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The Effect of 30-Minute Oxytocin Massage on Breast Milk Volume and Infant Weight Gain in Early Postpartum Women: A Randomized Controlled Trial

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ABSTRACT

Background & aim: Many new mothers discontinue breastfeeding prematurely. Exclusive Breastfeeding (EBF) during the first six months of life is widely recognized as an optimal feeding practice that supports infant health and survival. This study aimed to determine the effect of a 30-minute oxytocin massage on breast milk volume and infant weight gain among early postpartum women.

Methods: A randomized single-blind controlled trial with a two-group pretest–posttest design was conducted among 60 postpartum women. Participants were randomly assigned using computer-generated randomization with allocation concealment. The intervention group received a 30-minute oxytocin massage, while the control group received a 15-minute oxytocin massage for three consecutive days. Breast milk volume was measured using standardized manual milk expression, and infant weight was assessed using calibrated infant weighing scales. Outcomes were evaluated at baseline and after completion of the intervention. Data were analyzed using SPSS version 20 and paired- and independent-samples t-tests at $\alpha = 0.05$.

Results: The mean age of participants was 28.3 ± 5.1 years. The increase in breast milk volume and infant weight was greater in the intervention group (mean = 10.03 mL and 151.50 g) than in the control group (mean = 8.33 mL and 106.16 g). These differences were statistically significant for both breast milk volume ($t = -8.171$, $P< 0.001$) and infant weight gain ($t = -9.088$, $P< 0.001$). ANCOVA also showed significant between-group differences.

Conclusion: A 30-minute oxytocin massage may improve breast milk volume and infant weight gain, offering a practical, low-cost method for postpartum lactation support.

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Introduction

Breastfeeding is a crucial intervention for reducing infant mortality and promoting optimal child health (1). In impoverished areas, providing exclusive breast milk saves approximately 1.5 million newborns annually (2). Globally, only 48% of infants under six months of age are exclusively breastfed, remaining below the World Health Assembly target of 60% by 2030 (2-3). Acknowledging its critical role, the World Health Organization endorses exclusive breastfeeding for the first six months as a means of supporting infant growth, development, and overall health (4-5).

Data from the WHO in 2021 indicated that the global rate of exclusive breastfeeding for infants was only around 44 percent (5). Furthermore, only 67.74% of 0 to 6-month-old Indonesian babies received exclusively breast milk,

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compared to the target of 80%. Exclusive breastfeeding was reported in only 63.35% of infants based on data from the Health Office of West Java Province (6). Ciamis District achieved the second lowest score at 45.96%, still below the target (6). In addition, reports from the Health Office of Ciamis District showed that the achievement of exclusive breastfeeding in 2019 did not meet the intended target, with coverage limited to 49% (7). This situation was especially prevalent in the working area of Baregbeg Public Health Center, where exclusive breastfeeding rates remain below the national target. This problem results from factors such as a lack of awareness and insufficient healthcare support.

Assessing the efficacy of oxytocin massage in this specific circumstance is essential, considering that the procedures and obstacles differ in Indonesia (8). Despite these benefits, exclusive breastfeeding (EBF) faces several challenges, including maternal concerns about insufficient breast milk production (9). Many mothers experience difficulties in maintaining an adequate milk supply (10), which can lead to early supplementation with formula or other substitutes. Addressing these challenges is essential to improving breastfeeding rates and reducing infant mortality (11).

Breast milk production is regulated by hormonal mechanisms, particularly the role of oxytocin (12). Oxytocin massage is a proven method to enhance milk production by stimulating the spinal cord, activating neurotransmitters in the medulla oblongata, and signalling the hypothalamus (13). This process triggers the posterior pituitary gland to release oxytocin, which facilitates milk ejection and sustains lactation (14). Breastfeeding provides nutritional and emotional benefits for both children and mothers (15).

Furthermore, long-term benefits include a lower risk of breast and uterine cancers, obesity, osteoporosis, and type 2 diabetes mellitus (16-17). However, breastfeeding can be more challenging since it depends on the production of breast milk (18). Breastfeeding is facilitated by adequate breast milk production (18). Inadequate breast milk for the baby can result from a lack of or late production of breast milk (19). The two elements that affect breast milk production are production and release (20). The prolactin hormone influences breastmilk production; however, prolactin itself does not directly relate to the level of milk production (21). It is the oxytocin hormone that increases the movement of breastmilk to the breasts (22).

