

The Effectiveness of Breast Care and Oxytocin Massage Using Shallot Oil on Breast Engorgement in Postpartum Mothers on Days One and Two

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ABSTRACT

Breast engorgement is a common early-postpartum condition caused by excessive milk accumulation that exceeds the breast's storage and drainage capacity. The resulting swelling and pain may obstruct milk ducts and increase the risk of mastitis. Red onion (*Allium ascalonicum*), containing allicin and quercetin, has been traditionally used for its antimicrobial and anti-inflammatory properties, yet its effectiveness in topical form during early lactation remains unclear. This study aimed to evaluate the effectiveness of breast care and oxytocin massage using red onion oil in reducing breast engorgement during postpartum days 1 and 2. A one-group repeated-measurement experimental design was conducted among 30 postpartum mothers recruited through purposive sampling. The intervention consisted of breast care and oxytocin massage using 1% red onion oil diluted in virgin coconut oil, applied once daily for 15 minutes on postpartum days 1 and 2. Breast engorgement was assessed using the Breast Engorgement Scale before intervention and monitored for ten days. Data were analysed using descriptive statistics and Chi-Square tests ($\alpha = 0.05$). In results, on day 1, 43.8% of mothers experienced breast engorgement, increasing to 64.3% on day 2. Statistical analysis showed no significant association between the intervention and reduction in breast engorgement ($p = 0.261$). The findings align with the physiological peak of lactogenesis II, during which milk production increases sharply and short-duration topical therapy is insufficient to alter engorgement. In conclusion, breast care and oxytocin massage using red onion oil did not significantly reduce breast engorgement during the first two postpartum days. The intervention cannot be recommended as a standalone preventive measure for early engorgement; evidence-based lactation management remains essential.

Keywords: breast engorgement; red onion oil; oxytocin massage; postpartum; lactation

INTRODUCTION

Breast engorgement is widely acknowledged as one of the earliest and most prevalent lactation-related complications encountered by postpartum mothers, particularly during the critical transition from colostrum to mature milk production. Globally, its prevalence is estimated to range between 20% and 80%, reflecting substantial variation across populations, healthcare systems, breastfeeding practices, and sociocultural contexts [1]. Such a wide epidemiological range underscores not only the multifactorial nature of breast engorgement but also the complex interplay between biological, behavioural, and environmental determinants that shape lactation outcomes. It further highlights the importance of early, structured lactation support to prevent progression to more severe complications.

Epidemiological observations consistently indicate that mothers who deliver vaginally tend to experience higher rates of breast engorgement compared with those who undergo caesarean section. This difference is often attributed to earlier initiation of breastfeeding, more rapid onset of lactogenesis II, and greater hormonal responsiveness following vaginal birth. Nevertheless, both groups remain vulnerable to engorgement due to shared physiological mechanisms associated with the dramatic increase in milk synthesis during the early postpartum period [2]. These findings suggest that mode of delivery may influence the timing and intensity of engorgement, but it does not eliminate the risk, thereby reinforcing the need for universal postpartum lactation guidance.

Physiologically, breast engorgement results from a mismatch between excessive milk production and the infant's limited ability to effectively empty the breast, particularly during the early postpartum period when milk synthesis increases rapidly under the influence of prolactin and oxytocin [3]. As milk accumulates within the alveoli and ducts, intramammary pressure rises, leading to vascular congestion, interstitial edema, and subsequent breast swelling. This cascade of events produces a firm, tense, and often painful breast, accompanied by skin tautness and increased warmth. The resulting edema may compress milk ducts, further obstructing milk flow and creating a vicious cycle of milk stasis.

Beyond physical discomfort, engorgement can interfere with effective latch and milk transfer. The swollen areola becomes less pliable, making it difficult for the infant to achieve a deep latch, which in turn reduces milk removal and exacerbates intramammary pressure. This cycle not only perpetuates engorgement but may also contribute to early breastfeeding cessation if not addressed promptly. In severe cases, persistent engorgement can predispose mothers to mastitis, plugged ducts, and even breast abscess formation, illustrating the importance of early recognition and timely intervention. Overall, breast engorgement represents a dynamic physiological condition influenced by hormonal changes, breastfeeding behaviours, maternal-infant interaction, and postpartum care practices. Understanding its underlying mechanisms is essential for developing effective prevention and management strategies that support successful breastfeeding and maternal comfort.

