



Woolwich massage increases the smoothness of breast milk production in early postpartum mothers

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ABSTRACT

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Breast milk is the optimal nutritional intake for infants. However, breastfeeding coverage in Badung Regency remains suboptimal at 85.4%, largely due to insufficient breast milk production in early postpartum. This quasi-experimental study with a pre-test and post-test control group design was conducted in October 2025. The study population comprised mothers on postpartum days 3–7. Using an unpaired numerical two-group comparison formula, 27 participants per group were recruited via consecutive sampling based on established inclusion and exclusion criteria. The instrument was developed in 2019 and had demonstrated good reliability, with a Cronbach's alpha of 0.865. Univariate analysis revealed that most respondents were aged 20–35 years, had secondary education, were employed, and were primiparous. The mean post-test score in the control group was 5.04, compared to 7.37 in the treatment group. The mean change from pretest to posttest was 0.19 in the control group and 2.37 in the treatment group. Bivariate analysis using the Mann–Whitney test yielded $p = 0.001$ ($p < 0.05$), indicating that Woolwich massage significantly increases breast milk production smoothness in early postpartum at Mengwi I Community Health Center. Midwives are encouraged to provide counseling during third-trimester pregnancy classes on lactation preparation and Woolwich massage application.

INTRODUCTION

Breast milk is an optimal source of nutrition for infants with immature digestive systems because it is easily digested and provides a balanced combination of essential nutrients necessary to support healthy growth and development during the first six months of life¹. Accordingly, exclusive breastfeeding is recommended for the first six months of an infant's life. Although breastfeeding is a natural physiological process, inadequate preparation and knowledge may contribute to various breastfeeding-related difficulties, including breast engorgement and nipple soreness².

According to the World Health Organization (WHO), exclusive breastfeeding rates in 2021 remained below 50% in several countries, including Afghanistan (43.1%), Mexico (30.1%), Nigeria (23.3%), and Paraguay (29.6%)³. The United Nations Children's Fund (UNICEF) explains that the average coverage of exclusive breastfeeding worldwide is around 38%⁴. The Indonesian Health Profile reports that exclusive breastfeeding coverage in Indonesia increased from 67.96% in 2022 to 73.97% in 2023 and 74.73% in 2024⁵. While there has been an increase in exclusive breastfeeding coverage from 2022 to 2024, it remains far from the national target of 80%. According to the Central Statistics



Agency (BPS), in Bali Province, only 69.1% of infants under 6 months old received exclusive breastfeeding in 2023. According to the Badung Regency Health Office, exclusive breastfeeding coverage in 2022 was 56.8%, while in 2023 it was 77.9%, and in 2024 it increased to 85.4%. Despite the increase in exclusive breastfeeding coverage in Badung Regency, efforts to optimize it through promotive, preventive, and rehabilitative efforts are still needed⁶.

The government has introduced various measures to promote exclusive breastfeeding, including comprehensive education and counseling at community health centers (Puskesmas) and integrated health posts (Posyandu), assistance from healthcare professionals, support for expressing and storing breast milk, the provision of breastfeeding facilities in workplaces, and legal sanctions for parties that obstruct breastfeeding initiatives. These measures are outlined in Health Law No. 17 of 2023 and Government Regulation No. 28 of 2024⁷. Despite these initiatives, the national target for exclusive breastfeeding coverage has not yet been achieved. The absence of exclusive breastfeeding may adversely affect infant health and long-term well-being. Infants who do not receive exclusive breastfeeding may face a higher risk of infectious diseases and nutritional deficiencies, as well as an increased likelihood of developing certain allergies and lactose-related digestive problems. Furthermore, inadequate breastfeeding during infancy may be associated with a greater risk of obesity and diabetes later in life¹.

Research conducted by Qiftiyah (2024)⁸ showed that exclusive breastfeeding may be affected by delayed milk production after childbirth or an insufficient breast milk supply. These conditions are associated with lactogenesis II, the physiological stage of lactation characterized by a substantial increase in milk production. This phase typically begins after placental delivery and occurs within the first 72 hours postpartum. The process is triggered by a rapid decline in progesterone and estrogen levels following the expulsion of the placenta, allowing prolactin to stimulate breast milk synthesis. During pregnancy, elevated levels of progesterone and estrogen inhibit the full milk-producing effects of prolactin. Following childbirth, the decline in these hormones enables prolactin to support the initiation of copious milk production⁹. Mothers experience different times of lactation onset after giving birth. The onset of lactation is said to be late if the duration of time from delivery to the emergence of the mother's perception of the onset of lactation is more than 72 hours after giving birth¹⁰.

