Green Betel Leaf Compress as an Effective Therapy for Reducing Breast Engorgement Pain During Lactation

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ABSTRACT
Breast engorgement is a common condition among lactating mothers, characterized by breast fullness, tightness, and pain. This study aimed to compare the effectiveness of green betel leaf compresses and cabbage leaf compresses in reducing breast pain associated with engorgement. A quasi-experimental pretest–posttest design with two groups was employed, involving 70 breastfeeding mothers who were randomly assigned to either the green betel leaf compress group (n = 35) or the cabbage leaf compress group (n = 35). The intervention was administered twice daily for three consecutive days, with each session lasting 15 minutes. Pain intensity was measured using the Visual Analog Scale before and after the intervention, and participant satisfaction was assessed using a structured questionnaire. The results demonstrated that the mean pain score in the green betel leaf compress group decreased from 5.66 to 0.49, whereas in the cabbage leaf compress group it decreased from 5.54 to 4.31. The Wilcoxon test indicated a statistically significant reduction in pain in both groups ($p < 0.001$), and the Mann–Whitney test revealed a significant difference in effectiveness between the two interventions ($p < 0.001$). The mean satisfaction score was higher in the green betel leaf compress group (90.69) compared with the cabbage leaf compress group (59.51). In conclusion, both compress types were effective in reducing breast engorgement pain; however, green betel leaf compresses demonstrated more consistent pain reduction and higher levels of participant satisfaction.
Keywords: breast engorgement; green betel leaf compress; cabbage leaf compress; breast pain; breastfeeding mothers

INTRODUCTION
Breast engorgement is a frequently encountered condition among breastfeeding mothers and represents one of the most common challenges during the early postpartum period. Clinically, it is characterized by breast fullness, firmness, tightness, warmth, and pain resulting from an imbalance between milk production and milk removal [1]. This imbalance may occur when milk synthesis exceeds effective drainage, particularly in situations where breastfeeding is delayed, infrequent, or ineffective. Engorgement most commonly develops between the third and fifth days after childbirth, coinciding with the physiological onset of copious milk secretion (lactogenesis II), during which significant hormonal changes stimulate rapid increases in milk volume [2]. At this stage, increased blood flow, lymphatic congestion, and interstitial edema within the breast tissue further exacerbate swelling and tissue tension.

The pathophysiology of breast engorgement involves not only milk accumulation within the alveoli and ducts but also vascular and lymphatic congestion that contribute to increased intramammary pressure. The mechanical pressure exerted on surrounding tissues leads to distension of the milk ducts and compression of nerve endings, thereby stimulating nociceptors and generating pain sensations [3]. The overstretched tissue may also compromise effective milk flow, creating a cycle in which incomplete emptying perpetuates further engorgement. In addition to physical discomfort, severe engorgement can negatively affect the mother's psychological well-being by causing anxiety, frustration, and decreased confidence in breastfeeding. If not managed promptly and appropriately, breast engorgement may disrupt breastfeeding effectiveness, reduce milk transfer to the infant, decrease overall milk supply due to inadequate drainage, and increase the risk of complications such as blocked ducts and mastitis [4]. Therefore, early identification and evidence-based management are essential to prevent adverse maternal and neonatal outcomes.

The management of breast engorgement encompasses both pharmacological and non-pharmacological strategies. Pharmacological approaches, such as the use of analgesics or anti-inflammatory agents, may provide temporary pain relief; however, concerns regarding medication exposure during breastfeeding often encourage the prioritization of non-pharmacological interventions. Non-pharmacological methods are widely recommended as first-line management because they are generally safe, cost-effective, accessible, and compatible with breastfeeding practices. These interventions include frequent breastfeeding or milk expression, proper latch techniques, breast massage, and the application of warm or cold compresses [5,6]. Such approaches aim to relieve discomfort, promote milk flow, and reduce tissue swelling without interrupting lactation.

Warm compress therapy is commonly applied prior to breastfeeding to stimulate vasodilation, enhance local circulation, relax tense breast tissue, and facilitate the milk ejection reflex. Improved blood flow and tissue relaxation may assist in opening obstructed ducts and improving milk drainage [7]. Conversely, cold compresses are often used after breastfeeding to reduce inflammation, limit edema, and provide analgesic effects through vasoconstriction. Both thermal modalities have demonstrated clinical benefits in alleviating symptoms of engorgement, yet interest has increasingly shifted toward natural and herbal-based therapies that may offer additional pharmacological properties.