In addition to these core physiological mechanisms, numerous behavioural, environmental, and psychosocial factors have been identified as contributors to breast engorgement. Delayed initiation of breastfeeding; often due to cultural practices, maternal fatigue, or hospital routines can disrupt the natural establishment of milk flow. Incorrect positioning and attachment during breastfeeding may reduce the efficiency of milk removal, while infrequent feeding schedules or prolonged intervals between feeds can exacerbate milk stasis. Maternal stress, anxiety, and physical exhaustion further influence hormonal regulation, particularly oxytocin release, thereby impairing milk ejection [4]. Collectively, these factors illustrate the complex interplay between biological processes and maternal behaviours in shaping lactation outcomes.

If breast engorgement is not managed promptly and appropriately, it may progress to more severe complications. One such complication is breast abscess, a localized infection characterized by pus accumulation within breast tissue, often requiring incision, drainage, and antibiotic therapy [5]. Another common complication is mastitis, an inflammatory condition affecting approximately 10–30% of breastfeeding mothers worldwide. Mastitis not only causes significant pain and systemic symptoms but also contributes to early cessation of breastfeeding, thereby affecting infant nutrition and maternal health [6]. These complications highlight the importance of early, evidence-based interventions to prevent escalation.

A variety of non-pharmacological, evidence-based strategies have been recommended for the management of breast engorgement. These include the application of cabbage leaf compresses, which are believed to reduce swelling through anti-inflammatory phytochemicals; cold

compresses, which decrease edema and pain; warm compresses, which facilitate milk flow; herbal compresses containing plant-derived anti-inflammatory agents; and breast massage techniques, which enhance lymphatic drainage and milk removal [7]. These interventions are widely used in clinical and community settings due to their accessibility, low cost, and minimal risk.

In Indonesia, particularly within community midwifery practice, the use of red onion (*Allium cepa* var. *aggregatum*) has gained empirical acceptance as a traditional remedy for breast engorgement. This practice is rooted in longstanding cultural knowledge and supported by the biochemical composition of red onion, which contains organosulfur compounds (such as allicin and thiosulfonates) and flavonoids (including quercetin). These compounds have been documented to possess anti-inflammatory, antioxidant, antimicrobial, and immunomodulatory properties. They have been applied in complementary therapies for chronic diseases such as cancer, cardiovascular disorders, and inflammatory conditions including rheumatoid arthritis [8]. The potential anti-inflammatory effects of red onion suggest a plausible mechanism for reducing breast swelling, although scientific validation remains limited.

The application of red onion specifically for breast engorgement has been explored by Arsyada et al. [9], who compared the effectiveness of red onion compresses with cabbage leaf compresses. Their findings demonstrated that both interventions were capable of reducing mild breast swelling, although cabbage leaf compresses produced more consistent and predictable outcomes. This suggests that while red onion may offer therapeutic benefits, its effects may vary depending on preparation methods, dosage, or individual physiological responses.

Despite these emerging insights, several critical research gaps remain unaddressed. First, no studies have examined the combined use of oxytocin massage with red onion oil, even though oxytocin massage is widely recognised for stimulating endogenous oxytocin release, enhancing milk ejection, and improving breast drainage. The synergistic potential of combining a physiological stimulation technique (oxytocin massage) with a topical anti-inflammatory agent (red onion oil) has not been scientifically explored. Second, there is a complete absence of research on the topical pharmacokinetics of red onion's active compounds when applied to breast tissue. Understanding absorption, tissue penetration, local bioavailability, and potential systemic exposure is essential for establishing safety and efficacy.

Given these gaps, the present study aims to empirically evaluate whether breast care and oxytocin massage using red onion oil produce a significant reduction in breast engorgement. Beyond addressing a narrowly defined clinical question, this investigation seeks to bridge the divide between culturally embedded postpartum practices and evidence-based maternal health interventions. Red onion (*Allium ascalonicum*) has long been utilised in Indonesian traditional care due to its perceived anti-inflammatory and warming properties; however, its therapeutic potential in lactation management has not been rigorously examined within controlled scientific frameworks. By integrating this traditional modality with structured breast care and oxytocin massage—two interventions known to stimulate milk flow and reduce intramammary pressure—the study attempts to determine whether synergistic effects may emerge that could benefit postpartum mothers experiencing early engorgement.