Existing solutions to address breastfeeding challenges include pharmacological interventions, breastfeeding support programs, and maternal education (23). Pharmacological treatments are occasionally recommended to supplement lactation despite their potential side effects for both women and babies (24). Breastfeeding support, including professional lactation counseling and peer support groups, has been proven effective in improving breastfeeding outcomes by addressing common concerns and enhancing maternal confidence (25). Additionally, educational programs empower mothers with adequate knowledge and skills about breastfeeding and strategies to overcome common lactation difficulties (26).

Oxytocin massage is a non-pharmacological intervention designed to stimulate the secretion of oxytocin (27). Oxytocin massage and proper breast care may augment breast milk production, with efficacy contingent upon the frequency and duration of breastfeeding (18). This intervention activates the parasympathetic nervous system, thereby promoting oxytocin release from the posterior pituitary, particularly when massage is applied along the spinal area from the fifth to sixth ribs toward the scapular region (28).

However, non-pharmacological methods like oxytocin massage offer a safer, more natural, and cost-effective approach to supporting lactation (27,29). Oxytocin massage stimulates the release of oxytocin, which enhances milk ejection and overall milk production without the risks associated with medication (30). Stimulation of the parasympathetic nervous system through oxytocin massage and spinal massage along the fifth to sixth ribs extending to the scapular region accelerates oxytocin release from the posterior pituitary (28). Besides being easy to implement, either by trained healthcare providers or mothers, this technique has been shown to improve breastfeeding success rates (31). Given its accessibility, effectiveness, and minimal risk, oxytocin massage presents an innovative solution to breastfeeding challenges, particularly in regions with limited healthcare resources.

Data from the WHO in 2021 indicated that the global rate of exclusive breastfeeding for infants was only around 44 percent (World Health Organization, 2021). Furthermore, only 67.74% of 0 to 6-month-old Indonesian babies received exclusively breast milk, compared to the target of 80%.

Exclusive breastfeeding was reported in only 63.35% of infants based on data from the Health Office of West Java Province (6). Ciamis District achieved the second lowest score at 45.96%, still below the target (6). In addition, reports from the Health Office of Ciamis District showed that the achievement of exclusive breastfeeding in 2019 did not meet the intended target, with coverage limited to 49% (7).

This situation was especially prevalent in the working area of Baregbeg Public Health Center, where exclusive breastfeeding rates remain below the national target. This problem results from factors such as a lack of awareness and insufficient healthcare support. This study aimed to determine the effect of a 30-minute oxytocin massage on both breast milk volume and infant weight gain in early postpartum women.

Materials and Methods

This study employed a randomized single-blind controlled trial with a two-group pretest–posttest design involving 60 postpartum women at 14 days postpartum at Baregbeg Public Health Center, Ciamis, West Java, Indonesia. Data collection was conducted from July to November 2020. Eligible participants were postpartum mothers who were breastfeeding their infants at 14 days after vaginal delivery, had assumed care of their infants after hospital discharge, were able to provide informed consent, were not taking any medications, and had no history of spinal injury. Women were excluded if they had a history of cesarean delivery, were unable to communicate in Indonesian, or their infants required special care for more than 24 hours. The intervention was administered at home for three consecutive days, from postpartum day 14 to day 16. Baseline measurements were obtained before the first massage session on postpartum day 14, and post-intervention measurements were obtained after completion of the third massage session on postpartum day 16.

Sample size estimation was conducted using G-power analysis.The calculation was based on the t-test family, assuming a large effect size (0.8), an alpha error probability of 0.10, and a statistical power of 0.90. The minimum sample size was 56 subjects. The assumption of a large effect size was based on published methodological literature that outlines acceptable strategies for effect size selection in quantitative studies, particularly in cases where prior empirical estimates or pilot data are not available (32). This effect size was selected to ensure robust results and to reflect the potential impact of the 30-minute oxytocin massage on breast milk volume and infant weight gain. The minimum target sample size was 56 participants, with an alpha error probability of 0.1 and a power of 0.9, as calculated using G*Power analysis. This approach ensures the credibility and reliability of the study's findings.

