

## Association between Lactation Massage and Breast Milk Production among Postpartum Mothers: A Quasi-Experimental Study in a Primary Healthcare Setting

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### KEYWORDS

Lactation Massage;  
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### ABSTRACT

**Introduction:** Adequate postpartum milk output is critical for achieving exclusive breastfeeding. Delayed or inadequate breast milk production frequently results in early formula feeding and interruption breastfeeding exclusivity practices. Lactation massage is a complementary non-pharmacological technique thought to stimulate the production of oxytocin and prolactin hormones, which may contribute to breast milk production.

**Objective:** The present study aimed to investigate the correlation between lactation as well as breast milk production among postpartum mothers.

**Methods:** This study design a quasi-experimental non-equivalent control group and pretest–posttest assessment, conducted without randomization at Pratama Salbiyana Clinic, Medan Deli, Indonesia, from October 2024 to April 2025. Total of 20 postpartum women were recruited through total sampling and split into two groups: 10 Each group consisted of 10 participants. The provided group received with lactation massage daily for three consecutive days (on postpartum days 2 to 4), Meanwhile, the provided control group was given standard postpartum care. without massage. Breast milk output was evaluated both before and after the intervention through direct expression and measurement of volume (in cc) in field conditions, and results were categorized using predetermined criteria Wilcoxon signed-rank and Mann–Whitney tests were used ( $p < 0.05$ ).

**Results:** Findings indicated that the proportion of mothers producing higher amounts of milk production from 30% at baseline to 90% following the intervention. The Wilcoxon signed-rank test showed a significant improvement before and after lactation massage ( $p = 0.014$ ), and considerable difference was observed between the intervention and control groups ( $p = 0.029$ ). However, the results interpreting with caution as the small sample limited, absence of randomization, and possible inconsistencies in measurement conditions.

**Conclusion:** Lactation massage may be associated with increased Postpartum mothers' production of breast milk. These findings provide preliminary, context-specific evidence and should be interpreted cautiously. Further studies with larger sample sizes, randomized study designs, and standardized measurement methods protocols are needed to confirm these findings.

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## INTRODUCTION

The postpartum period is an important stage in a woman's life, during which physical recovery and adjustment to breastfeeding take place simultaneously (1). Early initiation and maintenance of breastfeeding are central to maternal and infant health. Adequate early postpartum milk production after childbirth is essential for achieving exclusive breastfeeding, which has been associated with reduced infant morbidity, improved neurodevelopment as well as long-term health benefits (2). One of the predominant challenges in the early postpartum period is delayed or insufficient milk production, frequently leading to premature formula supplementation (3). Such early interruption may compromise infant immunity and growth while also reducing maternal confidence in breastfeeding. Despite worldwide efforts to promote breastfeeding, exclusive breastfeeding rates remain below recommended targets (4). In Indonesia, breastfeeding coverage has not yet reached optimal levels (5).

Physiologically, lactation is regulated by a coordinated neuroendocrine mechanism involving prolactin and oxytocin (6). Prolactin is responsible for milk synthesis, whereas oxytocin facilitates milk ejection through the let-down reflex (7). Psychological stress, fatigue, and anxiety common experiences during the postpartum period may suppress oxytocin release and impair milk flow (7). Therefore, interventions that enhance relaxation and stimulate hormonal responses are important components of postpartum care (3).

Lactation massage has emerged as a complementary, non-pharmacological approach to support breastfeeding. This technique involves structured stimulation of the back, shoulders, spine, and breast areas to activate neuroendocrine pathways associated with lactation (8). Previous studies have demonstrated that massage-based interventions, including oxytocin massage, have been reported to increase breast milk production among postpartum mothers (9,10). Combined stimulation techniques have also shown improved breastfeeding outcomes (11,12). Breastfeeding success is influenced not only by biological factors but also by psychosocial support and maternal self-efficacy (14,15). Limited professional support has been associated with early breastfeeding cessation (16). Massage interventions may provide dual benefits by enhancing physiological milk flow and reinforcing maternal confidence (17,18). Randomized and systematic studies further confirm that structured massage interventions can increase milk volume and improve breastfeeding continuation rates (19,26).