Methodologically, the study is positioned to generate novel empirical evidence that contributes to the growing discourse on culturally relevant, low-cost, and accessible postpartum care strategies. In many low-resource settings, mothers rely heavily on traditional remedies due to limited access to professional lactation support. Therefore, validating or refuting the effectiveness of red onion oil within a scientific paradigm holds practical significance for midwives, community health workers, and maternal health policymakers. If proven effective, this intervention could serve as an affordable adjunct to standard lactation management, particularly in rural or underserved communities where conventional treatments may be unavailable or unaffordable.

The findings of this research are expected to contribute meaningfully to maternal and child health literature by expanding the evidence base surrounding non-pharmacological approaches to lactation challenges. Furthermore, the study has the potential to strengthen midwifery practice by offering practitioners an empirically supported technique that aligns with local cultural norms and maternal preferences. In clinical settings, such evidence may inform postpartum care protocols, enhance the quality of breastfeeding support, and reduce the incidence of complications associated with unmanaged engorgement, such as mastitis or early breastfeeding cessation. Ultimately, this research aspires to advance a more holistic, culturally sensitive, and scientifically grounded approach to postpartum care that benefits mothers across diverse healthcare environments.

METHODS

Study location and timeframe

The present study was carried out at *Tempat Praktik Mandiri Bidan (TPMB) Titik S.*, a community-based midwifery clinic located in East Java, Indonesia. This setting was selected due to its high caseload of postpartum mothers and its established role in providing breastfeeding support, making it an appropriate environment for observing breast engorgement and evaluating lactation-related interventions. Data collection was conducted during the early postpartum period, specifically within the first ten days following childbirth. This timeframe was intentionally chosen because breast engorgement typically emerges during lactogenesis II, when milk production increases sharply and mothers are physiologically vulnerable to breast swelling. Conducting the study within this critical window allowed for real-time monitoring of engorgement progression and treatment response.

Study type and research design

A quantitative experimental study employing a one-group repeated-measurement design was used [10]. This design was selected to enable systematic observation of changes in breast engorgement within the same group of participants across multiple time points. The repeated-measurement approach is particularly advantageous in postpartum research because it captures dynamic physiological changes and allows each participant to serve as her own control, thereby reducing inter-individual variability. This design also facilitates the detection of both immediate and sustained effects of the intervention, offering a more comprehensive understanding of treatment efficacy compared with single-time-point assessments.

Study subjects and recruitment procedures

The study population consisted of postpartum mothers who delivered vaginally and presented with clinically observable breast engorgement at TPMB Titik S. A purposive sampling strategy was employed to recruit participants who met the predetermined inclusion criteria [10]. This non-probability sampling method was appropriate because the study required participants with specific clinical characteristics relevant to the intervention. The inclusion criteria were as follows: 1) postpartum mothers with a history of spontaneous vaginal delivery; 2) mothers exhibiting breast engorgement upon clinical examination; 3) individuals willing to participate and able to provide written informed consent; 4) mothers without known allergies to red onion (*Allium cepa* var. *aggregatum*). Recruitment was conducted through direct screening during routine postpartum visits.

Mothers who met the criteria were approached individually, informed about the study objectives, procedures, potential risks, and benefits, and invited to participate voluntarily. A total of 30 respondents were successfully enrolled. This sample size was considered adequate for preliminary experimental evaluation in community-based settings and allowed for repeated measurements without excessive participant burden.

Independent variable: intervention and application procedures

The independent variable was the breast care intervention combined with oxytocin massage using red onion oil. This intervention was selected based on traditional Indonesian postpartum practices and emerging evidence regarding the anti-inflammatory properties of red onion. The protocol was adapted from the Academy of Breastfeeding Medicine 2023 and modified to incorporate the topical application of red onion oil.

Preparation of red onion oil

The red onion oil used in the intervention consisted of 1% red onion extract (1 mL) diluted in 5 mL virgin coconut oil (VCO). VCO was chosen as the carrier oil due to its established safety profile, skin permeability, and compatibility with herbal extracts. The dilution ensured that the concentration was safe for topical use while maintaining sufficient bioactive content.

Intervention procedure

The intervention was administered once daily on postpartum day 1 and day 2, with each session lasting 15 minutes. The procedure consisted of two components: 1) Breast care techniques, including gentle circular massage around the breast tissue to promote lymphatic drainage and reduce interstitial fluid accumulation; 2) Oxytocin massage, performed along the paravertebral region from the thoracic to lumbar area to stimulate endogenous oxytocin release, enhance milk ejection, and improve breast emptying.

