effect of pineapple consumption and massage therapy on postpartum outcomes. Existing research has examined these interventions separately, yet their potential synergistic impact remains unexplored. This gap is significant because nutritional and physical interventions act through distinct but complementary pathways—bromelain through anti-inflammatory and tissue repair mechanisms, and massage through hormonal stimulation. When integrated, they may yield stronger benefits for both uterine involution and lactation. Moreover, many prior studies are constrained by small sample sizes, short observation periods, or weak methodological controls, thereby limiting the generalizability of their findings.

In alignment with the Holistic Maternal Care Framework, which emphasizes the integration of physical, nutritional, and psychosocial support for postpartum women, the present study investigates the combined role of blanched pineapple consumption and massage therapy. By linking nutritional supplementation with a physical care modality, this research seeks to provide evidence for a culturally adaptable, safe, and effective strategy to optimize maternal recovery and support exclusive breastfeeding practices in Indonesia.

Theoretically, this research is anchored in the Holistic Maternal Care Framework, which posits that the integration of nutritional, physiological, and psychosocial interventions shapes maternal health outcomes. Within this framework, dietary strategies (e.g., pineapple consumption) and supportive physical therapy (e.g., massage therapy) are not viewed as isolated interventions but as interconnected components that collectively optimize maternal recovery and infant health. Specifically, the study adopted a biopsychosocial perspective: pineapple provides a biological substrate for anti-inflammatory and circulatory improvement, while massage therapy promotes psychological relaxation and hormonal responses conducive to uterine contractions and breastfeeding. This integrated conceptual approach offers a strong theoretical basis for hypothesizing that combining the two interventions will produce superior outcomes compared to either intervention alone.

In this context, this study seeks to discuss the following research objectives: to examine the effects of blanched pineapple consumption combined with massage therapy on reducing the height of the uterine fundus and milk production in postpartum mothers. By empirically testing this integrated approach, the study contributes to closing gaps in the existing literature, providing practical recommendations for maternal health care providers, and supporting the development of evidence-based postpartum care policies. Ultimately, these findings aim to advance the discourse on maternal health by demonstrating the potential to combine culturally acceptable nutritional and physical interventions to improve maternal and neonatal outcomes in resource-constrained global health care settings.

Methods

Study Design

This quasi-experimental study followed the TREND (Transparent Reporting of Evaluations with Nonrandomized Designs) reporting guideline (Flanagan & Beck, 2024). A two-group pretest–posttest approach was applied, in which postpartum mothers were assigned to an intervention and a control group. This design was selected as it allows the evaluation of causal relationships between the intervention and outcomes under real-world clinical conditions, while avoiding the ethical and practical challenges of full randomization. The study was conducted among postpartum mothers who had undergone normal delivery at Midwife's Independent Practices, providing a natural clinical environment for observing uterine involution and lactation output. Furthermore, supportive postpartum obstetric care and qualified midwives at these facilities facilitated participant eligibility and compliance with the intervention ([Maciejewski, 2020](#); [Montoya et al., 2023](#)).

Participants

The research team consists of maternal and child health experts with advanced training in nutrition, obstetrics, and clinical trial methodologies. All team members have prior experience conducting maternal health research and are certified in ethical research practice. There was no pre-existing relationship between the researcher and the participants, minimizing the potential for bias. To ensure flexibility, the researchers maintained a structured audit trail, conducted peer briefings, and hired independent midwives to manage the intervention and collect clinical measurements, thereby reducing the risk of the researchers' influence on the data.

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Instruments

This study's data collection employed anthropometric and clinical instruments to ensure accuracy and validity. UFH was measured using a standardized non-elastic measuring tape (SECA®, Germany) calibrated to the nearest 0.1 cm. Measurements were performed daily at the same time of day (08:00–09:00) with the mother in a supine position, following standard midwifery clinical procedures. Inter-rater reliability was established by training two midwives who performed duplicate measurements on a subsample of 10 participants, yielding an intraclass correlation coefficient (ICC) of 0.92, indicating excellent reliability.

Breast milk production was assessed using two complementary approaches. First, subjective maternal reports of breastfeeding frequency and adequacy were recorded using a structured daily log. Second, objective milk volume was quantified by manual expression for 10 minutes using a standardized breast pump (Medela®, Switzerland), with expressed milk measured using a calibrated measuring cylinder. Three senior midwifery experts established the content validity of the measurement tools, while pilot testing confirmed the clarity and feasibility of administration.