The study used a two-group randomized single-blind controlled trial. The random sequence was generated using a computer-based randomization procedure by a trained enumerator who was not involved in participant eligibility assessment or recruitment. Allocation concealment was ensured using sequentially numbered, opaque, sealed envelopes prepared by the same independent enumerator. Group assignments were revealed only after participant enrollment had been completed, thereby minimizing selection bias. Outcome assessors were blinded to group allocation to reduce potential assessment bias. A total of 30 participants were allocated to the control group and received a 15-minute oxytocin massage, while 30 participants were allocated to the intervention group and received a 30-minute oxytocin massage. Both interventions followed the same standardized oxytocin massage protocol, with the duration of massage being the only difference between the two groups.

A total of 60 participants provided written informed consent before study enrollment and received compensation for their participation. Each session used a moderate-pressure back massage. The intervention was delivered by the same eight massage therapists to standardize the type of touch among participants in each group. Screening methods, including questionnaires, were implemented to reduce the risk of disease transmission, and precautions were in place to ensure the safety of populations in affected

communities during data collection. In addition, measures such as wearing personal protective equipment (PPE) and disinfecting equipment were applied to reduce the risks of disease transmission. A 30-minute massage or pressure session was administered to this group, focusing on the back of the neck, spinal area, and the fifth and sixth coastal regions near the scapula with circular motions. Massage took place in their home, and the subjects attended daily sessions on days 1 to 3.

Eight massage therapists were involved in delivering the intervention. Before data collection, all therapists received standardized training from the research team on the oxytocin massage procedure, including participant positioning, massage sequence, massage technique, duration, and application of baby oil. The training included a demonstration and supervised practice to ensure that all therapists followed the same standardized protocol. The research team provided a written protocol and checklist to guide the implementation of each massage session. Adherence to the standardized massage protocol was monitored using the checklist during each session, covering participant positioning, massage sequence and technique, massage duration, and application of baby oil. The research team also used tracking sheets to monitor the completion of daily intervention sessions and maintained consistency in protocol implementation throughout the study.

Therapists were instructed to minimize communication with participants during the intervention, and the same therapists were involved in each session to maintain consistency. Participants were informed beforehand that verbal interaction would be restricted during the intervention. The research team also used tracking sheets to monitor daily data collection during the pretest and posttest. No adverse effects associated with the massage intervention were reported in either group.

A personal information form was employed to acquire the data and questionnaires at the patients' homes, specifically in their rooms. The entire data collection process lasted about an hour. A personal information form was completed by the researcher. The instrument comprised 12 items assessing participants' medical and sociodemographic characteristics. The intervention began after the subjects were randomized.

A total of 60 women who met the study eligibility criteria completed the questionnaire and observation sheet administered by the interviewer. A structured questionnaire was developed based on a review of the relevant literature and expert consultation to collect participants' sociodemographic and obstetric characteristics. Twenty women who were excluded from the main study participated in a pilot test to assess the clarity and feasibility of the questionnaire. The first section collected information on participants' age, education, delivery characteristics, occupation, body mass index (BMI), type of residence, parity, and breast care. The second section consisted of an observation sheet completed by the enumerator to record infant weight before and after the intervention and breast milk volume measurements.

Both groups of patients received daily oxytocin massages for 15 minutes and 30 minutes, respectively, between 07:00 and 10:00 at home for three days. Before the massage, the patients and their environment were prepared, and privacy was ensured. The most comfortable position for the back massage was established through discussion with the participants. Each participant was seated on a chair with a side table positioned in front, and pillows were placed on the table to provide adequate support. Before initiating the massage, the researcher, who was trained in massage techniques, washed, dried, and warmed her hands, then applied 5–10 drops of room-temperature liquid baby oil, commonly used to moisturize the back, to her hands. The massage procedure was subsequently initiated, with the oil serving to lubricate the skin and minimize friction.

Breast milk volume was assessed by collecting the breast milk released during the standardized observation period into a calibrated glass container. The volume collected was recorded in milliliters (mL). The measurement was performed 2 hours after the participant's last breastfeeding session. This measurement represented the amount of breast milk released during the specified observation period and was not intended to represent total breast milk

production over the entire lactation period. The same observation period, calibrated container, and measurement procedures were used for all participants to ensure consistency.