Low rates of exclusive breastfeeding among infants aged 0–6 months may contribute to an increased burden of health problems, including upper respiratory tract infections (35.09%), diarrhea (38.07%), and malnutrition (49.2%). These conditions may adversely affect infant health and development, potentially resulting in impaired physical growth, greater susceptibility to infections, reduced cognitive development, and psychological or behavioral difficulties. In severe cases, malnutrition can become life-threatening and may lead to death. The consequences of breastfeeding difficulties may also affect maternal well-being, causing feelings of guilt, frustration, and stress when mothers are unable to meet their own expectations or perceived social expectations regarding breastfeeding. Furthermore, difficulties with breastfeeding may contribute to physical complications, such as mastitis and breast engorgement¹¹. There are many reasons for the failure of exclusive breastfeeding, one of which is a mother's lack of confidence that her breast milk can meet her baby's nutritional needs¹². This lack of confidence and anxiety can inhibit the release of the hormone oxytocin. Oxytocin stimulates the release of prolactin, which stimulates milk production in mothers during breastfeeding. Ineffective milk release is caused by an inadequate oxytocin reflex, which results in poor milk flow or reduced milk volume¹³. Because of this, complementary care such as Woolwich Massage is necessary to increase milk secretion and volume, as well as prevent complications such as breast engorgement and inflammation¹⁴.

Efforts to increase breast milk production in mothers after giving birth, apart from pumping breast milk, can also be done by caring for or massaging the breasts¹⁵, cleaning the nipples, breastfeeding the baby frequently even though the breast milk has not yet come out¹⁶, breastfeeding early and regularly, taking breast milk supplement medication, and using the Woolwich Massage¹⁷. The Woolwich massage is a massage performed in the lactiferous sinus area 1–1.5 cm above the areola, with the aim of secreting breast milk located in the lactiferous sinus¹⁸, Woolwich massage is a non-pharmacological lactation intervention performed on the lactiferous sinus area, precisely 1–1.5 cm above the areola mammae¹⁹, to stimulate the ejection of breast milk stored in the lactiferous sinus²⁰.

Unlike oxytocin massage, which targets the back and spine to trigger the let-down reflex²¹, Woolwich massage acts directly on the breast tissue to stimulate the hypothalamus, thereby increasing the secretion of both prolactin and oxytocin hormones, which are essential for milk production and ejection. This targeted approach makes Woolwich massage particularly important in the early postpartum period, when insufficient breast stimulation and inhibition of the oxytocin reflex are among the leading causes of low milk production and early breastfeeding cessation^{22,23}. A preliminary study conducted at Mengwi I Community Health Center in May 2025 identified 15 mothers in the normal postpartum period. Interviews with these mothers revealed that 25% reported adequate breast milk flow and did not provide formula milk to their infants, whereas 75% had introduced formula milk because their babies were frequently fussy, which they perceived as an indication of insufficient breast milk during the early postpartum period. The interviews also revealed that none of the mothers were familiar with the Woolwich massage technique. Based on these preliminary findings, this study aimed to evaluate the effectiveness of Woolwich massage in improving breast milk production during the early postpartum period.

METHODS

This study employed a quantitative quasi-experimental design using a control group pretest–posttest approach. The study population comprised postpartum mothers on days 3–7 after childbirth. The sample size was calculated using a formula for comparing two independent groups with numerical data, resulting in 27 participants in each group. Data were collected using a 10-item questionnaire assessing the adequacy of breast milk production. Respondents were allocated to two groups according to their residential areas within the service coverage of Mengwi I Community Health Center: mothers residing in the northern area were assigned to the intervention group, while those in the southern area were assigned to the control group. Both groups completed a pretest before the intervention.