Intervention

The intervention combined blanched pineapple consumption and standardized postpartum massage therapy for seven consecutive days. Participants in the intervention group received 100 grams of blanched pineapple (*Ananas comosus*) twice daily, prepared by boiling for three minutes to reduce acidity and ensure tolerance, with adherence monitored by midwives. In addition, trained midwives provided a 15-minute standardized abdominal massage once daily to stimulate uterine contractions and improve circulation, following clinical midwifery guidelines. The control group received only routine postpartum care, including health education and monitoring, without additional interventions. All participants in the intervention group completed the protocol without major adverse events.

Data Collection

Data collection was carried out in the hospital during the immediate postpartum period, starting on the first day after delivery and continuing until the seventh day postpartum. The intervention group received blanched pineapple, given at a dose of 100 grams twice a day, in combination with standard postpartum massage therapy performed for 15 minutes once a day for seven consecutive days.

In contrast, the control group received only standard postpartum care as routinely provided by the Midwife's Independent Practice. Outcome measurements included a daily assessment of the height of the uterine fundus using a standard measuring tape in centimeters, as well as an evaluation of milk production through the test-weight method, where the baby's weight was recorded immediately before and after the breastfeeding session. In addition, a mother's self-report on perceived lactation adequacy was obtained to complete the

objective assessment. Data collection is carried out by trained midwives through direct clinical observation and measurement, with all recordings re-checked to ensure accuracy and reliability. To reduce the potential for observer bias, data collectors were blinded to certain study hypotheses.

Although this study uses a quantitative approach, the principles of methodological rigor are carefully maintained to enhance the credibility of the findings. Reliability is ensured through consistent application of standard interventions and outcome measurement protocols. Validity is strengthened by re-examining clinical measurements and blinding outcome assessors to minimize potential bias. Confirmation was achieved through an independent statistical review, which protected the results from the undue influence of researchers. In addition, transferability is supported by providing detailed descriptions of intervention protocols, thus allowing replication and potential applications in diverse healthcare settings.

Data Analysis

Quantitative data were analyzed using paired t-tests to compare pre-post changes within each group and independent t-tests to evaluate differences between the intervention and control groups. Statistical significance was set at $p < 0.05$, and analyses were conducted using SPSS version 26.0. Prior to hypothesis testing, assumptions of normality and homogeneity of variance were tested and met. Effect sizes were calculated to complement p-values and provide a measure of practical significance. Cohen's *d* with 95% confidence intervals (CI) was computed for both UFH reduction and breast milk production, with thresholds of 0.2, 0.5, and 0.8 interpreted as small, medium, and large effects, respectively. Missing data accounted for less than 5% of

total observations and were handled using listwise deletion, as the pattern was random and did not significantly bias the results. Two independent statisticians cross-checked data entry, coding, and interpretation to strengthen validity.

Ethical Considerations

Ethical approval for this study was obtained from the Health Research Ethics Committee (KEPK) of the Riau Ministry of Health Polytechnic, with approval number (No. LB.02.03/9/01/2025). In addition, official permission is given by the Midwife's Independent Practice management before data collection. All participants are fully informed about the research's objectives, procedures, potential risks, and benefits before enrollment. Written consent is obtained, and participants are guaranteed their right to withdraw at any stage without any consequences for their postpartum care. To ensure confidentiality and anonymity, participant identities are encoded, and all research data is stored securely with limited access to the research team only.

Results

A total of 50 postpartum mothers were enrolled in the study, with an overall mean

age of 28.4 years (SD = 4.2), ranging from 21 to 39 years. The mean age did not differ significantly between the intervention group (28.6 ± 4.1 years) and the control group (28.2 ± 4.3 years; $p = 0.72$), ensuring comparability at baseline. The parity distribution showed that 60% of the participants were multiparous, while 40% were primiparous, with the same proportion in both groups ($p = 0.65$).

In terms of educational background, 54% of mothers have completed secondary education, while 46% have higher education. The distribution between groups was statistically comparable ($p = 0.51$). Importantly, all participants reported their intention to breastfeed exclusively during the early postpartum period, demonstrating a strong baseline homogeneity in breastfeeding motivation in both groups. These findings suggest that both groups were demographically and clinically balanced before the intervention, minimizing the risk of selection bias. A detailed distribution of these characteristics is presented in Table 1, which complements the narrative description above by providing a clearer quantitative picture of the participants' profiles (**Table 1**).