Baseline measurements of breast milk volume and infant weight were obtained before the first massage session on postpartum day 14. The intervention was administered for three consecutive days, from postpartum day 14 to day 16. Follow-up measurements of breast milk volume and infant weight were conducted after completion of the third massage session on postpartum day 16 using the same measurement procedures and equipment. Thus, the follow-up period covered three days from the first to the final intervention session.

The research was approved by Dian Nuswantoro University HREC under protocol approval 319/EA/KEPK-Fkes-UDINUS/XI/2022. The data were collected at the Baregbeg Public Health Center, Ciamis, West Java, Indonesia. All subjects provided written informed consent after the procedures were explained. A total of 60 subjects participated in the study. This was a randomized single-blind clinical trial. It was registered with the code INA-100220250161FA1 in the Indonesia Clinical Research Registry (INA-CRR) by the Health Policy Agency of the Ministry of Health of the Republic of Indonesia.

A descriptive analysis was used to summarize participant characteristics. Data normality was assessed using the Kolmogorov–Smirnov test. The independent and dependent sample T-tests were conducted to compare the means of breast milk production before and after treatment, as well as between the groups. SPSS software version 20 for Windows was used. The exclusion criteria were checked during the study, and participants who met these criteria were excluded.

The research was carried out at the Public Health Center in Ciamis City, Indonesia.

Sociodemographic and obstetric data were collected using a structure questionnaire developed based on relevant literature and expert consultation. The questionnaire included information on age, education, occupation, body mass index (BMI), parity, place of residence, and birth-related characteristics. Data collection was conducted through interviewer-administered questionnaires, direct observation, breast milk volume measurement, and infant weight assessment (33).

Results

The randomization flowchart is demonstrated in Figure 1. Approximately 59% of invited women were eventually randomised in the study; 31% of the invited women were less than 2 weeks postpartum, and 4% had a caesarean section. A total of 60 subjects were randomized in the study and analyzed.

Overall, the 2-week postpartum women recruited were primarily adults with a mean age of 28.3 years (± 5.1) (Table 1).

In terms of educational attainment, most participants had completed high school (40%) or junior high school (38.3%). The vast majority of participants (91.7%) had given early breastfeeding. For the parity status, most subjects were at parity 2. The body mass index (BMI) of the subjects was mainly in the healthy weight and overweight ranges (53.3% vs. 40%, respectively). Subjects living in the rural area were greater than those in the suburban area (80% vs. 20%, respectively). Compared to working mothers, non-working mothers were greater (88.3 vs. 11.7%, respectively). The mean age of the infants was 14.1 days (±1.3).

For the intervention group, the mean maternal age was 28.8 (±4.8), whereas the control group had a mean age of 27.8 ± 5.4 years 27.8 (±5.4) (Table 1). Regarding educational attainment, most participants had completed senior high school (21.7%) and junior high school (21.7%).

Early initiation of breastfeeding was reported by nearly all participants (90%). In terms of parity, parity two was the most common status among participants. The body mass index (BMI) of the subjects was mainly in overweight and healthy weight status (53.3% vs 43.4%, respectively). Subjects living in the rural area were greater than those in the suburban area (90 45% vs. 10%, respectively). Compared to working mothers, non-working mothers were greater (86.7 vs. 13.3%, respectively). The mean age of the infants was 14.3 days (±1.4).