However, implementation of lactation massage in primary healthcare remains inconsistent (21,22). Given that primary healthcare clinics are often the first contact point for postpartum mothers, evaluating the effectiveness of lactation massage in this setting is crucial. Despite the growing body of evidence supporting massage-based interventions to enhance lactation, Nevertheless, several important gaps remain. First, most previous studies were conducted in controlled or hospital-based settings, limiting their generalizability to primary care facilities where resources and clinical support may vary significantly. Second, variations in intervention protocols, including differences between lactation massage and oxytocin massage techniques, have led to conceptual ambiguity and reduced comparability across studies. Third, attention to the effectiveness of these interventions during the early postpartum period (days 2–4), which is a critical window for the initiation of lactogenesis, remains limited. Therefore, context-specific evidence from primary care settings using clear intervention protocols is still needed. To address this gap, this study provides evidence from primary care facilities that employ a clear intervention postpartum in the immediate. The study aims to correlation manual stimulation and milk production in postpartum mothers in primary care facilities (23).

In this study, lactation massage is conceptualized as a comprehensive massage intervention that includes several stimulation techniques, one of which is a technique similar to oxytocin massage. Therefore, oxytocin massage is discussed as a component of lactation massage rather than as a separate or interchangeable intervention. In this study, lactation massage is conceptualized as a broader intervention that includes stimulation techniques similar to oxytocin massage, particularly targeting the paravertebral and breast areas to enhance neuroendocrine responses associated with lactation. One component of lactation massage involves techniques similar to oxytocin massage, which is a structured stimulation applied along the paravertebral region, specifically the upper thoracic vertebrae at approximately the fifth to sixth rib level, where sensory nerve endings associated with oxytocin release are located (27,28). The procedure is typically performed with the mother in a seated or slightly forward-leaning position to expose the back area. Gentle but firm circular or longitudinal strokes are applied along the spine and scapular region for approximately 10–15 minutes, often repeated once or twice daily during the early postpartum period (29). The

massage is commonly conducted by trained midwives or healthcare providers and may also be taught to family members to enhance home-based support (30).

Physiologically, stimulation of the paravertebral area activates afferent neural pathways that signal the hypothalamus to release oxytocin from the posterior pituitary gland (31). Increased oxytocin levels enhance the milk ejection reflex and improve breast emptying efficiency. Several recent clinical studies have demonstrated that massage-based lactation interventions, including techniques similar to oxytocin massage, have been associated with higher expressed breast milk volume within the first three postpartum days compared with routine care. Several recent clinical studies have demonstrated that oxytocin massage has been reported to increase expressed breast milk volume within the first three postpartum days compared with routine care (27,32). In addition to improving milk output, oxytocin massage has been associated with reduced maternal anxiety, improved relaxation, and increased breastfeeding confidence (33).

A quasi-experimental study in 2024 reported that postpartum mothers who underwent oxytocin massage experienced higher milk production scores and earlier onset of lactation compared to controls (32). Similarly, a 2024 systematic review concluded that massage-based stimulation techniques effectively enhanced oxytocin response and supported early breastfeeding success (34). Furthermore, a controlled clinical study found that combining oxytocin massage with breastfeeding education produced greater improvements in milk flow and maternal comfort than education alone (30).

Beyond physiological benefits, lactation massage interventions that include oxytocin-stimulation techniques may also support the emotional bonding process between mother and infant by facilitating smoother breastfeeding sessions. Beyond physiological benefits, oxytocin massage may strengthen the emotional bonding process between mother and infant by facilitating smoother breastfeeding sessions (31). Given its non-invasive nature and feasibility in primary healthcare settings, oxytocin massage has been suggested as a practical complementary intervention to support lactation outcomes (34).