Green betel leaf (*Piper betle L.*) is a traditional medicinal plant widely used in various cultures for its therapeutic properties. It contains bioactive compounds such as eugenol, flavonoids, tannins, and essential oils, which possess analgesic, anti-inflammatory, antioxidant, and antimicrobial effects [8]. Eugenol, in particular, is known for its capacity to inhibit inflammatory mediators and reduce pain perception, while flavonoids contribute to the stabilization of capillary permeability and attenuation of inflammatory responses. When applied as a warm compress, green betel leaves may provide a synergistic effect by combining thermal therapy with phytochemical-mediated analgesia and anti-inflammation.

Similarly, cabbage leaves (*Brassica oleracea*) have long been utilized as a traditional remedy for breast engorgement. Cabbage contains glucosinolates, polyphenols, and other sulfur-containing compounds that exhibit anti-inflammatory and anti-edematous properties [9]. The osmotic action of cabbage leaves is believed to facilitate the reabsorption of interstitial fluid, thereby reducing swelling. Additionally, the cooling sensation provided by chilled cabbage leaves may contribute to pain relief through local vasoconstriction and decreased nerve conduction velocity. Due to their accessibility and ease of use, cabbage leaf compresses have become a popular home-based intervention among breastfeeding mothers.

A previous studies have demonstrated that both betel leaf and cabbage leaf compresses are effective in reducing breast pain associated with milk stasis or engorgement [10–12]. These studies reported significant reductions in pain intensity following the application of either intervention, supporting their use as alternative or complementary therapies in lactation care. Most existing research has evaluated these interventions independently, without directly comparing their relative effectiveness under controlled conditions. Consequently, there remains limited comparative evidence to determine which compress type yields greater reductions in pain intensity, more consistent therapeutic outcomes, and higher maternal satisfaction.

Given the importance of identifying effective, safe, and practical interventions for managing breast engorgement, a direct comparative analysis is warranted. Understanding the relative benefits of green betel leaf compresses and cabbage leaf compresses may assist healthcare professionals, particularly nurses and midwives, in selecting evidence-based non-pharmacological therapies that optimize maternal comfort and breastfeeding success. Furthermore, integrating culturally relevant and plant-based therapies into clinical practice aligns with holistic and patient-centered approaches to maternal care.

This study aims to identify and compare the effectiveness of green betel leaf (*Piper betle L.*) compresses and cabbage leaf (*Brassica oleracea*) compresses in reducing breast pain caused by milk stasis among breastfeeding mothers [1]. The findings are expected to provide empirical evidence to support the selection of the most effective natural intervention for the management of breast engorgement in midwifery and nursing practice.

METHODS

This study employed a quasi-experimental design with a two-group pretest–posttest approach to determine the effectiveness of green betel leaf (*Piper betle L.*) compresses and cabbage leaf (Brassica oleracea) compresses in reducing breast pain caused by breast engorgement among breastfeeding mothers [13, 14]. The research was conducted in Malasom Village, Aimas District, Sorong Regency, Southwest Papua Province, Indonesia, from July to August 2025 [15].

The study participants were breastfeeding mothers experiencing breast pain due to engorgement, defined as a condition in which milk production exceeds milk removal, resulting in breast swelling, fullness, firmness, and pain [1-3]. Breast engorgement most commonly occurs between the third and seventh days postpartum due to the rapid increase in milk volume during lactogenesis II, although it may develop at any time within the first two weeks after childbirth [1, 2]. Accordingly, this study focused on mothers within 0–14 days postpartum, a critical period of lactation adaptation.

The study population consisted of all breastfeeding mothers with breast engorgement in the study area, totaling 85 individuals. The sample size was calculated using the Slovin formula with a 5% margin of error, yielding 70 respondents. These participants were then randomly allocated into two equal treatment groups of 35 participants each: the green betel leaf compress group and the cabbage leaf compress group. Inclusion criteria included breastfeeding mothers within 14 days postpartum who were experiencing breast engorgement, were not taking analgesic medications, did not have moderate to severe mastitis, and had no history of allergy to betel leaves or cabbage leaves [5].