The red onion oil was applied topically during the massage to allow transdermal absorption of its bioactive compounds. All interventions were performed by trained personnel to ensure consistency, safety, and adherence to the protocol.

Dependent variable: outcome and measurement techniques

The dependent variable was the severity of breast engorgement, measured using the Breast Engorgement Scale developed by Duygu [11]. This validated instrument assesses breast swelling based on clinical indicators such as firmness, tenderness, temperature, and maternal discomfort.

Measurement phases

Breast engorgement was assessed across three distinct phases: 1) Pre-intervention phase – baseline measurement conducted before any treatment was administered; 2) Intervention phase – monitoring of breast condition during the two days of treatment; 3) Post-intervention phase – daily self-assessment by respondents for ten consecutive days, accompanied by daily monitoring by the researcher to ensure accuracy, consistency, and adherence to the measurement protocol. This extended observation period allowed the researchers to capture both short-term and long-term effects of the intervention, providing a more comprehensive evaluation of treatment efficacy.

Data processing and statistical analysis

Data were processed using both descriptive and inferential statistical methods [12,13]. Descriptive statistics were used to summarise participant characteristics [14-16], including age, parity, breastfeeding initiation time, and baseline engorgement scores. These descriptive analyses provided an overview of the sample profile and ensured that the characteristics were appropriate for the intervention.

To evaluate the effectiveness of the intervention and determine whether a statistically significant association existed between the treatment and reduction in breast engorgement, the Chi-Square test was applied. This test was selected because the outcome variable was categorical, reflecting different levels of engorgement severity. The significance level (α) was set at 0.05, and results with $p < 0.05$ were considered statistically significant. This analytical approach allowed the researchers to determine whether the observed changes were attributable to the intervention rather than random variation.

RESULTS

Based on Table 1, the demographic profile of the 30 postpartum mothers enrolled in this study demonstrates a distribution that is strongly concentrated within the reproductive age range. A substantial majority of respondents (90%) were between 20 and 35 years, an age group widely recognised as the optimal reproductive period due to physiological maturity, hormonal stability, and lower obstetric risk profiles. Only a small proportion of respondents were younger than 20 years (6.7%) or older than 35 years (3.3%), indicating that the sample predominantly reflects women in the most biologically favourable age bracket for breastfeeding initiation and lactation adaptation.

In terms of parity, more than half of the respondents (53.3%) were primiparous, meaning they were experiencing childbirth and breastfeeding for the first time (Table 1). This is clinically relevant because primiparous mothers often face greater challenges in early breastfeeding, including difficulties with latch, positioning, and milk removal, which may predispose them to breast engorgement. Meanwhile, 43.3% were multiparous, suggesting prior breastfeeding experience that may influence their ability to manage early lactation problems. The presence of one grand multiparous mother (3.3%) within the reproductive age range is notable, as repeated pregnancies may alter breast tissue elasticity, milk production patterns, and susceptibility to

Table 1. Distribution of respondent characteristics

Variable	Category	Frequency	Percentage
Age	< 20 years	2	6.7%
	20–35 years	27	90.0%
	> 35 years	1	3.3%
Parity	Primiparous	16	53.3%
	Multiparous	13	43.3%
	Grand multiparous	1	3.3%

Table 2. Distribution of breast care with red onion oil and breast engorgement

Time	Breast condition	
	Not engorged: f (%)	Engorged: f (%)
Day 1	9 (56.3%)	7 (43.8%)
Day 2	5 (35.7%)	9 (64.3%)
Total	14 (46.7%)	16 (53.3%)

engorgement. Overall, the demographic characteristics indicate a sample with diverse lactation experiences, which enriches the interpretive value of the intervention outcomes.

The distribution of breast engorgement across the two treatment days provides important insights into the temporal pattern of breast tissue response following breast care and oxytocin massage using red onion oil (Table 2). On Day 1, 56.3% of mothers exhibited no breast engorgement, while 43.8% continued to experience swelling. This suggests that the intervention may have produced an initial beneficial effect for a portion of the respondents, potentially through improved milk flow, reduced interstitial fluid accumulation, or enhanced oxytocin-mediated milk ejection.