The intervention group received standard postpartum care and information, education, and communication (IEC), in addition to an innovative breast massage technique known as Woolwich massage. The massage was performed approximately 1–1.5 cm above the areola for 15 minutes per session, twice daily, in the morning and evening, over three consecutive days. Initially, the researchers, assisted by enumerators, provided practical demonstrations and instructions to ensure that participants understood the correct massage technique. Participants subsequently performed the massage independently at home, with implementation monitored through video calls and documented using observation sheets. Meanwhile, the control group received routine postpartum care during the second postpartum visit (KF 2) and IEC in accordance with the standard operating procedures (SOPs) implemented at Mengwi I Community Health Center. On the third day, both groups completed the same questionnaire again to assess changes in breast milk production. The questionnaire had been developed in 2019 and comprised 10 items for evaluating breast milk production. Its reliability had previously been established, with a Cronbach's alpha coefficient of 0.865, indicating good internal consistency.

Participants were recruited according to predetermined inclusion and exclusion criteria to promote sample homogeneity and reduce the potential influence of confounding factors. The inclusion criteria comprised: (1) postpartum mothers who did not use galactagogues, including supplements or medications intended to stimulate breast milk production; (2) mothers within the normal postpartum period, specifically days 3–7 after childbirth; (3) mothers with a mid-upper arm circumference (MUAC) of ≥ 23.5 cm, indicating no chronic energy deficiency (CED); (4) mothers without symptoms of postpartum blues, depression, anxiety, or other emotional disturbances; and (5) mothers who provided voluntary consent to participate in the study.

The exclusion criteria included: (1) postpartum mothers with breast anatomical abnormalities or pathological conditions, such as inverted nipples, mastitis, or a history of breast surgery; (2) postpartum mothers diagnosed with anemia; and (3) infants presenting with anatomical abnormalities of the tongue or oral cavity, including ankyloglossia (tongue-tie) or cleft palate, that could interfere with effective breastfeeding and potentially influence breast milk production outcomes.

One limitation of this study was the absence of random allocation, as participants were assigned to the intervention or control group according to their residential location within the northern and southern service areas of Mengwi I Community Health Center. This geographical approach was

implemented to minimize the potential for contamination bias, which could occur if participants from both groups lived in the same area and shared information about the intervention technique. Although this strategy helped reduce the risk of intervention-related information spreading between groups, it may have introduced selection bias because the baseline characteristics of the two groups might not have been entirely comparable. To evaluate baseline equivalence, maternal age, parity, educational attainment, and pre-intervention breast milk production scores were compared between the groups. The analysis revealed no statistically significant differences in these characteristics at baseline ($p > 0.05$), suggesting that the groups were comparable before the intervention.

This analysis method was used to determine the relationship between the independent and dependent variables. Data distribution was checked for normality using the Shapiro-Wilk test. The normality test indicated that the data were not normally distributed, so the non-parametric Wilcoxon test was used to test the difference between the pre-test and post-test results for the control and treatment groups. An unpaired two-group test using the Mann-Whitney U test was then conducted to compare the difference in breast milk production before and after the Woolwich massage in each group²⁴. This study received ethical approval from the Research Ethics Commission of the Denpasar Ministry of Health Polytechnic. The ethical clearance number is: DP.04.02/F.XXIV.25/871/2025.

RESULT AND DISCUSSION

Respondent Characteristics

This study was conducted within the working area of the Technical Implementation Unit of Mengwi I Community Health Center (UPTD Puskesmas Mengwi I), Badung Regency, which is one of three community health centers located in Mengwi District. The facility is situated at an altitude of 400 meters above sea level, and the majority of its surrounding area consists of agricultural land. UPTD Puskesmas Mengwi I is located on Jalan I Gusti Ngurah Rai, Banjar Panca Dharma, Mengwitani Village, Mengwi District, Badung Regency. The total coverage area of UPTD Puskesmas Mengwi I spans 37.8 km².