The independent variable in this study was the type of compress intervention administered, while the dependent variable was the level of breast pain associated with engorgement. Pain intensity was measured using the Visual Analog Scale (VAS) before the intervention (pretest) and after completion of the intervention period (posttest) [16]. The VAS consists of a 10-centimeter line representing a continuum from “no pain” to “worst imaginable pain,” allowing participants to indicate their perceived pain level quantitatively. In addition, respondent satisfaction with the intervention was assessed after completion of the treatment using a structured questionnaire [17-23].

The procedure for the green betel leaf compress involved boiling 7–10 fresh betel leaves in approximately 300–500 mL of water for 10–15 minutes until the water turned greenish in color. The boiled leaves were then allowed to cool to a warm, tolerable temperature before being applied to the affected breast area for 15 minutes [11, 12]. Care was taken to avoid direct contact with the nipple and areola.

The cabbage leaf compress procedure involved soaking fresh cabbage leaves in warm water prior to application. The softened leaves were then placed directly onto the affected breast area for 15 minutes per session. The intervention was administered twice daily for three consecutive days in both groups [24, 25]. As with the betel leaf compress, the nipple and areola were excluded from direct application to maintain hygiene and breastfeeding safety.

Data analysis was performed using statistical software. Univariate analysis was conducted to describe respondent characteristics, including age, parity, and postpartum status. Assumption testing was performed to assess data normality and homogeneity. Because the data were not normally distributed, the Wilcoxon signed-rank test was used to evaluate differences in pain intensity before and after the intervention within each group. The Mann–Whitney U test was applied to compare the effectiveness of the two treatment groups in terms of pain reduction and satisfaction scores. All statistical analyses were conducted with a significance level of $p < 0.05$ [19].

RESULTS

Based on Table 1, the mothers’ ages ranged from 22 to 32 years. The majority of respondents were within the 25–30-year age group. The highest proportion was observed at 27 years (17.1%), whereas the lowest proportions were found at ages 22, 23, and 32 years (1.4% each). Based on Table 2, the infants’ ages ranged from 7 to 14 days. The highest proportion was recorded at 11 days (20.0%), while ages 7, 8, 9, and 13 days each accounted for 7.1% of the sample.

Table 1. Age distribution of breastfeeding mothers

Age (years)	Frequency	Percentage
22	1	1.4
23	1	1.4
24	6	8.6
25	8	11.4
26	8	11.4
27	12	17.1
28	11	15.7
29	11	15.7
30	8	11.4
31	3	4.3
32	1	1.4

Table 2. Age distribution of infants

Age (years)	Frequency	Percentage
7	5	7.1
8	5	7.1
9	5	7.1
10	12	17.1
11	14	20.0
12	13	18.6
13	5	7.1
14	11	15.7

Based Table 3, in the first group, the mean pain score prior to the intervention was 5.66 and decreased substantially to 0.49 following the intervention. The mean satisfaction score among respondents in this group was 90.69, indicating a high level of satisfaction with the green betel leaf compress therapy. In the second group, the mean pain score before the intervention was 5.54 and decreased to 4.31 after the intervention. The mean satisfaction score in this group was 59.51, reflecting a moderate level of satisfaction compared to the green betel leaf compress group.

Based on Table 4, the Shapiro–Wilk normality test results indicated that all study variables had p-values < 0.05, demonstrating that the data were not normally distributed. Therefore, non-parametric statistical tests were applied for subsequent analyses.

Based on Table 5, the Wilcoxon Signed-Rank Test demonstrated a statistically significant difference between pre-intervention and post-intervention pain scores ($Z = -6.956$; $p < 0.001$), indicating an overall reduction in pain following treatment.

Based on Table 6, the Mann–Whitney U test revealed a statistically significant difference in pain reduction between the green betel leaf compress group and the cabbage leaf compress group ($p < 0.001$). These findings indicate that the green betel leaf compress was more effective in reducing breast engorgement pain.

Based on Table 7, the Spearman correlation analysis showed no significant association between pretest and posttest pain scores in the green betel leaf compress group ($p > 0.05$), suggesting that pain reduction occurred relatively consistently regardless of baseline pain intensity. In contrast, a significant positive correlation

was observed in the cabbage leaf compress group ($p < 0.01$), indicating that post-intervention pain levels were strongly associated with initial pain scores. In this study, the Spearman correlation test was conducted to evaluate the consistency of pain reduction responses relative to baseline pain intensity within each intervention group.

