

Association of oxytocin massage with oxytocin hormone levels and breast milk production in mothers with postpartum blues

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ABSTRACT

Introduction: Postpartum blues is a mild adaptation disorder in postpartum mothers that affects psychological and physiological conditions, including breast milk production. This condition significantly impacts maternal health and infant development. This study aimed to examine the association between oxytocin massage, oxytocin hormone levels, and breast milk production in mothers with postpartum blues.

Materials and Methods: A quasi-experimental pre-test and post-test design with treatment and control groups was used. The study was conducted at Siti Fatimah Special District Hospital for Maternal and Child Makassar and Pertiwi Mother and Child Hospital Makassar, from February to November 2024. A total of 68 postpartum mothers with postpartum blues were divided into two groups (34 participants per group). Screening was performed using the EPDS scale, oxytocin levels were measured using the ELISA method, and Breast milk production was assessed using a composite scoring system based on three main indicators: (1) infant weight gain, evaluated using the mean value (X) and standard deviation (SD); (2) breastfeeding frequency, recorded through maternal reports and structured observation; and (3) breastfeeding duration, assessed based on the average time per feeding session. Each indicator was assigned a score ranging from 1 to 3, corresponding to low (score 1), moderate (score 2), and high (score 3) levels. The total score from these three components was used to classify overall breast milk production into three categories: high production (total score 7–8), moderate production (total score 5–6), and low production (total score 3–4). Statistical analysis was conducted using SPSS.

Results: The baseline characteristics were evenly distributed across between the groups. The reduction in EPDS scores was greater in the treatment group (13.44 ± 2.765 to 12.12 ± 3.832) than in the control group (13.97 ± 3.196 to 13.26 ± 2.864), with a significant between-group difference ($p = 0.000$). Moreover, oxytocin levels increased

significantly in the treatment group (47.57 ± 10.42 pg/mL to 52.62 ± 11.33 , $p = 0.001$), whereas no significant change was observed in the control group, except for the comparison of the difference in oxytocin levels between the two groups confirming that this difference is statistically significant ($p = 0.007$).

Conclusion: This study suggests that oxytocin massage may serve as a complementary approach therapy for reducing postpartum blues symptoms and enhancing breast milk production. Its integration into clinical practice can support maternal postpartum care by promoting emotional well-being and improving lactation outcomes.

KEYWORDS:

Oxytocin Massage, postpartum blues, oxytocin hormone, breast milk production, postpartum depression

INTRODUCTION

Postpartum blues, also known as baby blues, is a postpartum adjustment disorder characterized by feelings of anxiety, panic attacks, fatigue, and guilt in caring for the newborn.¹ This condition is influenced by various factors, including education and employment.² Its effects include decreased maternal interest in the baby, an inability to provide proper care, and increased infant fussiness as a response to seeking attention.

Globally, the prevalence of postpartum blues in the general population ranges from 3% to 8%, with 50% of cases occurring among women of reproductive age (20–50 years).³ The causes of postpartum blues are multifactorial, with hormonal fluctuations being one of the primary contributors. Changes in estrogen, progesterone, prolactin, and cortisol levels can lead to postpartum depressive symptoms.⁴

Breast milk production is one of the aspects affected in mothers experiencing postpartum blues. The hormones prolactin and oxytocin, which regulate milk production and ejection, are highly sensitive to maternal psychological

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conditions. Mothers experiencing stress, sadness, or anxiety tend to exhibit disruptions in breast milk production, potentially compromising the achievement of exclusive breastfeeding targets.⁴

According to the Central Bureau of Statistics (2024), the percentage of infants under six months receiving exclusive breastfeeding in South Sulawesi was 77.20% in 2023, which remains below the national target of 80%. Thus, effective interventions are needed to address this issue, one of which is oxytocin massage.⁵

Oxytocin massage has been reported to increase levels of oxytocin and prolactin, two hormones with antidepressant and anxiolytic effects. These hormones also contribute to strengthening the emotional bond between mother and baby while reducing stress in mothers with postpartum blues^{6–8}. Additionally, oxytocin massage, through targeted stimulation of specific body points, has been shown to enhance oxytocin levels in the bloodstream, playing a crucial role in milk ejection during breastfeeding.^{9,10}

Although several studies have demonstrated the effectiveness of oxytocin massage in postpartum mothers, its specific application in cases of postpartum blues remains underexplored. Therefore, this study aims to examine the association between oxytocin massage in reducing postpartum blues symptoms and its impact on increasing breast milk production. The findings of this study are expected to provide a scientific basis for developing broader intervention programs, supporting maternal and infant health in Indonesia, and contributing to national efforts to increase exclusive breastfeeding coverage.