Table 1. Characteristics of research subjects

No	Characteristics	Control Group		Intervention Group	
		Total		Total	
		f	%	f	%
1	Age				
	Under 20 years old	3	11.1	4	14.8
	20-35 years old	19	70.4	18	66.7
	Over 35 years old	5	18.5	5	18.5
	Total	27	100.0	27	100.0
2	Education				
	Basic	4	14.8	2	7.4
	Secondary	15	55.6	15	55.6
	Higher	8	29.6	10	37.0
	Total	27	100.0	27	100.0
3	Occupation				
	Unemployed	19	70.4	22	81.5
	Employed	8	29.6	5	18.5
	Total	27	100.0	27	100.0
4	Parity				
	Primiparous	19	70.4	16	59.3
	Multiparous	8	29.6	11	40.7
	Total	27	100.0	27	100.0

Respondent characteristics in the Mengwi I Community Health Center work area showed that, by age, both in the control and treatment groups, the majority of respondents were aged 20-35 years,

with 19 (70.4%) in the control group and 18 (66.7%) in the treatment group. Regarding educational attainment, both in the control and treatment groups had a high school education, with 15 (55.6%) in the control and treatment groups, respectively.

Regarding employment status, the majority of respondents in both the control and treatment groups were unemployed, with 19 (70.4%) in the control group and 22 (81.5%) in the treatment group. Based on parity characteristics, both the control and treatment groups were mostly primiparous, with 19 (70.4%) in the control group and 16 (59.3%) in the treatment group.

Differences in breast milk production scores during the pretest in the two groups

The findings revealed that most participants in both the intervention and control groups were within the reproductive age range of 20–35 years. Maternal age may influence the breastfeeding process, as mothers within this age group generally have breast tissue that remains relatively elastic and responsive to infant suckling. These characteristics may facilitate the milk ejection reflex, thereby supporting effective breastfeeding. In a study by Fatayah and Zannah (2023)²⁵, it was found that mothers under 30 years old experienced a greater increase in their milk production after Woolwich massage compared to older mothers. Maternal age is one of the characteristics that influences the smoothness of breast milk production. According to data presented by the Indonesian Ministry of Health (2020), mothers aged between 20 and 35 years have a tendency to produce better breast milk compared to other age groups. This may be due to the more stable physical and emotional factors of mothers at that age, which contributes to the health of both mother and baby.

Maternal education also plays a crucial role. Mothers with higher education may have a better understanding of proper breastfeeding techniques and be more open to innovative interventions to promote breast milk production. Research by Ningsih (2024)²¹ showed that mothers with higher education were more motivated to participate in counseling sessions on complementary therapies to increase breast milk production. Maternal education is a crucial factor influencing breast milk production. According to data from the Central Bureau of Statistics (2021), mothers with higher education tend to better understand the importance of breastfeeding and ways to increase breast milk production. Haque's (2024)²⁶ study, found that most respondents had completed senior high school, and 80% of mothers experienced increased breast milk production following Woolwich massage. These findings suggest that mothers with a secondary education can benefit from appropriate breastfeeding techniques and professional support to improve milk production. Educational attainment may influence a mother's ability to access, understand, and utilize health-related information and support services. Although higher education is often associated with better health literacy and health outcomes, educational level alone does not determine breastfeeding success. Rather, access to accurate breastfeeding information, practical guidance, and adequate support from healthcare professionals plays an important role in helping mothers establish successful breastfeeding practices.

As shown in Table 2, the control group showed minimal improvement, with the mean score increasing slightly from 4.85 to 5.04. In contrast, the intervention group demonstrated a substantial increase in mean score from 5.00 to 7.37 (+2.37 points) following the Woolwich massage intervention. This improvement was consistent across all parameters the median from 5 to 7, the mode from 4 to 7, and notably, the minimum score increased from 3 (not smooth) to 6 (smooth), indicating that all participants in the intervention group achieved adequate breast milk production by posttest. These results suggest that Woolwich massage produced a more meaningful improvement in breast milk production smoothness compared to standard postpartum care alone.

