International Journal of Nursing and Midwifery Science (IJNMS)

http://ijnms.net/index.php/ijnms
e- ISSN: 2686-2123
p- ISSN: 2686-0538
ORIGINAL RESEARCH

EFFECT OF HONEY SUPPLEMENTATION ON BREAST MILK PRODUCTION AMONG POSTPARTUM MOTHERS IN A COMMUNITY MIDWIFERY PRACTICE: A QUASI-EXPERIMENTAL STUDY

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ABSTRACT

Background: Insufficient breast milk production is one of the leading barriers to successful exclusive breastfeeding among postpartum mothers. Honey is a natural nutritional supplement containing carbohydrates, amino acids, vitamins, minerals, antioxidants, and bioactive compounds that may support lactation by improving maternal nutritional status and metabolic function.
Objective: This study aimed to evaluate the association between honey supplementation and breast milk production among postpartum mothers receiving community-based midwifery care.
Methods: A quasi-experimental study employing a one-group pretest–posttest design was conducted at the Independent Midwifery Practice (TPMB) of Ida Siswi Astuty, West Kotawaringin Regency, Central Kalimantan, Indonesia, between November and December 2024. Thirty postpartum mothers were recruited using accidental sampling. Participants consumed one tablespoon (approximately 15 mL) of **TJ Honey®** three times daily for nine consecutive days. Breast milk production was measured before and after the intervention using a manual breast pump and standardized observation sheets. Data were analyzed using descriptive statistics and the Wilcoxon Signed Rank Test. Effect size was calculated using $r = |Z|/\sqrt{N}$.
Results: Mean breast milk production increased from **49.17 ± 18.62 mL** before the intervention to **136.83 ± 31.66 mL** after the intervention, corresponding to a mean increase of **87.66 mL**. The Wilcoxon Signed Rank Test demonstrated a statistically significant increase ($Z = -4.792$, $p < 0.001$), with a **large effect size ($r = 0.87$)**. Although breast milk production increased substantially during the intervention period, the quasi-experimental design without a comparison group limits causal interpretation.
Conclusion: Honey supplementation was **associated with** increased breast milk production among postpartum mothers. However, because this study employed a one-group pretest–posttest design, the findings should be interpreted cautiously. Honey supplementation appears to be a promising

Keywords

Breast milk production; Honey supplementation; Lactation; Postpartum mothers; Complementary nutrition

complementary nutritional strategy to support breastfeeding, but adequately powered randomized controlled trials are required before routine clinical implementation can be recommended.

INTRODUCTION

Breastfeeding is universally recognized as the optimal source of infant nutrition and plays a fundamental role in improving maternal and child health outcomes. The World Health Organization (WHO) and the United Nations Children's Fund (UNICEF) recommend initiating breastfeeding within the first hour after birth, providing exclusive breastfeeding for the first six months of life, and continuing breastfeeding alongside appropriate complementary feeding until two years of age or beyond (WHO, 2023; UNICEF, 2023). Breast milk contains a complete composition of macronutrients, micronutrients, immunological components, hormones, enzymes, and bioactive substances required to support infant growth, cognitive development, and immune function (Keikha et al., 2021). Furthermore, breastfeeding provides significant health benefits for mothers by promoting uterine involution, reducing postpartum hemorrhage, and lowering the long-term risk of breast cancer, ovarian cancer, type 2 diabetes mellitus, and cardiovascular disease (Victora et al., 2016; WHO, 2023).

Despite these well-documented benefits, insufficient breast milk production remains one of the most frequently reported barriers to successful exclusive breastfeeding worldwide. Global estimates indicate that only approximately 48% of infants younger than six months receive exclusive breastfeeding, which remains below the global nutrition target established by WHO (UNICEF, 2023). In Indonesia, exclusive breastfeeding coverage has gradually improved but has not yet reached the national target, with inadequate breast milk production continuing to be one of the major reasons for early breastfeeding discontinuation (Ministry of Health of Indonesia, 2024). Mothers commonly perceive that their milk supply is insufficient during the early postpartum period, leading to unnecessary formula supplementation and premature cessation of breastfeeding (Shen et al., 2023).