MATERIALS AND METHODS

The materials used in this study included a Human Oxytocin ELISA Kit (BT LAB, Cat. No. E1046Hu, Shanghai, China), was purchased from CV. Abiramalab (Indonesia); Vacutainer EDTA; alcohol swabs (OneMed, Indonesia); olive oil (Herborist, Indonesia); and distilled water (Ikapharmindo, Indonesia). Additionally, blood samples from mothers with postpartum blues were collected.

Study Site and Timeline

This Study was conducted at Siti Fatimah Special District Hospital for Maternal and Child Makassar and Pertiwi Mother and Child Hospital Makassar, Indonesia, for screening and recruitment. Oxytocin massage and blood sample collection were performed at participants' homes, while sample analysis was conducted at Hasanuddin University Medical-Research Center (HUM-RC), Makassar. The research period lasted from February to November 2024.

Population and Sampling

The study included postpartum mothers receiving care at the study hospitals. A non-probability purposive sampling technique was used, selecting mothers with EPDS scores ≥ 10 (postpartum blues) who provided informed consent. Inclusion criteria: (1) postpartum mothers (cesarean or vaginal delivery) on the third day of hospitalization, (2) singleton birth, (3) residing in Makassar City, (4) willing to participate, (5) infants with normal birth weight (≥ 2500 g),

(6) term birth, (7) no congenital abnormalities, (8) exclusively breastfed. Exclusion criteria: (1) history of peripartum depression, (2) maternal consumption of lactation-enhancing supplements. The sample size of 68 participants (34 per group) was determined using the Isaac and Michael formula. The first participant was randomly assigned using Excel, followed by alternate allocation until the target sample was reached.

Study Design

This study employed a quasi-experimental pre- and post-test design with treatment and control groups. Initial screening for postpartum blues was conducted using the Edinburgh Postnatal Depression Scale (EPDS) to identify eligible participants. The first participant meeting the inclusion criteria was randomly assigned using Excel randomization, followed by alternating allocation until the sample size reached 68 participants (34 in the treatment group and 34 in the control group). The treatment group received oxytocin massage for five consecutive days (20 minutes per session) starting from the third postpartum day, while the control group received no intervention. Oxytocin levels were measured before and after the intervention in the treatment group and at baseline and the end of the study in the control group. At the end of the study, EPDS scores were reassessed to evaluate changes in postpartum blues symptoms, while breast milk production was assessed in both groups.

Instrumentation

Postpartum blues was assessed using the Edinburgh Postnatal Depression Scale (EPDS), a validated 10-item questionnaire. Oxytocin levels were measured using the Human Oxytocin ELISA Kit (BT LAB, Cat. No. E1046Hu, Shanghai, China), with absorbance read using a Microplate Reader (450 ± 10 nm) and analyzed with Microplate Reader Software. Blood samples were stored in a laboratory-grade freezer (-20°C to -80°C) before analysis. Breast milk production was assessed using three parameters: infant weight gain, measured with the DIGIT-ONE BABY digital scale (Elitech Technology, Surabaya, Indonesia); breastfeeding frequency, recorded using a standardized observation forms; and Breastfeeding duration was recorded using a digital timer on participants' smartphones and documented in a structured logbook immediately after each session. Breast milk production was categorized as high, moderate, or low.

Oxytocin massage procedure

The procedure began with an explanation of its purpose and benefits to ensure maternal readiness. The mother was seated with her head resting on folded arms for optimal spinal access. Olive oil was applied to the therapist's palms before massaging along both sides of the spine using firm knuckle pressure and circular thumb motions, followed by downward strokes from the neck to the scapula. This sequence was repeated three times. To enhance relaxation, the session concluded with alternating warm and cool washcloths. The massage was administered once daily for 20 minutes per session and repeated for five consecutive days.^{11–13}

Blood Sample Collection and Preparation

Blood samples were collected from the median cubital vein using a sterile 3-5 mL syringe, were collected twice in both groups: before the intervention and after the final session,

Table I: Characteristics of respondents based on treatment and control groups (n = 34 per group)

Variable	Intervention			Control		
	Initial	Final	p-value	Initial	Final	p-value
EPDS score	13.44 ± 2.765	12.12 ± 3.832	0,001*	13.97 ± 3.196	13.26 ± 2.864	0,055*
EPDS Score Difference	-1.32 ± 13.941				-0.71 ± 2.140	0.000**
Oxytocin levels (pg/mL)	47.57 ± 10.42	52.62 ± 11.33	0,001*	46.97 ± 11.77	48.30 ± 10.08	0.228*
Oxytocin level difference (pg/mL)		5.05 ± 2.97			1.33 ± 5.35	0.007**

