

Effect of Warm Ginger versus Cold aloe vera Gel Compresses on Breast Engorgement among Postnatal Mothers: A Comparative Study

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Abstract

Background: Breast engorgement is one of the most common minor discomforts affecting 65% - 75% of lactating women throughout the world and 82% in Egypt, especially primiparae. It may subside within 24 to 48 hours or 3-5 days. Sometimes Breast engorgement lasts for more than 2 weeks, and interferes with the start and continuation of exclusive breastfeeding. **Aim of the study:** this study aims to investigate the effect of warm ginger versus cold aloe vera gel compresses on breast engorgement among postnatal mothers. **Design:** A quasi-experimental research design. **Sample:** A convenient sample of 60 postnatal mothers. **Setting:** This study was carried out at postnatal clinic and ward of El-Shatby Maternity University Hospital, Alexandria, Egypt, from July 2021 to August 2021. **Tools:** Data was collected through two tools, basic data structured interview schedule, which included socio-demographic data as well as reproductive and breastfeeding histories; Breast Engorgement Assessment Scale, which involved redness, pain, edema and pyrexia. **Results:** This study reported no breast engorgement and associated symptoms (redness, pain, edema, pyrexia) were found among warm ginger compresses group on the 7th day after intervention (23.3%), compared to cold aloe vera gel compresses group (6.7%), although the relationship was not statistically significant. **Conclusion:** this study concluded that warm ginger compresses were more effective in relieving breast engorgement and its associated symptoms (redness, pain, edema, pyrexia) among postnatal lactating mothers than cold aloe vera gel compresses, although the relationship was not statistically significant.

Keywords: Warm Ginger Compresses, cold aloe vera Gel Compresses, Breast Engorgement, Postnatal Mothers.

Introduction:

The postpartum, postnatal period or puerperium refers to the first 4-6 weeks following childbirth, when the mother's body returns to a non-pregnant state through physiological and anatomical changes. These changes are both retrogressive (involution of the uterus and vagina) and progressive (production of milk for lactation, restoration of the normal menstrual cycle, and beginning of a parenting role). Some of these changes may be simply bothersome for the new mother, although serious complications can also arise (Chauhan & Tadi, 2020; Cunningham et al., 2018).

One of postpartum changes is milk production that occurs within the breast alveoli and is squeezed out into the milk ducts, which carry the milk through the breast. Milk production is stimulated by dramatic reduction in progesterone, estrogen, and human placental lactogen levels after delivery of the

placenta. When the baby suckles, the maternal brain releases prolactin hormone, which causes the alveoli to begin making milk and oxytocin hormone, which causes muscles around the alveoli to squeeze milk out through the milk ducts (Alex et al., 2020).

Colostrum is the first breast milk, which occurs during pregnancy and lasts for 2-5 days postpartum. It is either yellowish or creamy in color and much thicker than the milk that is produced later. Transitional milk occurs after colostrum and lasts for approximately two weeks. It contains more calories than colostrum and has an orange tint. Mature milk is the final milk, which is whitish or bluish in color. It has two types; fore-milk, which found during the beginning of the feeding and hind-milk, which occurs after the initial release of milk (Pillay & Davis, 2020).

Around the third postpartum day 65% - 75% of lactating women throughout the world and 82% in Egypt experience some degree of primary breast engorgement, which is one of the most common minor discomforts, especially among primiparae (Durham & Chapman, 2018; Indrani & Sowmya, 2019; Zakarija-Grkovic & Stewart, 2020). Primary breast engorgement occurs when the blood and lymph fluids fill the tissues surrounding the alveoli, in preparation for milk production. On the other hand, secondary breast engorgement may start on the 5th postpartum day or in some cases on the 9th & 10th postpartum days, when the mother is not feeding frequently or the baby removes less milk from the breast. The woman's breast may be hard with tightly stretched skin that may appear shiny; it may also become swollen, warm, tender and throbbing pain may be felt. In addition, nipples may become flat and taut, and areola may become full and hard, leading to difficult latching. Moreover, low grade fever and decreased breast milk may be experienced (Hassan et al., 2020; Prabusankar & Kalaivani, 2020; Zolala et al., 2020).