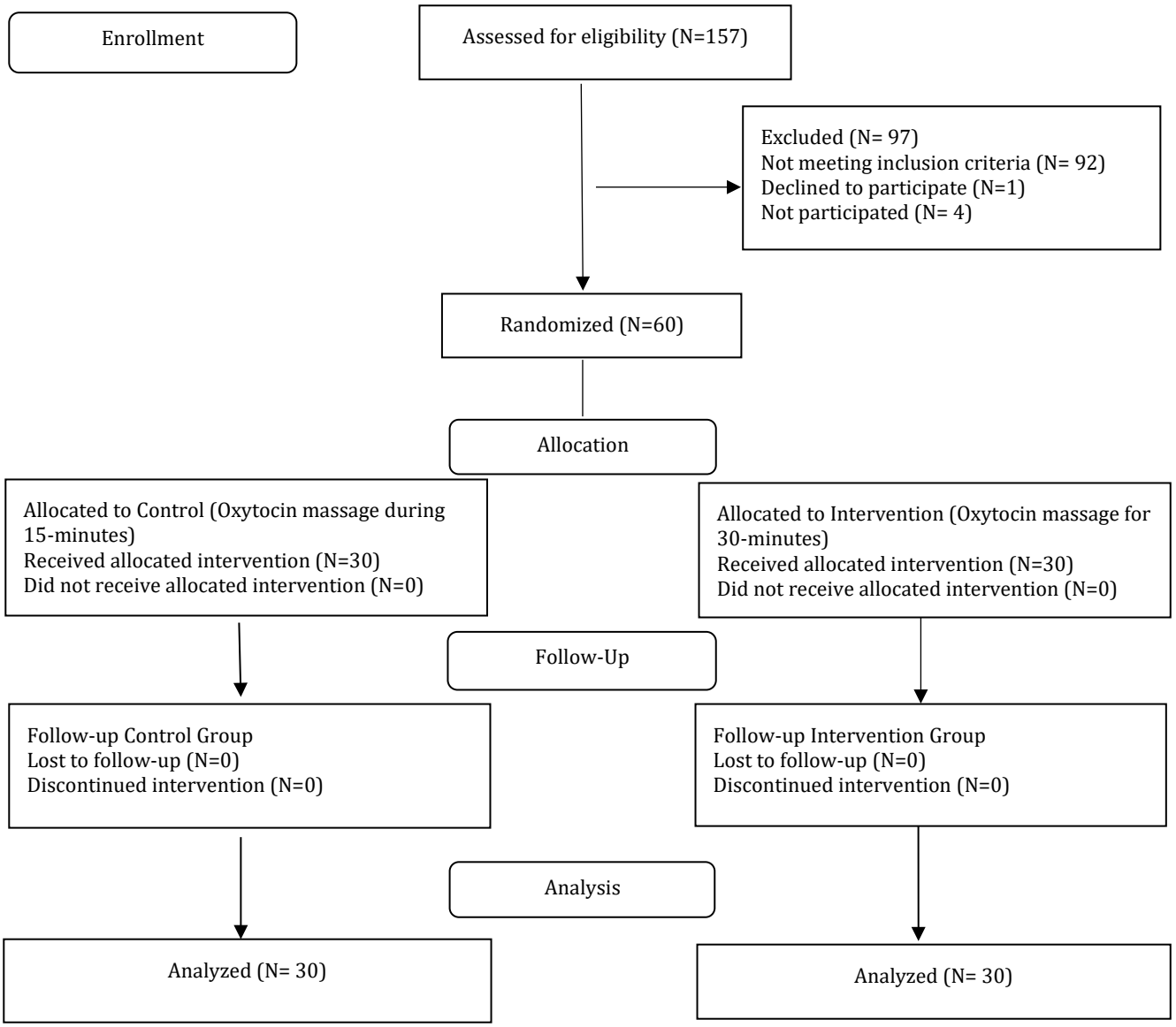

Figure 1. CONSORT Flowchart of the study

Data were described as a mean ± SD and number (percent), P-value was calculated using the Chi-square test.

After receiving the standard protocol (15 minutes of oxytocin massage), subjects' breast milk volume increased significantly from 7.59 ml to 15.92 ml with a t-value of -10.91. For the infant's weight, there was also a significant improvement from 3571.67 grams to 3677.83 grams with a t-value of 5.68.

As shown in Table 2, the control group demonstrated a significant increase in breast milk volume, from 7.59 ± 3.05 mL before the intervention to 15.92 ± 5.08 mL after the intervention (t = −10.913, P< .001). Infant weight also increased significantly from 3571.67 ± 573.50 g to 3677.83 ± 579.69 g (t = −5.683, P< 0.001).