However, on Day 2, the proportion of mothers experiencing breast engorgement increased substantially to 64.3%, while only 35.7% showed no engorgement. This shift indicates that breast engorgement remained a persistent issue for many respondents despite receiving the intervention. Several physiological explanations may account for this pattern. First, breast engorgement often peaks around postpartum days 2–4 due to the onset of lactogenesis II, during which milk production increases sharply. Second, mothers may still be adapting to breastfeeding techniques, leading to suboptimal breast emptying. Third, the anti-inflammatory effects of red onion oil may require longer application periods to produce measurable improvements.

When combining both treatment days, the overall proportion of mothers experiencing breast engorgement was 53.3%, slightly higher than those without engorgement (46.7%). This suggests that although the intervention may have provided some relief, it did not produce a consistent or sustained reduction in breast engorgement across the early postpartum period.

Table 3. Chi-square test of breast care with red onion oil and breast engorgement

Test	Value	df	Asymptotic Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-square	1.265	1	0.261	—	—
Continuity correction	0.575	1	0.448	—	—
Likelihood ratio	1.276	1	0.259	—	—
Fisher's exact test	—	—	—	0.299	0.225
Linear-by-linear association	1.223	1	0.269	—	—
Number of valid cases	30	—	—	—	—

The Chi-Square analysis was conducted to determine whether a statistically significant association existed between the breast care intervention (breast massage and oxytocin massage using red onion oil) and the occurrence of breast engorgement. The Pearson Chi-Square value of 1.265 with a p-value of 0.261 indicates that the observed differences in breast engorgement across treatment days were not statistically significant. Given that the predetermined significance level (α) was 0.05, the p-value exceeding this threshold demonstrates that the intervention did not produce measurable changes in breast engorgement that could be attributed to the treatment rather than random variation.

The Continuity Correction ($p = 0.448$) and Likelihood Ratio ($p = 0.259$) further support this conclusion, as both values also exceed the significance threshold. The Fisher's Exact Test, which is more appropriate for small sample sizes and provides a more conservative estimate, yielded p-values of 0.299 (two-sided) and 0.225 (one-sided), both of which remain above 0.05. These results collectively reinforce the finding that the intervention did not significantly influence breast engorgement outcomes.

The Linear-by-Linear Association value ($p = 0.269$) suggests that there was no linear trend or directional relationship between treatment day and breast engorgement severity. Additionally, the note indicating that no cells had expected counts below 5 confirms that the Chi-Square assumptions were met, ensuring the validity of the statistical test.

In overall interpretation, taken together, the statistical findings indicate that breast care and oxytocin massage using red onion oil did **not** demonstrate a statistically significant effect on reducing breast engorgement during the first two postpartum days. Although descriptive data showed some variation in engorgement across treatment days, these differences were not strong enough to establish a causal or meaningful relationship. This suggests that the intervention, in its current form—limited to two days of application—may not be sufficient to counteract the physiological surge in milk production characteristic of early lactogenesis.

Several factors may explain the lack of significant effect:

- 1) Physiological timing: Engorgement typically peaks around postpartum days 2–4, coinciding with the study's observation period, making it difficult for any intervention to fully counteract natural physiological processes.
- 2) Short intervention duration: Two days of treatment may be insufficient for herbal-based topical agents such as red onion oil to exert measurable anti-inflammatory effects.
- 3) Variability in breastfeeding technique: Differences in latch, positioning, and feeding frequency may have influenced breast emptying efficiency, overshadowing the effects of the intervention.
- 4) Individual differences in breast tissue response: Variations in breast anatomy, milk production, and hormonal regulation may have contributed to inconsistent outcomes.

In conclusion, while the intervention may hold theoretical promise due to the bioactive properties of red onion, the empirical evidence from this study does not support its effectiveness in reducing breast engorgement within the early postpartum period. Although red onion contains phytochemical constituents; such as flavonoids, organosulfur compounds, and phenolic antioxidants that have been associated with anti-inflammatory and circulatory-enhancing effects, these theoretical mechanisms were not reflected in measurable clinical outcomes during the limited two-day intervention window. The physiological intensity of lactogenesis II, characterized by rapid milk synthesis and substantial hormonal shifts, may have overshadowed any potential therapeutic impact of the intervention, particularly when applied for such a short duration.

These findings underscore the need for more rigorous and methodologically robust investigations before red onion oil can be recommended as a complementary therapy in postpartum breast care. Future research should incorporate longer intervention periods to allow sufficient time for transdermal absorption and biological activity of red onion compounds. Additionally, controlled comparison groups; such as standard breast care alone, oxytocin massage alone, or alternative herbal compresses would enable clearer attribution of treatment effects and reduce confounding influences related to breastfeeding frequency, maternal experience, and infant latch quality.