Breast engorgement subsides within 24 to 48 hours or 3-5 days by baby suckling or by expressing milk. It may last for more than 2 weeks, consequently, interferes with the start and continuation of exclusive breastfeeding. Therefore, treatment may include antibiotics, analgesics, rest, and hydration (Makwana & Tiwari, 2018). If breast engorgement is not treated promptly, it may lead to many complications as sore nipples, mastitis, abscess formation, decreased milk secretion, introduction of breast milk substitutes, and premature cessation of breastfeeding (Aprilina et al., 2021). Mastitis, an inflammation or swelling of breast tissues, is caused by infection, blocked milk duct, or allergy. Its symptoms include fever, malaise, unilateral breast pain, and tenderness in the infected area. It can be treated by a 10-day course of antibiotics and an over-the-counter pain reliever, such as acetaminophen or ibuprofen (Saputri et al., 2020).

Given the importance of breastfeeding and the significant pain discomfort experienced by women with breast engorgement, effective remedies need to be determined (Gresh et al.,

2019). In fact, there is an array of pharmacological and non-pharmacological strategies for managing breast engorgement and its associated pain. Pharmacological strategies are considered to be beneficial, but its side effects sometimes outweigh their benefits (Zaghloul et al., 2020). Therefore, non-pharmacological strategies attracted considerable attention in recent years such as kangaroo care, fluid limitation, binding the breasts or wearing a tight brassiere, application of cabbage leaves, hot and cold compresses alone or with herbal remedies (e.g., Fenugreek seeds and ginger) as well as local cactus or cold aloe vera gel applications (Hassan et al., 2020; Mangesi & Zakarija-Grkovic, 2016).

Compounds that are proposed as therapeutic medicine must have the broad spectrum of a therapeutic effect being harmless during the long-term use by having minimal side effects. These medicinal products are taken from traditional medicine (Ginger Rhizome or *Zingiber Officinale* Roscoe). Ginger, a medicinal plant with the potential effects on breast engorgement, has been used in the Chinese traditional medicine from 25 centuries ago and has been introduced by the United States Food and Drug Administration as a safe medicinal plant. Previous studies reported the analgesic and the anti-inflammatory effects of ginger through inhibiting cyclooxygenase and lipoxygenase pathways as well as preventing the metabolism of arachidonic acid. *Zingiber officinale* dense extract also possess significant anti-nociceptive and anti-inflammatory action after its trans-dermal delivery (Kravchenko et al., 2019; Rondanelli et al., 2020; Shahrajabian et al., 2019).

In addition to the benefits of ginger topical application, warm compresses on the breasts before feeding also was found to be effective; as hanging breasts and nipples in a pot of warm water and expressing milk before feeding can reduce pain, cause relaxation and increase blood flow to the area (Khosravan et al., 2017). The physiological effect of heat includes vasodilatation; sedation; increased capillary permeability, cell metabolism, and blood flow to the affected area; as well as introduction of antibodies, leukocytes, oxygen

and nutrients; in addition to promotion of tissue cure (Hassan et al., 2020).

Topical cold aloe vera gel application is another non-pharmacological method that can be used to relieve breast engorgement and its associated pain. Cold aloe vera gel compresses reduces breast hardness and pain to greater extents, as well as increases breastfeeding rate. This could be attributed to the natural active ingredients, Aloe polysaccharides (Meng et al., 2015; Rahnemaie et al., 2019). Aloe vera gel has anti-inflammatory effects through inhibiting the cyclooxygenase pathway and reducing prostaglandin E2 production from arachidonic acid. Recently, the novel anti-inflammatory compound called C-glucosylchromone was isolated from gel extracts. In addition to the benefits of topical aloe vera gel application, cold compresses on the breasts before feeding is thought to be soothing and decreasing the blood flow to the skin by vasoconstriction, which in turn is believed to decrease engorgement (Mangesi&zakarija-Grkovic,2016;Surjushe et al.,2008).