Table 2. Smooth breast milk production before and after woolwich massage in early postpartum

Group	n	Min	Max	Median	Mode	Mean	SD
Control							
<i>Pretest</i>	27	3	7	4	4	4.85	1.406
<i>Posttest</i>	27	3	7	5	4	5.04	1.344
Intervention							
<i>Pretest</i>	27	3	7	5	4	5.00	1.301
<i>Posttest</i>	27	6	10	7	7	7.37	1.079

The mean pretest scores suggest that there was no substantial difference in breast milk flow indicators between the intervention and control groups before the intervention. During the early postpartum period, limited breast milk production and low milk output may make it difficult for mothers to initiate breastfeeding promptly. These challenges may be associated with insufficient stimulation of prolactin and oxytocin, two hormones essential for milk synthesis and milk ejection, respectively. The physiological process of lactation provides an explanation for these changes. During pregnancy, prolactin levels increase due to activity of the anterior pituitary gland; however, high concentrations of estrogen and progesterone inhibit the onset of copious milk production. Following childbirth, the expulsion of the placenta leads to a marked decline in estrogen and progesterone levels, particularly within the first two to three days postpartum. This hormonal shift enables prolactin to stimulate increased milk synthesis, while oxytocin facilitates milk ejection. These physiological changes may help explain why some mothers experience difficulties with milk production and flow during the early postpartum period²⁷.

The results of the Wilcoxon test showed that in the control group there were 5 respondents who experienced an increase in breast milk production scores, there was one respondent who actually experienced a decrease in breast milk production, and 21 respondents whose breast milk smoothness scores remained the same from pretest to posttest with a p-value of 0.09 which means there was no difference in the pre-test and post-test breast milk production smoothness scores in the control group. In the treatment group there were 24 respondents who experienced an increase in breast milk production, no respondents experienced a decrease in breast milk production, and as many as 3 respondents said their breast milk production remained the same with a p-value of 0.00 which means there was a difference in the smoothness of breast milk production before and after giving the Woolwich Massage.

Table 3. Wilcoxon test results: differences in breast milk production scores before and after intervention in both groups

Breast Milk Production	<i>Positif Rank</i>	<i>Negatif Rank</i>	<i>Ties</i>	<i>n</i>	<i>p value</i>
Control					
Pretest	5	1	21	27	0.09
Posttest					
Intervention					
Pretest	24	0	3	27	0.00
Posttest					

Differences In Breast Milk Production Scores Post-test In The Two Groups

The Mann–Whitney test revealed a difference in posttest breast milk production scores between the intervention and control groups. The mean score in the intervention group was 2.33 points higher than that in the control group, with a statistically significant result ($p < 0.05$). These findings indicate that breast milk production outcomes were better among mothers who received Woolwich massage than among those who received standard postpartum care alone. Therefore, Woolwich massage may be an effective complementary intervention for improving breast milk production during the early postpartum period at UPTD Mengwi I Health Center.

The researchers believe that the Woolwich massage technique provides mothers with comfort, relaxation, and positive thoughts, enabling them to express breast milk smoothly. This massage movement also provides mechanical stimulation. Therefore, the combination of positive thoughts and mechanical stimulation will cause the body to produce the hormones prolactin and oxytocin, which significantly influence breast milk production and smooth milk flow. In line with research conducted by Qiftiyah and Qonitun (2024)⁸, the results showed that all 30 respondents who received Woolwich massage experienced smooth breast milk flow, and none experienced sufficient or insufficient milk secretion after the Woolwich massage intervention. According to research by Farida and Setyorini (2022)¹⁸, Woolwich massage can stimulate nerve cells in the breast, which then continue to the hypothalamus. The anterior pituitary releases prolactin (prolactin reflex), and the posterior pituitary

releases oxytocin (let-down reflex). These two hormones are then transported through the bloodstream to the myoepithelial cells in the breast for milk production and release.

Table 4. Mann-whitney test results: differences in breast milk production scores following woolwich massage in the early postpartum period in the two groups

Breast Milk Production	n	Min	Max	Mean±SD	p value
Control	27	3	7	5.04±1.344	0.001
Intervention	27	6	10	7.37±1.079	

The Woolwich massage technique emphasizes the importance of facilitating milk flow in addition to supporting milk production by the mammary glands. This massage is believed to stimulate the autonomic nerves and subcutaneous tissues, promoting tissue relaxation and improving circulation around the mammary ductal system. It may also help facilitate milk passage through the lactiferous ducts by reducing potential obstructions. Furthermore, stimulation of the breast tissue during massage may support the physiological mechanisms involved in lactation. However, milk production is primarily regulated by prolactin, whereas milk ejection is mediated by oxytocin. These hormonal responses are coordinated through neuroendocrine pathways involving the hypothalamus and pituitary gland.¹⁴ This is supported by research by Qiftiyah and Qonitun (2024)⁸, which showed differences in pre- and post-treatment breast milk volume. The post-treatment study showed an increase in breast milk volume. This is in line with research by Natalina (2025)²², which showed a significant difference ($p=0.026$) in breast milk production before and after Woolwich massage. Non-pharmacological management to increase breast milk production using the Woolwich Massage method is an alternative to increase comfort and relaxation in postpartum mothers during breastfeeding, thereby increasing milk volume. The Woolwich Massage method stimulates the prolactin reflex and the let-down reflex.