Table 1. Socio-demographic characteristics of participants in the intervention and control groups

Characteristics	Total (*N*= 60)	Control Group (N = 30) N (%)	Intervention Group (N = 30) N (%)	P-Value
Age (years) (mean± SD)	28.3 ± 5.1	27. 8 ± 5.4	28.8 ± 4.8	
<=24 years	15 25)	10(16.6)	5(8.4)	0.014
>24 years	45 (75)	20 (33.3)	25 (41.7)	
Educational level				
Elementary	7 (11.7)	6 (10)	1 (1.7)	
Junior High School	23 (38.3)	10 (16.6)	13 (21.7)	0.248
Senior High School	24 (40)	11 (18.3)	13 (21.7)	
University	6 (10)	3 (5)	3 (5)	
Birth-related characteristic				
Vaginal delivery	60 (100)	36 (60)	24 (40)	0.014
Preterm delivery	2 (3.4)	1 (1.7)	1 (1.7)	
Breast feeding	60 (100)	30 (50)	30 (50)	
Early breastfeeding	55 (91.7)	28 (46.7)	27 (45)	0.542
Non-early breastfeeding	5 (8.4)	2 (3.4)	3 (5)	
Therapy				
Breast care	10 (16.7)	6 (10)	4 (6.7)	0.282
Non-breast care	50 (83.3)	24 (40)	26 (43.3)	
Parity				
1st -2nd	49 (81.6)	25 (41.6)	24 (40)	0.648
3rd -5th	11 (18.4)	5 (8.4)	6 (10)	
BMI				
Normal Weight	33 (55)	19 (31.6)	14 (23.4)	0.421
Overweight	27 (45)	11 (18.3)	16 (26.7)	
Type of residence				
Rural (n)	48 (80)	21 (35)	27 (45)	<0.001
Suburban (n)	12 (20)	9 (15)	3 (5)	
Occupation				
Not working	53 (88.3)	27 (45)	26 (43.3)	0.591
Working	7 (11.7)	3 (5)	4 (6.7)	
Age of infant (days) (mean ±SD)	14 ± 1.4	14.1 ± 1.3	14.3 ± 1.4	0.620

Table 2. The Effect of 15-Minute Oxytocin Massage on Breast Milk Volume among Postpartum Women (Control Group) (N=30)

Variable	Pre-intervention	Post-intervention	t*	P-Value
	Mean± SD	Mean± SD		
Breast milk(ml)	7.59±3.05	15.92±5.08	-10.913	<0 .001
Infant's weight(gr)	3571.67±573.50	3677.83±579.69	-5.683	<0 .001

*Statistical analysis was performed using a paired t-test

A paired *t*-test analysis demonstrated that a 30-minute oxytocin massage significantly increased breast milk volume among postpartum women in the intervention group (Table 3). The mean breast milk volume increased from 8.75 ± 3.29 mL before the intervention to 18.78 ± 7.81 mL after the intervention (t = –8.171, P< 0.001). Similarly, the infants' mean body weight increased significantly from 3722 ± 544.57 grams to 3923.50 ± 91.30 grams following the intervention (t = –9.088, P< 0.001). These findings indicate that oxytocin massage was effective in enhancing both maternal milk volume and infant weight gain.

Table 3. The Effect of 30-Minute Oxytocin Massage on Breast Milk Volume among Postpartum Women (Intervention Group) (N=30)

Variable	Pre-intervention		Post-intervention		t*	P-Value
	Mean	SD	Mean	SD		
Breast milk (ml)	8.75	3.29	18.78	7.81	-8.171	<0.001
Infant's weight (gr)	3722	544.57	3923.50	91.30	-9.088	<0.001

*Statistical analysis was performed using a paired t-test.

Among the two groups, the independent t-test results showed a significant mean difference in breast milk after receiving the intervention.

Table 4 demonstrates a comparison of breast milk volume and infant weight between the intervention and control groups. The results showed that, with a mean difference of 1.70, the intervention group produced more breast milk on average (M = 10.03, SD = 6.72) than the control group (M = 8.33, SD = 4.11). In a similar vein, the mean weight difference between the infants in the intervention group (M = 151.50, SD = 91.30) and the control group (M = 106.16, SD = 102.31) was 45.34. Partial eta squared (η^2 =.423) indicated a moderate effect size, and both outcomes showed statistically significant differences (P <0.001). These findings imply that the intervention significantly increased infant weight and breast milk volume.