Breast milk production is influenced by a complex interaction of physiological, nutritional, hormonal, and psychosocial factors. Lactogenesis is primarily regulated by prolactin, which stimulates milk synthesis, and oxytocin, which facilitates milk ejection through the milk let-down reflex (Kent et al., 2022). Maternal nutritional status, breastfeeding frequency, hydration, maternal age, fatigue, anxiety, psychological stress, and family support have all been identified as important determinants of successful lactation (Septiyana et al., 2024; Shen et al., 2023). Psychological stress during the postpartum period may suppress oxytocin secretion, thereby impairing milk ejection despite adequate milk synthesis (Uvnäs-Moberg et al., 2020). Consequently, interventions that improve maternal nutritional status while reducing physiological stress may contribute to improved breastfeeding outcomes.

Nutritional interventions using natural products have received increasing attention because they are relatively safe, affordable, and culturally acceptable. Honey is a natural food rich in carbohydrates, amino acids, vitamins, minerals, flavonoids, phenolic compounds, and antioxidant substances that contribute to energy metabolism, immune regulation, tissue repair, and anti-inflammatory activity (Mărgăoan et al., 2021). These bioactive components may improve maternal recovery following childbirth and support the physiological processes involved in breast milk synthesis. Honey has also been reported to reduce oxidative stress and improve maternal energy balance, both of which are essential during the postpartum period (Alvarez-Suarez et al., 2022).

Several previous studies have demonstrated the potential benefits of honey supplementation for lactating mothers. Honey consumption has been associated with increased breast milk production and improved maternal nutritional status among postpartum women (Yanti et al., 2021). Similarly, Indasar et al. (2023) reported that honey combined with *Moringa oleifera* supplementation significantly increased breast milk production during the first postpartum week. A recent literature review also concluded that natural galactagogues, including honey and several medicinal plants, may positively influence lactation outcomes, although the overall quality of evidence remains limited because of methodological heterogeneity and relatively small sample sizes (Nurhayati et al., 2024).

Preliminary observations conducted at the Independent Midwifery Practice (TPMB) of Ida Siswi Astuty, West Kotawaringin Regency, revealed that many postpartum mothers experienced concerns regarding inadequate breast milk production during the first two weeks after delivery. Several mothers reported delayed onset of abundant milk production, while others expressed anxiety regarding their ability to exclusively breastfeed their infants. Although honey is traditionally recommended within the local community as a nutritional supplement to support breastfeeding, scientific evidence evaluating its effectiveness as a single nutritional intervention in community-based midwifery settings remains limited.

Research Gap. Previous studies have primarily evaluated honey in combination with other herbal galactagogues or focused on observational outcomes without directly quantifying changes in breast milk production before and after intervention (Indasar et al., 2023; Nurhayati et al., 2024). Furthermore, evidence from community-based midwifery practice in Indonesia remains scarce, particularly using a quasi-experimental design.

Novelty. This study evaluates honey supplementation as a single complementary nutritional intervention using a quasi-experimental one-group pretest-posttest design among postpartum mothers receiving community-based midwifery care. By directly measuring breast milk production before and after honey supplementation, this study provides practical evidence supporting the integration of honey into postpartum nutritional care and breastfeeding promotion programs.

Therefore, this study aimed to determine the effect of honey supplementation on breast milk production among postpartum mothers at the Independent Midwifery Practice (TPMB) of Ida Siswi Astuty, West Kotawaringin Regency, Central Kalimantan, Indonesia.

METHOD

This study employed a quasi-experimental one-group pretest–posttest design to investigate the association between honey supplementation and breast milk production among postpartum mothers. The design enabled within-subject comparisons of breast milk production before and after the intervention while minimizing inter-individual variability (Polit & Beck, 2021). However, because the study did not include a comparison group, the observed changes cannot be attributed solely to honey supplementation, and causal inferences should therefore be interpreted with caution.