Note: *Fisher's Exact Test, **Chi-Square Test, at a significance level of p < 0.05. SC = Cesarean Section

Table II: Comparison of EPDS scores, oxytocin levels (pg/mL) between treatment and control groups, as well as the score differences between the two groups (n = 34 per group)

Characteristics	intervention n (%)	Control n (%)	Total (%)	p-value
Age (years)				
20 - 35	27 (79.4)	22 (64.7)	49 (72.06)	0.378*
< 20 dan > 35	7 (20.6)	12 (35.3)	19 (27.94)	
Education (years)				
≤ 9	13 (38.24)	10 (29.41)	23 (33.82)	0.057*
≥ 9	21 (61.76)	24 (70.59)	45 (66.18)	
Occupation				
Employed	1 (2.9)	2 (5.9)	3 (4.41)	1.000*
Not employed	33 (97.1)	32 (94)	65 (95.59)	
Parity				
Primiparous	9 (26.5)	12 (35.3)	21 (30.88)	1.000*
Multiparous	25 (73.5)	22 (64.7)	47 (69.12)	
Delivery Type				
Normal	18 (52.9)	19 (55.9)	37 (54.41)	0.515**
SC	16 (47.1)	15 (44.1)	31 (45.59)	

Note: *Wilcoxon Signed-Rank Test, **Mann-Whitney U Test, at a significance level of p < 0.05.

Table III: Comparison of breast milk production in postpartum blues mothers who received oxytocin massage and those who did not receive oxytocin massage

Oxytocin Massage	Low n (%)	Moderate n (%)	High n (%)	Total n (%)	p-value
Intervention	2 (5.9%)	6 (17.6%)	26(76.5%)	34 (100%)	0.001*
Control	11 (32.4%)	18 (52.9%)	5(14.7%)	34 (100%)	
Total	13 (19.1%)	24(35.3%)	31(45.6%)	68 (100%)	

*Chi-Square Test, at a significance level of p < 0.05.

between 07:00 and 09:00 AM to minimize circadian variation. In the intervention group, the post-intervention blood draw was performed 15 minutes after the last massage session to capture the immediate hormonal response. The collected blood was immediately transferred into a vacutainer EDTA and stored in a cool bag at 4°C during transport to the laboratory. The blood samples were then centrifuged at 3000 rpm for 15 minutes to separate plasma from other blood components. The obtained plasma was pipetted into microtubes and stored at -20°C to -80°C until analysis

Oxytocin Level Measurement in Human Plasma

Oxytocin levels were measured using the Human Oxytocin ELISA Kit according to the manufacturer's protocol. The assay involved sample incubation, washing, substrate reaction, and absorbance measurement at 450 ± 10 nm using a microplate reader.^{14,15}

Breast Milk Production Measurement

Breast milk production was assessed using a composite scoring system based on three main indicators: (1) infant weight gain, evaluated using the mean value (X) and standard deviation (SD); (2) breastfeeding frequency, recorded through maternal reports and structured observation; and (3) breastfeeding duration, assessed based on the average time per feeding session. Each indicator was assigned a score ranging from 1 to 3, corresponding to low (score 1), moderate (score 2), and high (score 3) levels. The total score from these three components was used to classify overall breast milk production into three categories: high production (total score 7–8), moderate production (total score 5–6), and low production (total score 3–4). Infant weight gain was assessed at the beginning and end of the study using a calibrated digital scale. Breastfeeding frequency was documented in a structured logbook, recording the number of feeding sessions per day. Breastfeeding duration per session

was measured using a digital timer on the participants' smartphones, with instructions to start and stop the timer at the beginning and end of each breastfeeding session and record the duration in the logbook. Participants received training on data recording before the study began to enhance accuracy and minimize bias. Researchers monitored adherence to data recording during each visit, which coincided with the administration of oxytocin massage and blood sample collection.^{14,15}

Data and Statistical Analysis

Oxytocin levels were analyzed using Microplate Reader Software (ELISA), with data were presented as mean ± SD. Wilcoxon signed-rank and Mann-Whitney U tests assessed intra- and inter-group EPDS and oxytocin levels, while the Chi-square test evaluated breast milk production. Statistical significance was set at $p < 0.05$.^{14,15}

Ethical Approval

This study was approved by the Research Ethics Committee of Hasanuddin University, Makassar, Indonesia, with the ethical approval reference number: 52/UN4.6.4.5.31/PP36/2024. All participants provided written informed consent prior to participation.