Therefore, early identification and treatment of most problems that represent a real threat to the continuation of successful breastfeeding are necessary. Maternity nurses are in a unique position to evaluate the strength of evidence of such non-pharmacological strategies. They also play an important role in the early detection as well as the provision of proper and effective interventions for women with breast engorgement to enhance their successful breastfeeding.

Significance of the study:

Breast engorgement, its associated pain and complications are the most common reported causes of early weaning. There is a growing, but not yet a conclusive evidence to support warm ginger and cold aloe vera gel compresses as being effective in improving breast engorgement. So, this study was carried out as a trial to examine their effect on breast engorgement as well as to test their applicability as safe and cost-effective interventions, that may contribute to improving postpartum mother's quality of life.

Aim of the study:

This study aims to investigate the effect of warm ginger versus cold aloe vera gel compresses on breast engorgement among postnatal mothers.

Research hypotheses:

H1: Postnatal mothers who apply warm ginger compresses on their breast exhibit less engorgement than those who apply cold aloe vera gel compresses.

H2: Postnatal mothers who apply cold aloe vera gel compresses on their breast exhibit less engorgement than those who apply warm ginger compresses.

Subjects and method:

Design:

A quasi experimental, comparative study was utilized.

Setting:

The study was conducted at postnatal outpatient clinic and ward of El-Shatby Maternity University Hospital in Alexandria.

Subjects:

A convenient sample of 60 postnatal mothers was recruited from the previously mentioned setting according to the following inclusion criteria:

- With caesarean section delivery.
- Free from medical diseases that interfere with breastfeeding.
- Baby is free from congenital anomalies that affect breast feeding.
- Initiation of breast feeding.
- Willing to participate in the study.
- Did not have an allergic history of ginger and aloe vera.
- Did not get any analgesics before breast engorgement treatments for at least 6 hours.

The study subjects were assigned into two equal groups:

- The study group (1) included 30 postnatal mothers, who applied warm ginger compresses group on their breasts.
- The study group (2) involved 30 postnatal mothers, who applied cold aloe vera gel compresses on their breasts.

The sample size of postnatal mothers was estimated by using the Epi-Info 7 program, where the following parameters were applied:

- Population size = 4238/3 months
- Expected frequency =50%
- Acceptable error = 10%
- Confidence coefficient = 95%
- Minimal sample size = 60

Tools:

Two tools were used by the researchers to collect the necessary data:

Tool one: basic data structured interview schedule: which was developed by the researcher and entailed 3 parts:

Part I: Socio- demographic data such as such as age, level of education, occupation, marital status, original residence, type of family and family income/month.

Part II: Reproductive history such as gravidity, parity, number of abortions, stillbirths, and living children as well as type of last delivery.

Part III: Breastfeeding history such as previous breastfeeding problems and action taken to overcome these problems.

Tool two: Breast Engorgement Assessment Scale:

This tool was especially designed to provide the baseline data regarding signs and symptoms of the engorged breast. It was implemented by using an observational checklist which illustrated the breast current condition (redness, pain, edema and pyrexia). It comprised four main parts:

Part I: Modified REEDA Scale (MRS)

It was originally developed by Hill (1990), adapted and used by the researchers to provide the most objective means for evaluating the condition of the engorged breast after delivery concerning to redness, which was classified into 3 categories:

- Mild redness: < 0.25 cm bilateral or < 0.5 cm unilateral
- Moderate redness: 0.5 cm bilateral or 1 cm unilateral
- Severe redness: > 0.5 cm bilateral or > 1 cm unilateral

Part II: Visual Analog Scale (VAS):

It was originally developed by Woodforde & Merskey (1972) and adapted by the researcher to measure intensity of breast pain. This scale is a self-report device that consists

of a horizontal line in centimeters from 0 to 10, representing:

- 0 = no pain
- 1-3 = mild pain
- 4-6= moderate pain
- 7-10 = severe pain

Part III: Newton's Scale (1951)

This scale was adapted by the researchers to measure the chest circumference just above the nipple in the semi-recumbent position during the first 12 hours after delivery. It is considered to baseline measurement to assess breast edema as the following:

- 0 =No edema (<1.5 cm above basic).
- 1 =Mild edema (1.5 cm -< 2.5 cm above basic).
- 2 = Moderate edema (2.5 cm- <4 cm above basic).
- 3 =Severe edema (>4 cm above basic).

Part IV: Pyrexia Chart

A thermometer is used to measure body temperature, which is classified as follows:

- 0 =No pyrexia (37- <37.5 °C)
- 1 =Mild pyrexia (37.5- < 38 °C)
- 2 = Moderate pyrexia (38-< 38.5 °C)
- 3 =Severe pyrexia (≥38.5 °C)

Total score of breast engorgement was determined by collection of redness, pain, edema & pyrexia scores as follows:

- No breast engorgement (0-<3)
- Mild breast engorgement (3-<6)
- Moderate breast engorgement (6-< 9)
- Severe breast engorgement (9-12)

Field Work:**First phase (Initial preparatory phase):**

- An approval from Ethical Research Committee, Faculty of Nursing, Zagazig University was obtained.
- Official permission to collect data was obtained from the responsible authority of the study setting after explaining the purpose of the study.
- Tool one was developed by the researchers based on extensive review of recent and relevant literature, while tool two was adapted to suit Egyptian women
- Tools were reviewed for content validity by a jury of 3 expert professors in the field.

- Tool two was checked for its reliability by Cronbach's alpha test and the result was reliable (0.844).
- A pilot study was carried out on 6 postnatal mothers (excluded from the study subjects) to test the feasibility of the study as well as to ascertain the clarity and applicability of the tools, in addition to calculate the time needed to complete them. After pilot study, the tools were revised, reconstructed and made ready for use.

Second phase (Implementation phase):

- Data were collected over a period of 4 months, starting from the beginning of July 2021 till the end of October 2021.
- Data of tool one were collected from postnatal mothers during the first 12 hours after delivery at the postpartum ward.
- Data of tool two were collected from postnatal mothers on the 3rd postpartum day at the postnatal outpatient clinic to identify those who developed breast engorgement and exclude those who didn't develop it.
- Data were collected through an interview schedule which was conducted individually for 15-20 minutes.
- Meanwhile, instructions about breastfeeding techniques and breast hygiene were given by the researchers to postnatal mothers of the two studied groups.
- The warm ginger compresses group was asked to apply powder ginger in warm water on the affected breast for 20 minutes before each feeding, starting from the 3rd postpartum day.
- The cold aloe vera gel compresses group was asked to apply them on the affected breast for 20 minutes before each feeding, starting from the 3rd postpartum day. Aloe vera fresh gel was extracted from natural aloe vera leaves. The leaf is placed longitudinally or vertically and cut with sharp knife. It should be stripped of liquid substances that reside on the first layer of the leaf because it can cause obvious skin burns if applied directly to the skin, then the aloe vera gel is scraped with a spoon and stored in a sterilized, clean glass jar. It remains valid for use for a short period

ranging from one to four weeks in the refrigerator.

- The researchers demonstrate the related intervention for every postnatal mother and asked her to re-demonstrate it.
- The researchers encouraged postnatal mothers to comply with the intervention through daily telephone call.

Third phase (Evaluation phase):

- After completion of data collection, comparison between the two groups was done to identify the effect of warm ginger and cold aloe vera gel cold compresses on breast engorgement.
- Reassessment of postnatal mothers was carried out by the researchers, using tool two, on the 5th and the 7th postpartum day through home visits.