Study Setting

The study was conducted at the Independent Midwifery Practice (TPMB) of Ida Siswi Astuty, West Kotawaringin Regency, Central Kalimantan, Indonesia, between November and December 2024. The practice provides routine maternal and newborn healthcare services, including antenatal, intrapartum, postpartum, and neonatal care.

Participants

The study population consisted of postpartum mothers attending routine postnatal care at TPMB Ida Siswi Astuty during the study period. Mothers between the **5th and 14th postpartum day** were considered eligible because this period corresponds to lactogenesis II, during which breast milk production becomes established.

Participants were recruited consecutively using an accidental sampling technique until the required sample size was achieved. A total of **30 postpartum mothers** fulfilled the eligibility criteria, agreed to participate, and completed the study.

Because this study was designed as an exploratory community-based quasi-experimental study, no formal *a priori* sample size calculation was performed. Instead, all eligible postpartum mothers attending the study site during the recruitment period were invited to participate. Consequently, the findings should be interpreted as preliminary evidence requiring confirmation in larger controlled studies.

The participant recruitment process followed the **Transparent Reporting of Evaluations with Nonrandomized Designs (TREND) Statement.** The flow of participants through recruitment, eligibility assessment, enrollment, intervention completion, follow-up, and final statistical analysis is presented in **Figure 1 :** Participant Flow Diagram According to the TREND Statement

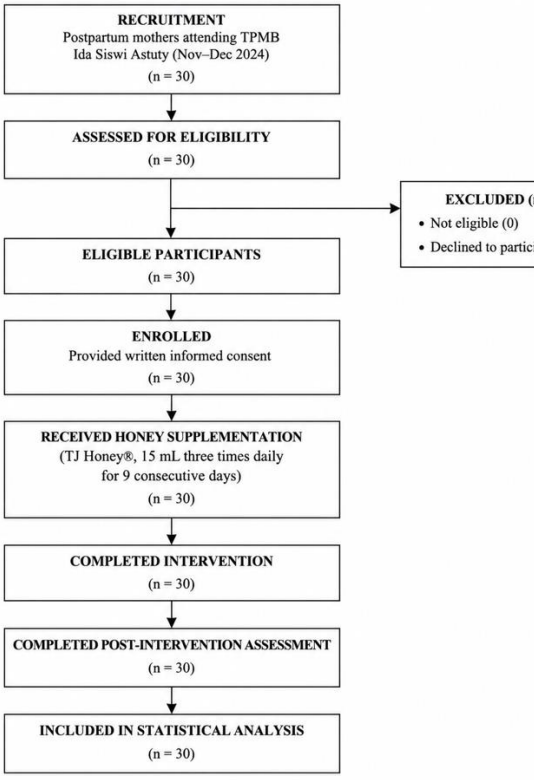

Figure 1. Participant flow diagram according to the Transparent Reporting of Evaluations with Nonrandomized Designs (TREND) Statement, illustrating participant recruitment, eligibility assessment, enrollment, intervention completion, and final analysis.

Inclusion Criteria

Participants were eligible if they:

1. were between the 5th and 14th postpartum day;
2. delivered a healthy singleton infant;
3. intended to breastfeed;
4. agreed to consume honey throughout the intervention period; and
5. provided written informed consent.

Exclusion Criteria

Participants were excluded if they:

1. experienced severe postpartum complications;
2. had medical contraindications to breastfeeding;
3. had a known allergy to honey; or
4. failed to complete the intervention protocol.

Intervention

The intervention consisted of supplementation with **TJ Honey®,** a commercially available standardized pure honey product in Indonesia. The use of a single commercial product ensured consistency in nutritional composition throughout the intervention.

Each participant consumed one tablespoon (approximately **15 mL)** of honey three times daily (morning, afternoon, and evening) for **nine consecutive days,** resulting in a total daily intake of approximately **45 mL.** Honey was consumed directly without dilution while participants continued breastfeeding according to infant demand.