## **METHODS**

### **Study Design**

A quasi-experimental approach was utilized in this study, featuring a non-equivalent control group with both pretest and posttest evaluations. The research took place at Pratama Salbiyana Clinic in the Medan Deli District, Deli Serdang Regency, Indonesia. Twenty mothers who had recently given birth and were on their second postpartum day were enrolled through total sampling. Participants were assigned to either the intervention group ( $n = 10$ ) or the control group ( $n = 10$ ), based on the sequence of their recruitment and the availability of clinic services, with no random allocation involved. Due to the restricted number of eligible subjects, no prior calculation for sample size calculation. This method of group assignment was chosen to mirror practical clinical situations commonly found in primary healthcare environments. Nevertheless, the lack of randomization could present a risk of selection bias. Only mothers who were breastfeeding and agreed to participate were included, while those experiencing medical issues that could interfere with breastfeeding were excluded from the study. The intervention group received lactation massage once daily for three consecutive days (postpartum days 2–4), each session lasting approximately 30 minutes following a standardized procedure. The control group received routine postpartum care without massage intervention.

Breast milk production was evaluated prior to and following the intervention using direct expression and a volume measurement (cc). The measurement was performed under routine clinical conditions without strict laboratory standardization. Milk production was categorized as higher milk production (5–10 cc) or lower milk production (<5 cc) based on predefined operational criteria used in this study.

Data were analyzed using the Wilcoxon signed-rank test and Mann–Whitney test. A  $p$ -value of  $< 0.05$  was considered statistically significant. Ethical approval was obtained (No. 1890/F/KEP/USM/XI/2024).

### **Study Setting and Study Period**

The study was conducted at Pratama Salbiyana Clinic, Medan Deli District, Deli Serdang Regency, Indonesia. Data collection was carried out from October 2024 to April 2025

## **Population and Sample**

The source population included all postpartum mothers on the second day after delivery who attended Pratama Salbiyana Clinic during the study period. A total sampling method was used, and all eligible mothers who met the inclusion criteria were enrolled as study participants. In total, 20 postpartum mothers were recruited and divided into an intervention group (n = 10) and a control group (n = 10).

Criteria participants were mother on day two after birth, mothers who were breastfeeding, and those who were willing to participate. Mothers with medical complications that could interfere with breastfeeding were excluded.

Given that the research took place entirely within one primary healthcare setting, these findings are highly specific to that environment, potentially restricting their external validity to broader demographics.

## **Intervention**

The intervention group received lactation massage once daily for three consecutive days (postpartum days 2–4). Each session lasted approximately 30 minutes and was performed according to a standardized operating procedure. The massage technique involved stimulation of the neck, shoulders, back, spine, and breast areas to promote prolactin and oxytocin secretion. The control group received standard postpartum care and health education without lactation massage.

## **Measurement of Variables**

The variable in this study was lactation massage. The dependent variable in this study is breast milk production, which served as the outcome measure before (pretest) and after (posttest) the intervention using direct expression and volume measurement with a measuring cup and syringe, recorded in cubic centimeters (cc).

To improve measurement consistency, breast milk expression was performed under similar clinical conditions for all participants, with a fixed expression duration and conducted by trained healthcare personnel. However, the measurement was carried out under routine clinical conditions without strict laboratory standardization.

The primary outcome was recorded as a continuous variable (volume in cc). For descriptive purposes, milk production was categorized as “higher milk production” (5–10 cc) and “lower milk production” (<5 cc) based on operational criteria developed for this study under field conditions. These cutoff points were not derived from a universally validated clinical standard but were used to facilitate descriptive comparison between groups. For descriptive purposes, milk production was also categorized as “higher milk production” (5–10 cc) and “lower milk production” (<5 cc) based on predefined operational criteria used in this study. All measurements were documented using a structured observation sheet.

## **Data Analysis**

Data were analyzed using statistical software. Descriptive (univariate) analysis was performed to summarize respondent characteristics and breast milk production using frequency distributions, percentages, and median values. Data normality was evaluated by applying the Shapiro-Wilk test. Since the data were not normally distributed, non-parametric statistical methods were employed. The Wilcoxon signed-rank test was conducted to assess within-group milk production between pretest and posttest measurements. In addition, Posttest results were compared between the intervention and control groups using the Mann–Whitney test groups.