Data are presented as mean and standard deviation (SD). Differences between groups were analyzed using an independent samples t-test.

Based on Table 5, the univariate ANCOVA indicated that, after controlling for pretest breast milk volume scores, there was a statistically significant effect of group on posttest breast milk volume (P <0.001), showing a large effect size. Pretest scores were also a significant covariate (P = .016), meaning baseline breast milk volume scores significantly predicted post-intervention outcomes. These results indicated that the improvement in breast milk volume (710.12 ml, P< 0.001) had a strong and significant effect on the outcome, even after adjusting for baseline differences.

Table 4. The Comparison of breast milk volume and Infant's Weight between the Intervention and Control Groups (N=60)

Variable	Control Group	Intervention Group	Partial Eta Squared	P-Value
	Mean± SD	Mean± SD	Mean± SD	
Breast milk (ml)	8.33±4.11	10.03±6.72	1.70±0.423	<0 .001
Infant's weight (gr)	106.16±102.31	151.50±91.30	45.34±0.423	< 0.001

Data are presented as mean and standard deviation (SD). Differences between groups were analyzed using an independent samples t-test

Table 5. ANCOVA for Post-Intervention breast milk volume controlling for Baseline Scores

Variable	Sum of Squares	df	Mean Square	F	P	Partial η^2
Pre-test (Covariate)	105.875	1	105.875	7.213	0.016	0.311
Group	710.120	1	710.120	48.387	<0.001	0.751
Error	235.446	16	14.676			
Total	1051.441	18				

According to the findings presented in Table 6, an ANCOVA result was carried out to examine differences in infants' posttest weight between the intervention and control groups, adjusting for pretest weight.

The results indicated that baseline weight was a significant predictor of post-intervention weight, F (1, 16) = 8.35, P = .012, partial η^2 = .343, suggesting a moderate contribution of baseline weight to the outcome. After controlling for this covariate, a significant difference emerged

between the two groups, F (1, 16) = 37.84, P< 0.001, partial η^2 = .703. These findings indicate that the 30-minute oxytocin massage intervention was associated with significantly greater infant weight outcomes compared with the control group.

Table 6. ANCOVA linearity test of pre-test and post-test scores of the infant's weight

Variable	Sum of Squares	df	Mean Square	F	P	Partial η^2
Pre-test (Covariate)	540.160	1	540.160	8.345	0.012	0.343
Group (Control vs Intervention)	2450.560	1	2450.560	37.840	<0.001	0.703
Error	1030.000	16	64.375			
Total	3471.220	19				

Discussion

This study aimed to evaluate the effect of a 30-minute oxytocin massage on breast milk volume and infant weight gain among early postpartum women. The findings of this study indicate that breast milk volume increased following three days of 30-minute oxytocin massage. These results are consistent with previous research demonstrating the beneficial effect of this intervention on enhancing breast milk production (34). However, the current study showed a higher mean difference in breast milk volume before and after receiving the intervention (10.03 vs. 8.33). Another study showed that oxytocin massage has many benefits in the breastfeeding process (35), such as increasing the milk production of postpartum mothers who have less milk production (36), reducing stress on postpartum mothers, reducing spinal pain, stimulating the work of the oxytocin hormone, enhancing comfort, improving the movement of milk to the breasts, increasing the frequency of breast filling, and supporting breastfeeding.

Massage was associated with elevated oxytocin levels and reductions in adrenocorticotropin hormone (ACTH), nitric oxide (NO), and beta-endorphin (BE). When compared with the rest group, the massage group demonstrated significantly greater changes in oxytocin, ACTH, NO, and BE (37). Oxytocin is synthesized in the supraoptic and paraventricular nuclei of the hypothalamus and subsequently transported to the pituitary gland via the tuber cinereum and infundibulum (38) during oxytocin massage for approximately 30 minutes.

Oxytocin massage is a treatment associated with breast milk production. The intervention group showed a significantly greater increase in breast milk volume than the control group, suggesting that a longer duration of oxytocin massage may enhance lactation outcomes. This is in line with a study by Ike Johan and Ninik Azizah, who found higher odds of breast milk among mothers who received oxytocin massage compared to those in the control group who did not receive oxytocin massage (28). This is similar to the study findings from the theory that explains that giving a massaging the whole spine (vertebrae) stimulates the posterior pituitary for the secretion of oxytocin (39-40).