To ensure intervention fidelity, all participants received identical verbal instructions regarding honey consumption, breastfeeding techniques, and breast milk expression procedures. Compliance with the intervention was monitored daily using structured observation sheets.

Participants also received standardized breastfeeding education before the intervention. However, breastfeeding frequency, maternal dietary intake, daily fluid intake, maternal sleep quality, psychological stress, infant suckling efficiency, and the use of additional nutritional supplements were not formally monitored or experimentally controlled. These variables were therefore considered potential confounding factors and should be taken into account when interpreting the study findings.

Outcome Measurement

The primary outcome was breast milk production, measured immediately before (pretest) and after (posttest) completion of the nine-day intervention.

Breast milk volume was expressed using a manual breast pump and measured in milliliters (mL) using a calibrated measuring container. All measurements were performed using the same breast pump, measuring equipment, and standardized procedures to minimize measurement variability.

Although manual pumping provides an objective estimate of milk volume, it may not fully represent physiological breast milk production because pumping efficiency can be influenced by maternal comfort, milk ejection reflex, pumping technique, and the interval since the previous breastfeeding session. These limitations were considered when interpreting the study findings.

The independent variable was honey supplementation, whereas the dependent variable was breast milk production

Statistical Analysis

Data were analyzed using **IBM SPSS Statistics.**

Participant characteristics were summarized using descriptive statistics. Continuous variables were presented as mean ± standard deviation (SD), median, minimum, maximum, and 95% confidence interval (CI), whereas categorical variables were summarized as frequencies and percentages. Data normality was assessed using the **Shapiro–Wilk test** because of the relatively small sample size (Razali & Wah, 2011). Since breast milk production data were not normally distributed (pretest $p = 0.001$; posttest $p = 0.002$), differences between pre- and post-intervention measurements were analyzed using the **Wilcoxon Signed Rank Test.** Statistical significance was established at $p < 0.05$.

To quantify the magnitude of the intervention effect, the effect size (r) was calculated using the following equation:

$$r = \frac{|Z|}{\sqrt{N}}$$

where Z represents the Wilcoxon Signed Rank Test statistic and N represents the total number of paired observations. Effect sizes were interpreted according to Cohen's criteria, with values of approximately 0.10, 0.30, and 0.50 representing small, moderate, and large effects, respectively (Tomczak & Tomczak, 2014).

Ethical Considerations

This study was conducted in accordance with the ethical principles of the **Declaration of Helsinki** for research involving human participants (World Medical Association, 2013). All participants received written and verbal explanations regarding the study objectives, procedures, potential benefits and risks, confidentiality, voluntary participation, and their right to withdraw at any time without consequences. Written informed consent was obtained before enrollment.

Ethical approval was granted by the **Health Research Ethics Committee of Universitas Strada Indonesia, Kediri, Indonesia** (Ethical Clearance No. **001880/EC/KEPK/I/II/2024).**

RESULTS

A total of **30 postpartum mothers** completed the study and were included in the final analysis. The findings are presented according to participant characteristics, adherence to honey supplementation, changes in breast milk production following the intervention, and the statistical analysis of the intervention effect.

Participant Characteristics

The demographic characteristics of the participants are presented in **Table 1**.

Table 1. Demographic Characteristics of the Participants (n = 30)

Characteristic	Mean ± SD	Min–Max	95% CI
Age (years)	31.00 ± 2.91	24–36	29.91–32.09
Age Category		n	%
20–24 years		2	6.7
25–29 years		8	26.7
30–34 years		16	53.3
35–39 years		4	13.3
Total		**30**	**100.0**

The participants had a mean age of **31.00 ± 2.91 years** (95% CI: **29.91–32.09**), ranging from **24 to 36 years**. More than half of the participants (**53.3%**) were aged **30–34 years**, followed by those aged **25–29 years** (**26.7%**).

Adherence to Honey Supplementation

Participant adherence to the prescribed honey supplementation regimen is summarized in **Table 2**.