Breast milk production is influenced by various maternal and environmental factors, including psychological well-being, breast anatomy, nutritional status, sleep quality, and family support. A mother's emotional and mental condition may affect the physiological processes involved in lactation, while inadequate rest due to frequent nighttime infant awakenings may contribute to breastfeeding difficulties. Adequate and balanced nutritional intake is also important for maternal health and breastfeeding; however, its influence can be difficult to assess without systematic evaluation of dietary patterns, such as through dietary recall methods. Although Woolwich massage may help improve breast milk production, other contributing factors should also be considered when interpreting its effectiveness. Studies evaluating massage without controlling for potential confounders, including maternal nutrition, sleep, and psychological well-being, may have limitations in the generalizability of their findings. Therefore, maintaining emotional balance, obtaining sufficient rest, and ensuring adequate fluid and nutritional intake are important aspects of breastfeeding support. In addition, maternal physical and psychological health, together with appropriate breast care, may contribute to lactation outcomes, while external factors such as family support and access to adequate nutrition can further influence breastfeeding success.

This study has several limitations, particularly regarding field conditions and social and domestic factors that were beyond the researchers' control. Specifically, maternal dietary intake, psychological status, sleep patterns, and fatigue could not be adequately monitored or controlled throughout the intervention. Maternal rest was especially challenging to regulate because newborns often have irregular and unpredictable sleep schedules. In addition, maternal nutritional intake was not objectively assessed, as dietary data were not collected using a food recall instrument during the study period. These limitations should be considered when interpreting the findings, as such factors may have influenced breast milk production outcomes independently of the intervention.

CONCLUSION

The intervention group demonstrated greater breast milk production following Woolwich massage than the control group, indicating that this technique may be effective in improving breast milk production during the early postpartum period at UPTD Mengwi I Community Health Center. Despite

the limitations of this study, the findings offer valuable implications for midwifery practice. Woolwich massage is a straightforward, non-pharmacological, and relatively inexpensive intervention that can be introduced to postpartum mothers during routine postnatal care visits (KF 2). Because the technique can be performed independently after appropriate instruction, it may also be practiced at home, potentially improving access to breastfeeding support for mothers in both urban and rural communities.

Further research is needed to address the limitations identified in this study and strengthen the evidence regarding the effectiveness of Woolwich massage. Future investigations could employ randomized controlled trials (RCTs) involving larger sample sizes and multiple research sites to improve the robustness and generalizability of the findings. In addition, subsequent studies should consider incorporating objective outcome measures, including expressed breast milk volume measured in milliliters, infant weight gain, and breastfeeding frequency. The use of validated instruments to assess maternal psychological well-being and standardized dietary assessment methods, such as food recall instruments, would also help account for potential confounding factors and provide a more comprehensive evaluation of the intervention's effects.

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CONFLICT OF INTEREST

The authors declare that there are no internal conflicts regarding the writing of this research and article.

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DECLARATION OF ARTIFICIAL INTELLIGENCE USE

The authors used ChatGPT (OpenAI, GPT-6) to assist in paraphrasing sentences and improving the clarity and language of the manuscript. The authors reviewed and verified all AI-assisted revisions to ensure the accuracy, scientific integrity, and originality of the manuscript. The authors take full responsibility for the content of the manuscript.

AUTHOR CONTRIBUTIONS

NMPM, SR and AAS contributed to the conceptualization, methodology, and design of the study. NMPM contributed to data collection and data analysis. NMPM prepared the original manuscript, while SR and AAS contributed to reviewing and editing the manuscript. All authors reviewed and approved the final version of the manuscript and agreed to be accountable for all aspects of the work.

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