Statistical analysis was done by the researchers as follows:

- The collected data were categorized, coded, computerized, tabulated and analyzed using Statistical Package for Social Sciences (SPSS) version 23 program.
- Statistical measures were used such as cross tabulation to describe and summarize categorical variables of the two groups.
- A descriptive and analytical statistics were used such as percentages, mean & SD; whereas Chi-square-test, Fisher Exact-test and t-test were used to find out the difference in the results at 0.05 (5%) level of significance.

Ethical consideration was maintained by obtaining the appropriate approvals; securing the subject's written informed consent, after explaining the aim of the study; keeping their privacy and right to withdraw at any time as well as assuring confidentiality of their data.

Results:

Table (I) presents the number and percent distribution of postnatal mothers according to their socio-demographic data. **Mean age** was 25.90 ± 5.333 & 25.87 ± 5.290 years for warm ginger and cold aloe vera gel compresses groups respectively. **Level of education** also manifested that more than one-half (53.3% & 56.7%) of the former and the latter groups respectively can just read and

write. In addition, **occupation** revealed that a sizeable proportion of warm ginger and cold aloe vera gel compresses groups (83.3% & 73.3%) respectively were housewives. However, 62% of working latter group was **employee**, compared to 40% of working former group. Moreover, a sizeable proportion of warm ginger and cold aloe vera gel compresses groups (66.7% & 73.3%) were **married** respectively. Furthermore, the majority of the two groups (86.7% & 80%) was **urban residents and had extended family** respectively. Finally, about three-fifths and more (63.3% & 56.7%) of cold aloe vera gel and warm ginger compresses groups respectively reported **not enough family income/month**. Accordingly, the two groups' socio-demographic data were almost similar, where no statistically significant differences were found between them.

Table (II) shows the number and percent distribution of postnatal mothers according to their reproductive history. **Mean gravidity** was 3.32 ± 1.51 & 3.43 ± 1.57 pregnancies for warm ginger and cold aloe vera gel compresses groups respectively, while **mean parity** was 2.30 ± 1.00 & 2.17 ± 0.96 deliveries for both groups respectively. In addition, a sizeable proportion of warm ginger and cold aloe vera gel compresses groups (70% & 76.7%) respectively had **no abortion**, and most of them (96.7% & 93.3%) respectively had **no stillbirths**. Moreover, the vast majority of warm ginger and cold aloe vera gel compresses groups (90% & 83.3%) respectively had 1-3 **living children**. Furthermore, **the last delivery** was performed normally for a sizeable proportion of the former and the latter groups (73.3% & 70%) respectively.

Table (III) exhibits the number and percent distribution of postnatal mothers according to their breastfeeding history. **Previous breastfeeding problems** were reported by about three-fifths and more (58.3% & 66.7%) of warm ginger and cold aloe vera gel compresses groups respectively. Meanwhile, a sizeable proportion of the two groups, who had problems reported breast engorgement (71.4% & 68.8%) respectively and continuation of breastfeeding (78.6% & 68.8%) respectively. All the remaining of warm ginger and cold aloe vera gel

compresses groups with breastfeeding problems (21.4% & 31.2%) respectively reported discontinuation of breastfeeding temporarily. However, the relationship between the two groups' breastfeeding history was found to be not statistically significant.

Table (IV) manifests the number and percent distribution of postnatal mothers according to their breast redness using MRS. Although no statistically significant differences were found between both groups, severe redness was found among 66.7% of warm ginger compresses group, compared to 83.3% of cold aloe vera gel compresses group **on the 3rd day after intervention**. Mild redness was also observed among 33.3% of the former group, compared to 16.7% of the latter group **on the 5th day after intervention**. In addition, no redness was noticed among 23.3% of warm ginger compresses group, compared to 6.7% of cold aloe vera gel compresses group **on the 7th day after intervention**. However, a highly statistically significant difference was detected among each group before and after all interventions, where $P=0.000$.