Table 2. Adherence to Honey Supplementation During the Intervention (n = 30)

Honey Supplementation	n	%
Regular	28	93.3
Irregular	2	6.7
Total	**30**	**100.0**

Most participants (**93.3%**) consumed honey regularly throughout the intervention period, while only two participants (**6.7%**) reported irregular consumption.

Breast Milk Production Before and After Honey Supplementation

Changes in breast milk production before and after honey supplementation are presented in **Table 3**.

Table 3. Breast Milk Production Before and After Honey Supplementation (n = 30)

Variable	Mean ± SD (mL)	Median	Mode	Min	Max
Pre-intervention	49.17 ± 18.62	50.00	60	20	90
Post-intervention	136.83 ± 31.66	125.00	120	70	210
Mean Difference	**87.66**				

Breast milk production increased substantially following honey supplementation. The mean breast milk volume increased from **49.17 ± 18.62 mL** before the intervention to **136.83 ± 31.66 mL** after the intervention, corresponding to a **mean increase of 87.66 mL**.

Effect of Honey Supplementation on Breast Milk Production

The Shapiro–Wilk test demonstrated that breast milk production data were not normally distributed (**pre-intervention p = 0.001**; **post-intervention p = 0.002**). Therefore, the Wilcoxon Signed Rank Test was used to compare breast milk production before and after honey supplementation.

Table 4. Effect of Honey Supplementation on Breast Milk Production (n = 30)

Variable	Positive Ranks	Negative Ranks	Ties	Z-value	p-value	Effect Size (r)
Breast milk production	30	0	0	−4.792	<0.001	0.87 (Large)

The Wilcoxon Signed Rank Test demonstrated a statistically significant increase in breast milk production following honey supplementation (**Z = −4.792, p < 0.001**). All participants experienced increased breast milk production after the intervention, as indicated by **30 positive ranks**, with no negative ranks or ties. The calculated **effect size (r = 0.87)** indicated a **large intervention effect**, suggesting that honey supplementation produced a substantial improvement in breast milk production among postpartum mothers.

DISCUSSION

The present study demonstrated that honey supplementation significantly increased breast milk production among postpartum mothers. The mean breast milk volume increased by **87.66 mL,** from **49.17 ± 18.62 mL** before the intervention to

136.83 ± 31.66 mL after nine days of honey supplementation. Statistical analysis using the Wilcoxon Signed Rank Test confirmed that the increase was statistically significant **($Z = -4.792$; $p < 0.001$)**, while the calculated effect size **($r = 0.87$)** indicated a **large intervention effect.** These findings suggest that honey supplementation may serve as an effective complementary nutritional strategy for improving lactation performance during the early postpartum period.

The observed improvement in breast milk production may be explained by the nutritional composition and biological properties of honey. Honey is a natural source of readily available carbohydrates, particularly glucose and fructose, which provide rapid energy to meet the increased metabolic demands of lactation. In addition, honey contains amino acids, vitamins, minerals, flavonoids, phenolic compounds, and antioxidant substances that support maternal metabolism, tissue repair, and immune function (Mărgăoan et al., 2021). Adequate maternal energy intake is essential for milk synthesis because lactation requires substantial caloric expenditure. Improved nutritional status may enhance the activity of mammary epithelial cells responsible for milk synthesis, thereby increasing breast milk production (Keikha et al., 2021).

Breast milk production is physiologically regulated by prolactin and oxytocin, two hormones that play complementary roles in lactation. Prolactin stimulates milk synthesis within the mammary alveolar cells, whereas oxytocin facilitates milk ejection through contraction of the myoepithelial cells surrounding the mammary glands (Kent et al., 2022). Maternal stress, fatigue, and inadequate nutritional intake may suppress oxytocin secretion and reduce the efficiency of the milk ejection reflex, ultimately decreasing breast milk production (Uvnäs-Moberg et al., 2020). Honey supplementation may indirectly improve lactation by enhancing maternal energy availability, reducing oxidative stress through its antioxidant properties, and supporting postpartum recovery, thereby creating physiological conditions that favor optimal prolactin and oxytocin activity (Alvarez-Suarez et al., 2022). Although the present study did not directly measure hormonal concentrations, the substantial increase in breast milk volume observed after the intervention supports the hypothesis that improved maternal nutritional status contributes to enhanced lactation performance.