Table 1. Demographic and Clinical Characteristics of Participants

Characteristic	Intervention	Control	Entire	p-value
Age (years), Mean ± SD	28.6 ± 4.1	28.2 ± 4.3	28.4 ± 4.2	0.72
Age range (min-max)	21-39	22-38	21-39	-
Parity				0.65
Primiparous, n (%)	10 (40.0)	10 (40.0)	20 (40.0)	-
Multiparous, n (%)	15 (60.0)	15 (60.0)	30 (60.0)	-
Educational background				0.51
Secondary education, n (%)	13 (52.0)	14 (56.0)	27 (54.0)	-
Higher education, n (%)	12 (48.0)	11 (44.0)	23 (46.0)	-

Notes: Values are presented as mean ± standard deviation (SD) or number (percentage). An independent t-test or chi-square test was applied as appropriate.

Reduction in the Height of the Uterine Fund

Daily monitoring of uterine fundus height showed a consistent downward trend in both groups, but the rate of decline

was faster in the intervention group that received a combination of blanched pineapple consumption and postpartum

massage therapy. The average height of the uterus on Day 1 was relatively the same between groups, confirming the initial homogeneity. Starting on Day 3, the intervention group showed a sharper decline compared to the control group, which continued progressively until Day 7. At the end of the observation period, the intervention group achieved an average decrease of about 7.2 cm (SD = 1.4), significantly greater than the 5.8 cm (SD = 1.8) recorded in the control group.

A clinical interpretation of these findings suggests that the bioactive enzyme bromelain in blanched pineapple, combined with mechanical stimulation of uterine

massage, is likely to accelerate uterine muscle contraction and tissue recovery. This synergistic effect facilitates faster involution and provides subjective comfort, as reflected in the participants' testimonies. A mother from the intervention group stated that she felt her stomach shrink faster and more comfortably after massage therapy while consuming pineapple, indicating that, beyond measurable outcomes, the intervention also improved maternal well-being as well as perception of recovery. Comparative data over seven days of observation are presented in **Table 2**, which highlights the progressive reduction in uterine fund height between groups.

Table 2. Mean Reduction in UFH (cm) from Day 1 to Day 7

Day	Intervention Group (Mean \pm SD)	Control Group (Mean \pm SD)	P-value*
1	20.4 \pm 2.1	20.2 \pm 2.0	0.782
2	18.9 \pm 1.9	19.5 \pm 2.1	0.228
3	17.1 \pm 1.8	18.3 \pm 2.0	0.041
4	15.4 \pm 1.7	17.0 \pm 1.9	0.029
5	13.6 \pm 1.6	15.5 \pm 1.8	0.017
6	12.0 \pm 1.5	13.8 \pm 1.7	0.010
7	11.0 \pm 1.4	12.9 \pm 1.6	0.004

*Independent t-test, $p < 0.05$ considered significant

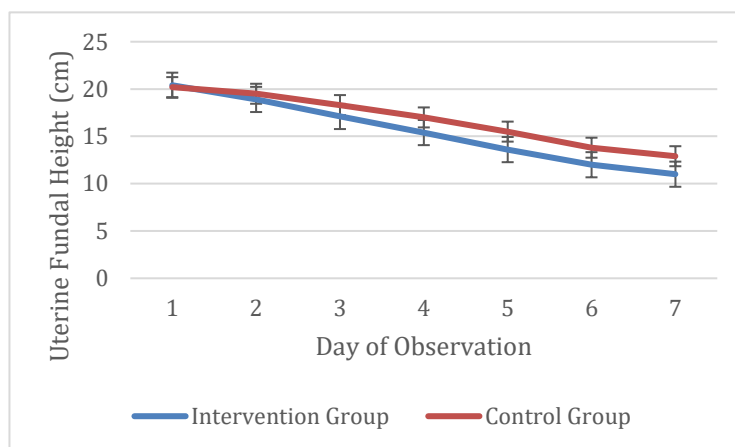


Figure 2. Mean Reduction of UFH (cm)

The table above explains that significant differences began to emerge from day 3, and intensified on day 7, confirming that the dual intervention (pineapple + massage) had a faster effect

than standard treatment (**Table 2** and **Figure 1**).

Breast Milk Production

Breast milk production, assessed through a standard test-weighing method,

showed a significant improvement in the intervention group receiving a combination of blanched pineapple consumption and postpartum massage therapy. On Day 1, the average milk production between the two groups was comparable, thus reflecting the initial homogeneity. However, from Day 3, the intervention group began to show better results, characterized by greater weight gain in the infants compared to the control group. This difference became more pronounced as the observation period progressed until Day 7. At the end of observation, the average milk production in the intervention group was recorded at 684 mL/day (SD = 95), much higher than the 512 mL/day (SD = 88) in the control group. This increase of 33.6% confirms the substantial physiological benefits of the intervention, both in supporting smooth milk production and in having a positive impact on infant growth.