Table (V) displays the number and percent distribution of postnatal mothers according to their breast pain intensity using VAS. Although the relationship between both groups was not statistically significant, mild and moderate pain among warm ginger compresses group was double-fold those among cold aloe vera gel compresses group (26.7% & 13.3%) **on the 3rd & the 5th day after intervention**. No pain was also observed among 23.3% of the former group, compared to 6.7% of the latter group **on the 7th day after intervention**. However, the relationship among each group before and after all interventions was found to be highly statistically significant ($P=0.000$).

Table (VI) demonstrates the number and percent distribution of postnatal mothers according to their breast edema using Newton's Scale. In spite of no statistically significant differences were discovered between both groups, moderate and mild edema was detected among 33.3% of warm ginger compresses group, compared to 16.7% of cold aloe vera gel compresses group **on the 3rd & the 5th day after intervention**. No

edema was also noticed among 23.3% of the former group, compared to 6.7% of the latter group *on the 7th day after intervention*. However, a highly statistically significant difference was detected among each group before and after all interventions, where $P=0.000$.

Table (VII) represents the number and percent distribution of postnatal mothers according to their level of pyrexia using Pyrexia Chart. Although the relationship between both groups was not statistically significant, mild pyrexia was found among 33.3% of warm ginger compresses group, compared to 16.7% of cold aloe vera gel compresses group *on the 5th day after intervention*. No pyrexia was also observed among 23.3% of the former group, compared to 6.7% of the latter group *on the 7th day after intervention*. However, the relationship was highly statistically significant among warm

ginger compresses group ($P<0.0001$), while it was statistically significant among cold aloe vera gel compresses group ($P=0.003$), before and after all interventions

Table (VIII) reveals the number and percent distribution of postnatal mothers according to their total score of breast engorgement. In spite of no statistically significant differences were found between both groups, mild engorgement was observed among 33.3% of warm ginger compresses group, compared to 16.7% of cold aloe vera gel compresses group *on the 5th day after intervention*. No engorgement was also detected among 23.3% of the former group, compared to 6.7% of the latter group *on the 7th day after intervention*. However, a highly statistically significant difference was detected among each group before and after all interventions, where $P<0.0001$.

Table (I): Number, percent and mean distribution of postnatal mothers according to their socio-demographic data

Socio demographic data	Warm Ginger Compresses (n = 30)		Cold aloe vera Gel Compresses (n = 30)		t-test (P) F/ χ^2 (P)
	No.	%	No.	%	
Age (years): Min.-Max. Mean \pm SD.	19– 37 25.90 \pm 5.333		19 – 37 25.87 \pm 5.290		0.022 (0.983)
Level of Education:					
- Read and write	16	53.3	17	56.7	0.107 (0.991)
- Basic	7	23.3	6	20.0	
- Secondary or its equivalent	6	20.0	6	20.0	
- University	1	03.3	1	03.3	
Occupation:					
- Housewife	25	83.3	22	73.3	0.884 (0.347)
- Working	5	16.7	8	26.7	
Type of work:	(n=5)		(n=8)		
- Employee	2	40.0	5	62.5	0.627 (0.428)
- Farmer	3	60.0	3	37.5	
Marital status:					
- Married	20	66.7	22	73.3	0.317 (0.573)
- Divorced	10	33.3	8	26.7	
Original residence:					
- Urban	26	86.7	26	86.7	0.000 1.000
- Rural	4	13.3	4	13.3	
Type of family:					
- Extended	24	80.0	24	80.0	0.000 1.000
- Nuclear	6	20.0	6	20.0	
Family income/month:					
- Just enough	11	36.7	13	43.3	0.278 (0.598)
- Not enough	19	63.3	17	56.7	

χ^2 (P): Chi-Square Test & P for χ^2 Test

F (P): Fisher Exact test & P for F Test

Table (II): Number, percent and mean distribution of postnatal mothers according to their reproductive history