The findings of this study are consistent with previous research investigating honey as a complementary nutritional intervention for breastfeeding mothers. Yanti et al. (2021) reported that postpartum mothers who consumed honey experienced significantly greater breast milk production than mothers who did not receive honey supplementation. Similarly, Indasar et al. (2023) demonstrated that supplementation with honey combined with *Moringa oleifera* significantly improved breast milk production during the first postpartum week. Furthermore, a recent literature review by Nurhayati et al. (2024) concluded that natural galactagogues, including honey, moringa, and several medicinal plants, have promising potential to improve lactation outcomes, although stronger evidence from well-designed intervention studies remains necessary. The present study contributes additional evidence by demonstrating the effectiveness of honey supplementation as a **single nutritional intervention,** thereby reducing potential confounding effects associated with combined herbal therapies.

From a clinical perspective, the findings have important implications for maternal and newborn health services, particularly in community-based midwifery practice. Honey is widely available, relatively inexpensive, culturally accepted, and easy to consume, making it a practical complementary nutritional intervention for postpartum mothers. Midwives may incorporate evidence-based counseling regarding appropriate honey supplementation into routine postpartum education, while emphasizing that honey should complement, rather than replace, recommended breastfeeding practices. Integrating nutritional counseling with breastfeeding support may strengthen exclusive breastfeeding programs and contribute to improved maternal and infant

health outcomes, especially in primary healthcare and independent midwifery practice settings.

This study has several strengths. It employed a prospective quasi-experimental design that allowed direct comparison of breast milk production before and after the intervention within the same participants. The intervention protocol was standardized through the use of a single commercial honey product (**TJ Honey®),** identical dosage, consistent duration of supplementation, and uniform outcome measurement procedures. Nevertheless, several limitations should be acknowledged. The absence of a control group limits causal inference, while the relatively small sample size may reduce the generalizability of the findings. In addition, breast milk production was assessed using manual breast pumping rather than biochemical or hormonal assessment, and maternal dietary intake, hydration status, psychological stress, and breastfeeding frequency were not controlled during the intervention period. Future studies should employ randomized controlled trial designs with larger sample sizes, longer follow-up periods, and objective biological markers, such as serum prolactin and oxytocin concentrations, to further elucidate the mechanisms through which honey supplementation influences lactation.

Overall, the present findings indicate that honey supplementation represents a promising complementary nutritional strategy for enhancing breast milk production among postpartum mothers. Although additional high-quality clinical trials are warranted, the results provide preliminary evidence supporting the integration of honey supplementation into postpartum nutritional counseling and breastfeeding promotion programs within community-based maternal healthcare services.

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CONCLUSIONS

Honey supplementation significantly increased breast milk production among postpartum mothers, as evidenced by a substantial improvement in mean breast milk volume following a nine-day intervention. These findings indicate that honey may serve as an effective complementary nutritional intervention to support lactation during the early postpartum period.

The present study contributes to the growing body of evidence supporting the role of natural nutritional supplementation in breastfeeding promotion by demonstrating the effectiveness of honey as a single intervention in a community-based midwifery setting. Given its affordability, accessibility, and cultural acceptability, honey supplementation may be incorporated into postpartum nutritional counseling and breastfeeding support programs provided by midwives and primary healthcare professionals.

Despite these promising findings, the quasi-experimental design, relatively small sample size, and absence of a control group may limit the generalizability of the results. Future studies employing randomized controlled trials with larger populations, longer follow-up periods, and objective biological markers, including prolactin and oxytocin concentrations, are recommended to further clarify the physiological mechanisms underlying the effects of honey supplementation on lactation outcomes.

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