In addition, changes in breast milk production were descriptively evaluated to provide an overview of within-group all tests were two-tailed with  $p < 0.05$  considered substantial. Breast milk volume was additionally summarized using median and spread (IQR) values because the data did not follow a normal distribution. Changes in milk volume between pretest and posttest were descriptively evaluated within and between groups.

Baseline (pretest) values were descriptively compared between groups prior to intervention. However, no adjusted multivariable analysis or covariance adjustment was performed to control for potential baseline imbalance.

## **Ethical Considerations**

Ethical approval was obtained from the Health Research Ethics Committee of Sari Mutiara Indonesia University (No. 1890/F/KEP/USM/XI/20244). Written informed consent was obtained, with confidentiality, anonymity, and the right to withdraw ensured.

## RESULTS

### Characteristics of Respondents

A total of 20 postpartum mothers were included in this study, consisting of 10 mothers in the intervention group and 10 mothers in the control group. Most respondents were aged 20–35 years (90%). More than half had higher education (55%), and 55 % were not employed. The allocation of participants into the intervention and control groups was equal (50% each).

### Comparison of Breast Milk Production Before and After the Intervention

Before the intervention, the majority of mothers in both groups experienced lower milk production (70%). In the intervention group, prior to lactation massage, 7 mothers (70%) had lower milk production and 3 mothers (30%) had higher milk production. After receiving lactation massage, 9 mothers (90%) showed higher milk production, while only 1 mother (10%) remained in the lower milk production category. In contrast, in the control group, 7 mothers (70%) had lower milk production before the observation period, and this condition remained unchanged after conventional postpartum care.

### Effect of Lactation Massage Within Groups

A substantial different was observed in the intervention group using the Wilcoxon signed-rank test in breast milk production before and after lactation massage ( $p = 0.014$ ), whereas no statistically significant changes were observed in the control group.

### Comparison Between Groups

The Mann–Whitney test demonstrated a substantial difference in post-intervention milk production between the intervention and control groups ( $p = 0.029$ ). Lactation massage was associated with higher milk production mothers and with conventional care. The Mann–Whitney test demonstrated a substantial different in post-intervention milk production between the intervention and control groups ( $p = 0.029$ ). These findings suggest that lactation massage was associated with higher breast milk in postpartum mothers compared with conventional care.

**Table 1.** Characteristics of Respondents (n = 20)

Variable	Frequency (n)	Percentage (%)
Age		
20–35 years	18	90.0
<20 or >35 years	2	10.0
Education		
Higher education	11	55.0
Secondary education	9	45.0
Occupation		
Employed	9	45.0
Unemployed	11	55.0
Group		
Intervention	10	50.0
Control	10	50.0

Table 1 shows the respondents' demographic characteristics. Most postpartum mothers were aged between 20–35 years (90%), indicating that most participants were within the optimal reproductive age range. More than half of the respondents had higher education (55%), while 45% had secondary education. Regarding employment status, 55% were not employed and 45% were employed. The distribution between the intervention and control groups was equal (50% each), indicating comparable demographic characteristics. However, these variables alone may not fully account for potential confounding factors related to breastfeeding outcomes.

**Table 2.** Breast Milk Production Before and After the Intervention

Group	Pretest higher milk production n (%)	Pretest lower milk production n (%)	Posttest higher milk production n (%)	Posttest lower milk production n (%)
Intervention (n=10)	3 (30%)	7 (70%)	9 (90%)	1 (10%)
Control (n=10)	3 (30%)	7 (70%)	3 (30%)	7 (70%)

Table 2 presents the distribution of breast milk production before and after the intervention in both groups. Prior to the intervention, 70% of mothers in each group experienced lower milk production, indicating a similar baseline condition. After receiving lactation massage, the proportion of mothers with higher milk production in the intervention group increased markedly from 30 % to 90 %. In contrast, no change was observed in the control group no improvement was observed in the control group, where the distribution remained unchanged (30% higher milk production and 70% lower milk production). These findings indicate a higher proportion of mothers with higher breast milk production increased in the intervention group after the intervention, whereas no changes were observed in the control group. These findings suggest a significant improvement in the intervention group compared with the control group.