The mother's self-report reinforces these quantitative findings. Many participants in the intervention group reported subjective improvements, such as increased breast fullness, stronger breast ejection reflexes, and more frequent infant satiety cues. One mother described her experience: "After consuming pineapple and massaging regularly, my breast milk felt smoother, my baby was full faster." This qualitative testimony highlights not only the measurable physiological outcomes but also the perceived benefits of the mother that increase confidence and satisfaction during the breastfeeding process.

Physically, these results can be attributed to two synergistic mechanisms.

First, pineapple contains bromelain, an enzyme with anti-inflammatory properties and improved blood circulation, which can indirectly support lactogenesis by promoting systemic recovery and reducing postpartum edema. Second, postpartum massage therapy provides direct stimulation of the release of oxytocin. This hormone plays a dual role in promoting uterine contractions (accelerating involution) and facilitating the decline of breast milk. The combination of nutritional and mechanical interventions thus holistically addresses maternal recovery and lactation physiology ([Roslianti et al., 2022](#); [Mohd Shukri et al., 2018](#)).

Interestingly, this analysis also revealed a strong relationship between uterine involution and lactation outcomes. Mothers who experienced a consistently greater decrease in uterine fundus height tended to show higher milk production, as assessed through infant weight gain (BB). This confirms that the acceleration of postpartum recovery is not an isolated process, but rather part of an integrated physiological adaptation, in which faster recovery of uterine tone contributes positively to hormonal balance and lactation function. These findings align with the study's conceptual framework, which emphasizes that integrated interventions that focus on maternal recovery while stimulating lactation can yield synergistic benefits for postpartum health. Comparative results are presented in **Table 3**, which illustrates progressive differences in milk production between the two groups over a seven-day observation period.

Table 3. Mean Breast Milk Production (mL/day) from Day 1 to Day 7

Day	Intervention Group (Mean ± SD)	Control Group (Mean ± SD)	P-value*
1	310 ± 72	305 ± 70	0.841
2	395 ± 80	348 ± 76	0.128
3	456 ± 85	388 ± 78	0.047
4	522 ± 90	421 ± 81	0.021

5	587 ± 92	465 ± 85	0.013
6	642 ± 94	488 ± 86	0.009
7	684 ± 95	512 ± 88	0.004

**Independent t-test, p < 0.05 considered significant*

Overall, these findings suggest that a combination of nutritional (pineapple consumption) and physiological (uterine massage) interventions not only accelerates uterine involution, but also optimizes breast milk production, thus providing dual benefits for maternal recovery and infant well-being.

Discussion

The findings of this study provide strong evidence that a combined intervention of blanched pineapple consumption and postpartum massage therapy significantly accelerated uterine involution and increased milk production among postpartum mothers compared to standard care alone. These results resonate with, but also expand, the existing literature on maternal recovery and lactation. Previous research has shown the beneficial role of massage therapy in stimulating uterine contractions and oxytocin release, which directly supports uterine involution and the milk ejection reflex (Ardela et al., 2020; Pigai & Yanuarti, 2023). Similarly, the bromelain content in pineapple has been reported to have anti-inflammatory and proteolytic properties that accelerate tissue healing and recovery. Our findings are consistent with these theoretical foundations, but they contribute new insights by showing that dual interventions produce synergistic effects, greater than the sum of their parts (Dewi et al., 2025).

This study also highlights the physiological interconnection between uterine involution and lactation. The observation that mothers who experienced greater fundal height reduction also reported higher milk production suggests a conceptual linkage: accelerated maternal

recovery may facilitate the body’s ability to prioritize lactation and sustain breastfeeding (Villarme Requejo et al., 2020). These findings challenge the traditionally separate views of maternal recovery and infant nutrition, instead offering a more integrated model in which nutritional interventions and physiological stimulation work together to optimize maternal and neonatal outcomes. Such perspectives advance theoretical understanding in maternal health science by framing postpartum care as a holistic process rather than a series of isolated clinical outcomes (UvnäsMoberg et al., 2020).

From a scientific and policy perspective, the implications of this research are significant. First, it suggests that culturally acceptable, low-cost, and non-pharmacological interventions can significantly improve maternal health (Ridzuan et al., 2021). Pineapple is widely available in many regions, and postpartum massage is already integrated into traditional maternal practices, making this combined approach feasible and sustainable in clinical and community settings. Second, the study underscores the importance of integrating dietary and physical interventions into routine postpartum care guidelines, especially in resource-constrained environments with limited access to pharmacological or technological alternatives. The conceptual contribution of this study is not limited to maternal physiology but also touches on public health policy: the adoption of such integrative practices can reduce reliance on costly interventions, promote breastfeeding success, and ultimately contribute to improved maternal and child health

outcomes at the population level ([Bazzano et al., 2020](#); [Bergman, 2019](#)).