Table 3. Comparison of pretest and posttest pain scores and satisfaction levels between the green betel leaf compress group and the cabbage leaf compress group

Group	The green betel leaf compress group				The cabbage leaf compress group			
Statistics	Minimum	Maximum	Mean	Std. deviation	Minimum	Maximum	Mean	Std. deviation
Pretest pain	3	9	5.66	1.51	3	10	5.54	1.85
Posttest pain	0	2	0.49	0.56	0	9	4.31	2.25
Satisfaction	80	100	90.69	5.02	50	74	59.51	4.22

Table 4. The results of normality test (Shapiro–Wilk)

Variable	Statistic	df	p-value
Pretest pain	0.944	70	0.003
Posttest pain	0.849	70	0.000
Satisfaction	0.849	70	0.000

Table 5. The Comparison of pain levels before and after intervention (combined groups)

Category	n	Mean rank	Sum of ranks	Z (Wilcoxon)	p-value
Pain reduction	64	34.20	2189.00	-6.956	< 0.001
Pain increase	2	11.00	22.00		
No change	4	–	–		

Table 6. The Comparison of pain levels before and after intervention (combined groups)

Group	Mean rank	Sum of ranks	Z (Mann–Whitney U)	p-value
Green betel leaf compress	52.29	1830.00	-6.997	< 0.001
Cabbage leaf compress	18.71	655.00		

Table 7. Spearman correlation between pretest and posttest pain scores in the green betel leaf compress group and the cabbage leaf compress group

Group	The green betel leaf compress group		The cabbage leaf compress group	
Statistics	r	p-value	r	p-value
Correlation test (pretest and posttest pain)	0.217	0.212	0.857	< 0.001

DISCUSSION

The findings of this study demonstrate that both interventions—green betel leaf compresses and cabbage leaf compresses—were effective in reducing breast pain associated with breast engorgement among breastfeeding mothers. Breast engorgement is a common lactation-related problem during the early postpartum period and is characterized by breast fullness, edema, increased tissue tension, and pain. If not properly managed, this condition may disrupt breastfeeding continuity and potentially lead to more serious complications such as mastitis or breast abscess [2]. The statistically significant reduction in pain intensity observed in both intervention groups confirms the therapeutic value of non-pharmacological compress therapy in managing engorgement-related discomfort.

However, the results further indicate that the green betel leaf compress demonstrated superior effectiveness compared to the cabbage leaf compress. This superiority was reflected in a greater reduction in mean pain scores, higher respondent satisfaction levels, and a more consistent therapeutic response. Notably, in the green betel leaf group, pain reduction occurred relatively independently of baseline pain intensity, suggesting that the intervention was effective across varying degrees of initial discomfort. In contrast, within the cabbage leaf group, the degree of pain reduction was strongly associated with the initial pain level, indicating that the therapeutic response was more variable and dependent on the severity of pre-intervention symptoms.

The effectiveness of both interventions must also be interpreted in light of the demographic and clinical characteristics of the study participants. The majority of mothers were within the healthy reproductive age range, which is generally associated with optimal physiological recovery and lactation capacity. Furthermore, most infants were in the early neonatal period, a critical phase of breastfeeding adaptation. During this phase, milk production increases significantly as part of the physiological process of lactogenesis II, yet the frequency and effectiveness of breast emptying may not yet be optimal. This imbalance between milk production and milk removal substantially increases the risk of breast engorgement [21, 22]. Therefore, timely and appropriate interventions during this critical period are essential to maintain breastfeeding success and prevent complications.

The findings of this study are consistent with previous research indicating that green betel leaf compresses effectively reduce breast pain associated with engorgement through direct analgesic and anti-inflammatory effects. Prior studies have reported that regular application of green betel leaf compresses over several consecutive days significantly decreases pain intensity and enhances maternal comfort during breastfeeding [11, 12]. The therapeutic effect is attributed to the phytochemical constituents of betel leaves, including eugenol, flavonoids, and tannins, which exhibit anti-inflammatory, antioxidant, and analgesic properties. These bioactive compounds act directly on local inflammatory mediators, thereby suppressing nociceptive signaling and reducing tissue inflammation [8, 24].