In the intervention group, the median breast milk volume increased from 4 cc (IQR: 3–5 cc) at pretest to 8 cc (IQR: 7–9 cc) at posttest. In the control group, the median breast milk volume remained relatively unchanged, from 4 cc (IQR: 3–5 cc) at pretest to 4 cc (IQR: 3–5 cc) at posttest.

**Table 3.** Statistical Analysis of Breast Milk Production

Analysis	Test Used	p-value
Pre–post intervention group	Wilcoxon test	0.014
Posttest intervention vs control	Mann–Whitney test	0.029

Table 3 summarizes the statistical analysis results. The Wilcoxon signed-rank a substantial different in milk production before and after intervention in the lactation massage group ( $p = 0.014$ ), indicating an observable change following the intervention. Furthermore, by the Mann-Whitney test intervention and control groups after treatment ( $p = 0.029$ ). These results indicate a statistically substantial in milk production between groups following the intervention. The findings suggest that lactation massage may be associated with higher milk production in postpartum mother; however, the results should be considered carefully given the limited number of participants and the absence of random assignment in the study design.

Overall, the data indicate a steady pattern of higher breast milk production among participants in the treatment group arm versus the control group; however, the extent of this increase should be viewed with caution given the limited sample.

Descriptively, the treatment group demonstrated a median increase of 4 cc in breast milk volume between pretest and posttest, whereas the control group showed minimal change.

## DISCUSSION

### Interpretation of Main Findings

This study found higher an increase in breastfeeding rates among postpartum mothers who received lactation massage compared to those who received routine postpartum care. The observed differences between pretest and posttest measurements in the intervention group, as well as between groups at posttest, suggest a potential association between lactation massage and higher enhanced breast milk production.

These findings are in line with previous studies reporting that massage-based interventions may support lactation by enhancing neuroendocrine responses, particularly through the stimulation of prolactin and oxytocin secretion (6,7,17,18). However, this alignment should be interpreted cautiously, as differences in study design, sample size, and intervention protocols may influence the comparability of results.

Furthermore, because this study employed a non-randomized design and a small sample size, the findings should be interpreted cautiously, as these factors may constrain the ability to draw strong causal inferences.

Although statistically significant differences were observed, the magnitude of change should be interpreted cautiously due to the limited sample size.

### **Biological Mechanism of Lactation Massage**

The effectiveness of lactation massage can be explained through neuroendocrine mechanisms. Lactation is hormonally regulated by prolactin, which stimulates milk synthesis, and oxytocin, which facilitates milk ejection through the let-down reflex (6,7). Mechanical stimulation of the back and spinal area may activate sensory nerve pathways connected to the hypothalamus, leading to increased oxytocin secretion. Additionally, massage may enhance parasympathetic nervous system activity, promoting relaxation and reducing stress-induced inhibition of oxytocin release (17,18). Since psychological stress is known to interfere with milk ejection, interventions that promote relaxation may support improve the efficiency of milk flow. The observed difference improvement in milk production in this study is therefore biologically plausible and consistent with established physiological theory.

### **Psychological and Behavioral Contributions**

Beyond physiological mechanisms, psychological factors may also contribute to breastfeeding outcomes. Postpartum mothers often experience fatigue, anxiety, and concerns regarding milk sufficiency, which can affect breastfeeding performance (14,15). Massage-based interventions may enhance maternal comfort and perceived support, which in turn may improve breastfeeding confidence. Increased self-efficacy has been associated with more successful breastfeeding practices, suggesting that psychological support may complement physiological effects.