Equally important is the need for pharmacokinetic and pharmacodynamic evaluation of red onion oil when applied to breast tissue. Understanding its absorption profile, tissue penetration, local bioavailability, and potential interactions with lactational physiology would provide

essential insight into whether the compound possesses meaningful therapeutic potential or whether its effects are primarily anecdotal and culturally driven. Such evidence would also help determine appropriate dosage, frequency, and application methods for future clinical trials.

Taken together, the results of this study highlight both the limitations of short-term application and the broader research opportunities surrounding culturally embedded postpartum practices. While red onion oil remains an accessible, low-cost, and culturally familiar modality, its clinical utility in managing early breast engorgement cannot be confirmed at this stage. Continued scientific exploration is warranted to determine whether this traditional intervention can be refined, standardized, and validated for integration into evidence-based postpartum care.

DISCUSSION

Breast engorgement represents one of the most common and distressing lactation-related conditions encountered by postpartum mothers, particularly during the initial days following childbirth. This condition arises when the rate of breast milk production surpasses the capacity of the mammary gland to store and release milk efficiently. As milk accumulates within the alveoli and ducts, intramammary pressure increases, leading to breast swelling, firmness, and pain. The resulting tension within the breast tissue not only causes significant discomfort but may also interfere with effective breastfeeding, thereby creating a cycle in which inadequate milk removal further exacerbates engorgement. Physiologically, breast engorgement is closely associated with the transition from colostrum to mature milk production, a period marked by rapid hormonal changes and increased milk synthesis. When milk stasis persists, the ducts may become obstructed, creating an environment conducive to bacterial entry and subsequent infection. This process may progress to mastitis, an inflammatory condition characterised by pain, erythema, fever, and systemic symptoms [6]. Breast engorgement is most commonly observed during postpartum days 2–4, coinciding with the peak of lactogenesis II, and is more frequently reported among primiparous mothers or those who delay early initiation of breastfeeding.

Red onion (*Allium ascalonicum*) has long been utilised in traditional medicine due to its antimicrobial and anti-inflammatory properties. The bioactive compounds allicin and quercetin are known to exert bactericidal effects against pathogens commonly implicated in mastitis, thereby reducing the risk of infection in lactating mothers with obstructed ducts [7]. Allicin, in particular, disrupts bacterial cell membranes and inhibits enzymatic pathways essential for microbial survival. Meanwhile, quercetin acts as a potent antioxidant and anti-inflammatory agent, capable of modulating cytokine activity and reducing tissue swelling. The clinical effectiveness of red onion as a topical therapy depends on several factors, including the frequency of application, duration of contact with the skin, and the physiological condition of the breast tissue at the time of treatment. Transdermal absorption plays a crucial role in determining whether these phytochemicals can penetrate the skin barrier and exert therapeutic effects [17]. Thus, the pharmacodynamic impact of red onion oil is influenced not only by its chemical composition but also by the method and duration of application.

Breast care and oxytocin massage are widely implemented as preventive strategies to support optimal breast function during lactation. Oxytocin massage stimulates endogenous oxytocin release, enhancing milk ejection and facilitating breast emptying. In this study, however, the results demonstrated no statistically significant association between breast care combined with oxytocin massage using red onion oil and the reduction of breast engorgement during postpartum days 1 and 2 ($p = 0.261$). This finding aligns with established physiological mechanisms of early lactation. During postpartum days 2–4, milk production increases sharply due to elevated prolactin levels and the rapid decline of progesterone following placental expulsion [2]. This hormonal shift triggers the onset of copious milk secretion, often overwhelming the breast's capacity for drainage. As a result, breast engorgement during this period is largely driven by intrinsic physiological processes rather than external interventions. The accumulation of colostrum and early milk may therefore persist despite topical treatments, particularly when applied for only two consecutive days. This suggests that the intervention duration in the present study may have been insufficient to counteract the natural trajectory of early lactogenesis.