Despite these promising findings, certain limitations must be acknowledged. The study was conducted with a relatively small sample of 50 mothers recruited through purposive sampling at a single Midwifery Independent Practice, which may limit the representativeness of the findings. In addition, the study period was limited to the first seven days postpartum, preventing conclusions about long-term outcomes such as sustained breastfeeding rates, uterine recovery after the first week, or potential side effects from prolonged pineapple consumption. The reliance on maternal self-reports to supplement objective measures of breast milk production also introduces the possibility of subjective bias. Therefore, future research should expand sample sizes across multiple sites, include more diverse populations, and extend follow-up periods to assess results' durability and wider applicability. In addition, biochemical analysis of breast milk composition can provide further insights into the nutritional quality and immunological benefits associated with the intervention.

The relevance of these findings to nursing and midwifery practice is both direct and practical. Healthcare professionals can integrate blanched pineapple consumption and massage therapy into standard postpartum care as complementary interventions that promote recovery and lactation. Training midwives to provide guidance on safe pineapple intake and standardized massage techniques can empower mothers and their families to actively participate in the recovery process. At the institutional level, maternity wards can incorporate these practices into patient education and postpartum protocols, offering mothers professional support and evidence-based options for self-care ([Rahnemaie et al.,](#)

2019; [Suwikrom et al., 2021](#)). For policymakers, these results underscore the potential for cost-effective, non-invasive interventions that improve maternal outcomes and support national breastfeeding initiatives. By encouraging the inclusion of such practices in postpartum health programs, governments and health care systems can strengthen maternal and child health strategies, especially in areas where resources are limited but traditional practices are valued ([Ningsih et al., 2023](#); [PubMed, 2021](#)).

This study reinforces the existing evidence on the benefits of massage and nutritional interventions and provides new insights into the synergistic relationship between maternal recovery and breastfeeding. The implications extend from theory to practice, offering a holistic perspective that integrates maternal physiology, neonatal nutrition, and health system priorities. While more research is needed to validate and generalize these findings, the evidence presented here underscores the potential for simple, culturally resonant, and cost-effective interventions to transform postpartum care in meaningful and sustainable ways.

Implications and limitations

This study was limited by its quasi-experimental design and the absence of full randomization, which may have introduced selection bias. Although adherence was monitored, blinding of intervention providers was not feasible. Nevertheless, the findings provide strong preliminary evidence that integrating nutritional and physical interventions can accelerate postpartum recovery. Policymakers may consider promoting the combined use of blanched pineapple and massage therapy as a culturally acceptable, non-pharmacological strategy in maternal health programs, while future research should employ larger randomized

controlled trials to strengthen causal inference.

Relevance to for Practice

The findings of this study provide direct implications for midwifery and nursing practice, demonstrating that the combination of blanched pineapple consumption and postpartum massage therapy offers a simple, safe, and cost-effective intervention to enhance uterine involution and breast milk production. This integrated approach can be incorporated into routine postpartum care to promote faster maternal recovery and improve lactation outcomes, particularly in low-resource settings where access to pharmacological treatments is limited. Midwives and healthcare professionals can apply these findings by providing education on the safe preparation and consumption of blanched pineapple and performing standardized massage techniques to stimulate oxytocin release. Implementing these culturally acceptable interventions strengthens maternal self-care and family involvement in postpartum recovery and supports national initiatives aimed at increasing exclusive breastfeeding rates and improving overall maternal-child health outcomes.

Conclusion

The study showed that a combined intervention of blanched pineapple consumption and postpartum massage therapy significantly accelerated uterine involution and increased milk production compared to standard treatments. These findings highlight the synergistic relationship between maternal recovery and breastfeeding, offering evidence that simple, low-cost, and culturally relevant practices can effectively support maternal health and breastfeeding success. The key conclusion is that integrating nutritional

and physiological interventions into routine postpartum care provides a holistic approach to improving maternal and neonatal outcomes and offers an evidence-based framework for future research and policy development.

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CrediT Authorship Contributions Statement

Yeni Aryani: Conceptualization, Methodology, Supervision, Writing - Original Draft

Annisa Tri Yustita: Writing - Original Draft, Review & Editing, Visualization, Funding Acquisition

Conflicts of Interest

There is no conflict of interest.

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