### **Comparison with Earlier Studies**

The findings of this study are generally consistent with previous research reporting higher breast milk production following massage-based interventions. The findings of this study are generally consistent with previous research reporting improvements in breast milk production following massage-based interventions (9,10,19). However, differences in study design, sample size, and intervention protocols should be considered when interpreting these similarities. Some previous studies employed randomized designs or larger samples, which may provide stronger evidence compared to the present study.

In addition, variations in the timing and duration of the intervention, especially during a postpartum period, may influence the magnitude of the observed effects. Therefore, direct comparison across studies should be made cautiously.

The relatively pronounced increase observed in this study may also be influenced by the timing of the intervention, which was conducted during postpartum days 2–4, a critical phase of lactogenesis. However, this interpretation requires further investigation.

### **Public Health Implications**

From a public health perspective, improving early breast milk production is important for supporting exclusive breastfeeding practices (4,5). Perceived insufficient milk supply remains one of the leading causes of early breastfeeding discontinuation (16). Lactation massage may be considered as a complementary supportive approach in primary healthcare settings, particularly during the early postpartum period. Lactation massage may be considered as a complementary approach in primary healthcare settings, particularly during the early postpartum period. Given its non-invasive nature and feasibility, this intervention suggested a practical to support breastfeeding outcomes (23). However, further studies with more rigorous designs are needed before broader implementation can be recommended.

### **Study Limitations**

This may limit the generalizability of the findings limited sample size ( $n = 20$ ) may reduce the statistical strength of the findings and restrict their generalizability. Second, the use of a non-randomized design could increase the possibility of selection bias and limits causal interpretation. Third, breast milk production was measured under routine clinical conditions without strict laboratory standardization, which may introduce measurement variability. In addition, potential confounding factors such as maternal psychological condition, breastfeeding frequency, mode

of delivery, and prior breastfeeding experience were not fully controlled. Therefore, the findings should be interpreted cautiously and considered as preliminary, context-specific evidence. Consequently, the findings should not be interpreted as evidence of a definitive causal relationship between lactation massage and breast milk production.

In addition, although pretest measurements were compared descriptively between groups, no adjusted statistical analysis was performed to fully control for potential baseline differences. Therefore, residual baseline imbalance may have influenced the observed outcomes.

## **CONCLUSION**

These findings indicate that lactation massage may contribute to higher breast milk production among postpartum mothers in primary care settings. The increased milk output in the intervention group suggests a possible correlation lactation and breast milk production during the early postpartum period. The increase in milk production observed in the intervention group a potential benefit of this complementary approach during the early postpartum period.

However, these findings should be interpreted with caution, non-randomized design, and potential measurement variability. Therefore, the results of this study should be considered as preliminary and context-specific evidence.

Further studies with larger samples, randomized designs, and standardized measurement protocols Additional studies are necessary to substantiate these findings and enhance their validity evidence base for clinical and public health applications.

## **AUTHOR CONTRIBUTION STATEMENT**

Ronni Naudur Siregar: conceptualization, methodology, supervision, validation, writing—original draft preparation, writing—review & editing, and project administration. Eva Hotmaria Simanjuntak: data curation, formal analysis, software, validation, and writing—review & editing. Netti Meilani Simanjuntak: investigation, data curation, resources, and field implementation.

## **CONFLICT OF INTEREST**

The authors declare that there is no conflict of interest regarding the publication of this article. This research was funded by Universitas Sari Mutiara Indonesia. The funder had no role in the study design, data collection, data analysis, interpretation of data, writing of the manuscript, or decision to publish the results.

## **DECLARATION OF GENERATIVE AI AND AI-ASSISTED TECHNOLOGIES IN THE WRITING PROCESS**

Authors are required to transparently disclose any use of generative artificial intelligence (AI) tools or AI-assisted technologies—such as ChatGPT, Grammarly, or DeepL—during the manuscript preparation process. This policy aims to uphold academic integrity, promote responsible authorship practices, and ensure compliance with ethical publication standards. If AI tools have been employed to support language refinement, enhance clarity, or improve the overall readability and structure of the manuscript.

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