Similarly, the present findings align with earlier studies demonstrating that cabbage leaf compresses can reduce breast pain and swelling in breastfeeding mothers. Cabbage leaves are known to possess mild anti-inflammatory properties and provide a localized cooling effect, which contributes to vasoconstriction and reduction of interstitial edema within the breast tissue [25]. The cooling mechanism may temporarily decrease nerve conduction velocity and diminish pain perception. Nevertheless, several studies have suggested that the therapeutic response to cabbage leaf compresses tends to be slower and less consistent compared to herbal interventions that contain direct analgesic compounds, which parallels the results observed in this study [6].

The difference in effectiveness between the two interventions can be explained from a pathophysiological perspective. Breast engorgement results from the accumulation of milk within the alveoli and ducts, leading to increased intramammary pressure, tissue edema, and localized inflammatory responses that stimulate pain receptors [4]. Green betel leaves contain active compounds such as eugenol, flavonoids, and tannins that exert direct anti-inflammatory and analgesic effects at the site of application. This mechanism enables rapid and relatively uniform pain reduction across different baseline pain intensities [11].

In contrast, cabbage leaf compresses primarily function through a physical cooling mechanism that induces temporary vasoconstriction and reduces tissue edema. Because this mechanism mainly targets swelling rather than directly modulating inflammatory mediators, the extent of pain reduction may depend more heavily on the initial degree of inflammation and tissue congestion. Consequently, the therapeutic response may vary more substantially among individuals, which explains why pain reduction in the cabbage leaf group was strongly correlated with baseline pain intensity [9]. These mechanistic differences likely account for the greater consistency and overall superiority of green betel leaf compresses observed in this study.

The findings of this research have important implications for maternal nursing practice and breastfeeding care services. Green betel leaf compresses may be recommended as a primary non-pharmacological intervention for managing breast engorgement pain due to their demonstrated effectiveness, safety, ease of application, affordability, and high maternal satisfaction [23]. As a culturally familiar and accessible herbal therapy, green betel leaf

compresses may also enhance acceptance and adherence among breastfeeding mothers. Meanwhile, cabbage leaf compresses remain a viable alternative non-pharmacological therapy, particularly in settings where betel leaves are unavailable or based on maternal preference.

The implementation of these non-pharmacological interventions has the potential to prevent further complications of breast engorgement, including mastitis and breast abscess, and to support the continuation of exclusive breastfeeding in accordance with maternal health service recommendations [21]. Effective early management of engorgement not only alleviates maternal discomfort but also contributes to sustained breastfeeding practices and improved neonatal health outcomes.

Despite its contributions, this study has several limitations. First, the quasi-experimental design without a true control group limits the ability to establish definitive causal relationships between the interventions and outcomes [14]. Second, the relatively short duration of the intervention does not allow for assessment of long-term therapeutic effects or recurrence rates. Third, pain intensity and satisfaction were measured using self-reported instruments, which, although validated, remain subject to subjective perception and potential response bias [18,19]. Future research is therefore recommended to employ a randomized controlled trial design, extend the duration of intervention and follow-up, and incorporate additional variables such as breastfeeding technique, frequency of milk expression, and hormonal factors that may influence the severity of breast engorgement and response to treatment.

CONCLUSION

This study concludes that both green betel leaf (*Piper betle L.*) compresses and cabbage leaf (*Brassica oleracea*) compresses are effective in reducing breast pain intensity associated with breast engorgement among breastfeeding mothers. However, green betel leaf compresses demonstrated superior effectiveness compared to cabbage leaf compresses, as evidenced by a greater reduction in pain scores, higher levels of respondent satisfaction, and a more consistent analgesic effect that was not influenced by baseline pain intensity.

These findings indicate that green betel leaf compresses represent a more advantageous, safe, and practical non-pharmacological intervention for the management of breast engorgement pain. Nevertheless, cabbage leaf compresses may still be utilized as an alternative supportive therapy, depending on clinical circumstances, resource availability, and maternal preference.

Ethical consideration, competing interest and source of funding

-Ethical approval for this study was obtained from the Health Research Ethics Committee of the Faculty of Health Sciences and Technology, Universitas Jenderal Achmad Yani, under approval number No. 031/KEPK/FITKes-Unjani/VII/2025. All respondents provided written informed consent after receiving comprehensive information regarding the study objectives, procedures, potential benefits, and risks. Participant confidentiality was maintained by anonymizing data and using coded identifiers. The study adhered to the ethical principles of autonomy, beneficence, non-maleficence, and justice throughout the research process.
-There is no conflict of interest related to this publication.
-Source of funding is authors.

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