RESULTS

This study evaluated association between oxytocin massage, oxytocin hormone levels, and breast milk production in mothers with postpartum blues. As shown in Table I, the baseline characteristics of the treatment and control groups were statistically comparable ($p > 0.05$), confirming group homogeneity prior to the intervention. This ensures an unbiased evaluation by eliminating the influence of external factors, such as demographic differences, on the results. With comparable baselines, the study guarantees valid comparisons and focuses on the primary variables. Normality tests on EPDS scores and oxytocin showed non-normal distribution ($p \leq 0.05$) for most of the data. Therefore, non-parametric tests, including the Wilcoxon Signed-Rank and Mann-Whitney U tests, were used for intra- and inter-group comparisons.

Following the intervention (Table II), the treatment group exhibited a significant reduction in EPDS scores and a corresponding increase in oxytocin levels ($p = 0.01$), whereas no significant changes were observed in the control group, except for the comparison of the difference in oxytocin levels between the two groups using the Mann-Whitney test, which yielded a p -value of 0.007, confirming that this difference is statistically significant. In addition, breast milk production outcomes (Table III) showed a significant improvement in the treatment group, with a higher proportion of mothers achieving high production compared to the control group ($p = 0.01$), where 76.5% of mothers achieved high milk production compared to 14.7% in the control group.

DISCUSSION

The greater reduction in EPDS scores in the treatment group compared to the control group indicates the positive impact of oxytocin massage in alleviating postpartum blues

symptoms. The very small p -value ($p = 0.001$) (Table II) confirms the statistical significance of this change, directly resulting from the oxytocin massage intervention. These results are consistent with previous studies showing that oxytocin massage reduces EPDS scores by increasing oxytocin levels, a neuropeptide hormone known for its antidepressant and anxiolytic effects, which in turn reduces depression symptoms and strengthens the mother-baby bond, particularly in postpartum blues.⁷ Increased oxytocin levels through this intervention also elevate endorphins, reduce cortisol, decrease anxiety, and improve maternal emotional well-being^{16,17}, whereas low oxytocin levels are often associated with higher EPDS scores and increased risk of postpartum depression (Kim et al., 2014), suggesting that oxytocin massage can help reduce depression symptoms.¹⁸

The greater increase in oxytocin levels in the treatment group compared to the control group (5.05 pg/mL vs. 1.33 pg/mL) further supports the effectiveness of the intervention. Without oxytocin massage, hormone levels in the control group remained stable, indicating no significant natural increase during the observation period.¹⁹ These findings align with studies suggesting that physical stimulation, such as massage, can trigger oxytocin release, enhance milk production, and provide relaxation effects for postpartum.^{8,11}

A significant difference in milk production distribution between the treatment and control groups demonstrates the positive effect of oxytocin massage on milk production in postpartum blues.²⁰ Oxytocin stimulation through massage enhances hormone levels and affects the physiological mechanisms related to lactation, including stimulating the let-down reflex, which impacts the efficiency and volume of milk production.¹³ These results align with previous studies that have shown that oxytocin massage not only increases oxytocin, a hormone crucial for milk ejection, but also supports overall breastfeeding success.^{10,17,21,22} Moreover, oxytocin massage also improves breastfeeding frequency and duration, which ultimately contributes to the increase in infant weight gain.²³

This study demonstrates that oxytocin massage is associated with increases oxytocin levels, reduces postpartum blues symptoms, and enhances milk production in postpartum. While this therapy has been widely applied to mothers without emotional disturbances, its focus on postpartum blues remains limited. This study introduces oxytocin massage as a complementary intervention to support breastfeeding success and improve the psychological condition of mothers.

Based on these findings, oxytocin massage can be recommended as a safe and effective nonpharmacological intervention to support breastfeeding, particularly for postpartum blues. Increased oxytocin levels promote milk production and maternal emotional well-being, which strengthens the mother-baby bond. As a practical intervention, oxytocin massage can be integrated into maternal and child health services.

The study has limitations, such as not measuring other hormones related to postpartum blues and other factors that

could influence the outcomes, such as maternal psychological conditions and social support. Larger sample studies are needed to confirm these findings and broaden the generalizability of the results.

CONCLUSION

This study confirms that oxytocin massage significantly increases oxytocin levels, alleviates postpartum blues symptoms, and enhances breast milk production in postpartum. Based on these findings, oxytocin massage is a promising non-pharmacological intervention to be integrated into postpartum care, particularly for mothers experiencing breastfeeding difficulties or early signs of postpartum depression. This technique is simple, non-invasive, and cost-effective, making it suitable for application by healthcare providers, midwives, or even family members in both home and community settings. The practical implications suggest that oxytocin massage could be incorporated into a holistic maternal care approach to enhance breast milk production and maternal emotional well-being. Future research with larger sample sizes, direct milk volume measurement over a longer period, and additional biochemical markers is needed to further validate its effectiveness and expand its clinical application.

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