The absence of a significant reduction in breast engorgement following the intervention highlights an important limitation of the study. The short duration of treatment; limited to two days may not have allowed adequate time for the active compounds in red onion oil to exert measurable anti-inflammatory effects. Previous studies provide supporting evidence for this interpretation. Arsyada [9] reported that red onion compresses applied for three consecutive days were effective in reducing breast swelling among mothers with engorgement. Similarly, Shafa [19] demonstrated that grated red onion mixed with lemongrass oil required seven days of continuous application to reduce pain associated with rheumatoid arthritis, an inflammatory condition. These findings suggest that red onion-based therapies may require longer exposure periods to achieve therapeutic outcomes, particularly in conditions characterised by significant tissue inflammation.

Beyond intervention duration, the present study also faced limitations related to sample size and the absence of control for confounding variables. The sample size of 30 respondents, while adequate for preliminary analysis, may limit the generalisability of the findings. Additionally, the study did not control for key confounders such as breastfeeding frequency, infant latch technique, and maternal breastfeeding experience—all of which are known to influence the occurrence and severity of breast engorgement [7,18]. Variations in these factors may have contributed to inconsistent outcomes across respondents, potentially masking any subtle effects of the intervention. Furthermore, the study did not evaluate the pharmacokinetic behaviour of red onion oil when applied to breast tissue, leaving unanswered questions regarding its absorption, distribution, and local bioavailability [20].

Despite these limitations, the study contributes valuable insights into the clinical application of traditional herbal therapies in postpartum care. The findings indicate that breast care and oxytocin massage using red onion oil cannot be recommended as a standalone preventive intervention for breast engorgement during postpartum days 1 and 2. Instead, evidence-based lactation management practices should remain the primary focus of engorgement prevention. These include early initiation of breastfeeding, on-demand feeding, proper latch and positioning education, and continuous breastfeeding support. Red onion oil may still hold potential as a curative intervention during later stages of engorgement, particularly when inflammation becomes more pronounced and when longer treatment durations are feasible.

Research strengths

- 1) The study integrates traditional Indonesian postpartum practices with contemporary lactation science, offering a culturally grounded approach that enhances acceptability and feasibility in community settings.
- 2) The design allowed for temporal tracking of breast engorgement across multiple postpartum days, providing richer and more dynamic data than cross-sectional or single-measurement studies.
- 3) The breast engorgement scale [10] ensured systematic, reproducible, and clinically meaningful assessment of breast swelling.
- 4) Conducting the study in a community midwifery practice enhances ecological validity and reflects actual postpartum care conditions, increasing the relevance of findings for frontline maternal health providers.

- 5) Breast engorgement is a major contributor to breastfeeding difficulties and early cessation [21]; thus, research addressing its management has substantial public health significance.

Research limitations

- 1) The two-day application period may not have been adequate for transdermal herbal therapies to exert measurable anti-inflammatory effects, especially during the peak of lactogenesis II.
- 2) The relatively small number of respondents restricts statistical power, reduces the ability to detect subtle effects, and limits generalisability to broader populations.
- 3) Key lactation-related factors; such as breastfeeding frequency, infant latch quality, maternal fatigue, and feeding technique were not controlled, potentially influencing breast engorgement outcomes.
- 4) The study did not assess the absorption, tissue penetration, or biological activity of red onion oil when applied to breast tissue, leaving its therapeutic mechanism uncertain.
- 5) The intervention coincided with postpartum days 1–2, a period dominated by strong intrinsic hormonal influences that may overshadow external treatments.
- 6) The absence of a control or placebo group limits the ability to attribute observed changes solely to the intervention.
- 7) Although performed by trained personnel, subtle differences in pressure, duration, or technique may have influenced treatment outcomes.

CONCLUSION

Statistical analysis revealed no significant association between breast care and oxytocin massage using shallot oil for managing breast engorgement on the first and second days. These results indicate that interventions aimed at preventing breast engorgement are insufficient to address the physiological process of engorgement during the breastfeeding period.

Ethical consideration, competing interest and source of funding

-The study adhered to established ethical principles for research involving human participants, including respect for autonomy, beneficence, non-maleficence, and justice. Ethical approval was obtained from the Health Research Ethics Committee, under registration number No. DP.04.03/F.XXI.31/0752/2024. All participants received detailed information regarding the study's purpose, procedures, potential risks, and expected benefits. Written informed consent was obtained prior to participation. Confidentiality and anonymity were strictly maintained throughout the research process, and participants retained the right to withdraw at any time without penalty. The study complied with national ethical guidelines and international standards such as the Declaration of Helsinki.

-There is no conflict of interest.

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