An intervention group given a 30-minute oxytocin massage showed a significant increase in the infant's weight gain, which was 1.42 times more likely to increase than the control group. This is in line with another study that found an increase in infants' weight gain in the first six months of their lives (41-42).

This study confirms that a 30-minute oxytocin massage significantly increases breast milk volume compared to standard care, highlighting its potential as a non-pharmacological intervention to support lactation. Given its simplicity, cost-effectiveness, and ease of implementation, it is recommended that oxytocin massage be integrated into routine postpartum care, particularly in low-resource areas with limited access to lactation support. Healthcare providers, including midwives and lactation consultants, could be trained to administer this technique and educate mothers on how to do it to optimize breastfeeding outcomes. This is in line with another study that found an increase in infants' weight gain in the first six months of their lives (41-42).

The findings of this study, supported by multiple prior studies, consistently underscore the may improveof oxytocin massage in

enhancing breast milk volume and promoting infant weight gain. This intervention not only stimulates the physiological release of oxytocin but also contributes to maternal comfort, stress reduction, and improved lactation outcomes (43-44). These cumulative findings reinforce the value of oxytocin massage as a practical, low-cost, and evidence-based strategy to support breastfeeding, particularly in settings with limited access to advanced lactation support. With growing evidence from both clinical trials and physiological studies, oxytocin massage holds promise as a standard non-pharmacological intervention in postpartum care, aligning with global efforts to improve maternal and infant health outcomes through sustainable breastfeeding practices.

This study has several limitations that should be considered when interpreting the findings. First, the study involved a relatively small sample size from a single public health center, which may limit the generalizability of the results to other populations and settings. Second, the follow-up period was limited to three days after the intervention, preventing the assessment of long-term effects of oxytocin massage on breast milk volume and infant growth. Third, although randomization was performed, potential confounding factors affecting breastfeeding outcomes, such as maternal nutritional status, psychological condition, family support, and breastfeeding frequency, were not fully controlled. In addition, age matching between participants was not conducted, and breast milk quality was not assessed.

Despite these limitations, the study has several strengths. The randomized single-blind controlled trial design reduced selection and assessment bias. Standardized intervention procedures were implemented by trained therapists, and outcome measurements were conducted using calibrated instruments and uniform protocols. Furthermore, the study evaluated both breast milk volume and infant weight outcomes, providing a more comprehensive assessment of the effectiveness of oxytocin massage in early postpartum women.

Future studies are warranted to investigate the long-term effects of oxytocin massage on exclusive breastfeeding rates, its impact on maternal stress and bonding, and comparisons with other lactation-enhancing interventions. Additionally, large-scale trials involving diverse populations could strengthen the generalizability of these findings and guide the development of standardized protocols for clinical practice.

Conclusion

A 30-minute oxytocin massage may be a potential supportive intervention for improving breast milk volume among women in the early postpartum period. The findings suggest that this intervention may also be associated with short-term improvements in infant weight gain. These findings highlight the potential value of implementing this protocol among mothers in the early postpartum period to support breastfeeding and promote early infant health.

Declarations

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Conflicts of interest

The authors declared no conflicts of interest.

Ethical approval

Written informed consent was obtained from all participants, and data were collected anonymously. Participants were informed about the study objectives, their right to decline responding to the questionnaire, and their freedom to discontinue or withdraw from the study at any time.

Code of Ethics

All study procedures received ethical approval from the Dian Nuswantoro University HREC under protocol approval 319/EA/KEPK-Fkes-UDINUS/XI/2022

Use of Artificial Intelligence

Not applicable.

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Authors' contributions

KDP and YIH contributed substantially to the study conception and design and were responsible for data collection. EYK and IP performed the data analysis and interpretation. The initial manuscript draft was prepared by KDP and EYK. IP also contributed to the study design, interpretation of findings, and critical revision of the manuscript for important intellectual content. All authors reviewed and approved the final version of the manuscript and accept responsibility for all aspects of the work, ensuring that any issues related to accuracy or integrity are appropriately addressed.

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