Reproductive history	Warm Ginger Compresses (n = 30)		Cold aloe vera Gel Compresses (n = 30)		t-test (P) F/ χ^2 (P)
	No	%	No	%	
Gravidity:					0.277
Mean \pm SD	3.32 \pm 1.51		3.43 \pm 1.57		(0.783)
Parity:					0.514
Mean \pm SD	2.30 \pm 1.00		2.17 \pm 0.96		(0.609)
No of abortion:					
0	21	70.0	23	76.7	0.341
1-4	9	30.0	7	23.3	(0.559)
No of stillbirth:					
0	29	96.7	28	93.3	0.351
1	1	03.3	2	6.7	(0.554)
No of living children:					
1-3	27	90.0	25	83.3	0.577
4 +	3	10.0	5	16.7	(0.447)
Type of last delivery:					
- Normal	22	73.3	21	70.0	0.082
- CS	8	26.7	9	30.0	(0.775)

 χ^2 (P): Chi-Square Test &P for χ^2 Test

F (P): Fisher Exact test &P for F Test

Table (III): Number and percent distribution of postnatal mothers according to their breastfeeding history

Breastfeeding history	Warm Ginger Compresses (n = 24) #		Cold aloe vera Gel Compresses (n = 24) #		F/ χ^2 (P)
	No	%	No	%	
Occurrence of previous BF problem:					
- Yes	14	58.3	16	66.7	0.356
- No	10	41.7	8	33.3	(0.551)
Type of problem:	(n=14)		(n=16)		
- Breast engorgement	10	71.4	11	68.8	0.115
- Cracked nipple	2	14.3	2	12.5	(0.944)
- Mastitis	2	14.3	3	18.7	
Action taken for this problem:	(n=14)		(n=16)		
- Continuation of BF	11	78.6	11	68.8	0.368
- Discontinuation of BF	3	21.4	5	31.2	(0.544)
Duration of discontinuation:	(n=3)		(n=5)		
- Temporary	3	100.0	5	100.0	0.5
					(0.480)

6 postnatal mothers of each group were primiparae with no previous BF experience

 χ^2 (P): Chi-Square Test &P for χ^2 Test

F (P): Fisher Exact test &P for F Test

Table (IV): Number and percent distribution of postnatal mothers according to their breast redness using MRS

Breast redness	Warm Ginger Compresses (n = 30)		Cold aloe vera Gel Compresses (n = 30)		F/ χ^2 (P)
	No.	%	No.	%	
Before intervention:					
- Moderate (0.5 cm b or 1 cm u)	8	26.7	5	16.7	0.884 (0.347)
- Severe (> 0.5 cm b or > 1 cm u)	22	73.3	25	83.3	
3 days after intervention:					
- Moderate (0.5 cm b or 1 cm u)	10	33.3	5	16.7	2.222 (0.136)
- Severe (> 0.5 cm b or > 1 cm u)	20	66.7	25	83.3	
5 days after intervention:					
- Mild (< 0.25 cm b or < 0.5 cm u)	10	33.3	5	16.7	2.886 (0.236)
- Moderate (0.5 cm b or 1 cm u)	19	63.3	22	73.3	
- Severe (> 0.5 cm b or > 1 cm u)	1	03.3	3	10.0	
7 days after intervention:					
- No redness	7	23.3	2	06.7	3.969 (0.137)
- Mild (< 0.25 cm b or < 0.5 cm u)	22	73.3	25	83.3	
- Moderate (0.5 cm b or 1 cm u)	1	03.3	3	10.0	
F/ χ^2 (P)	64.011 (0.000)**		68.476(0.000)**		

b for bilateral & u for unilateral

F (P): Fisher Exact test & P for F Test

: Highly Significant at P \leq 0.05 χ^2 (P): Chi-Square Test & P for χ^2 Test*: Significant at P \leq 0.05Table (V):** Number and percent distribution of postnatal mothers according to their breast pain intensity using VAS

Breast pain intensity	Warm Ginger Compresses (n = 30)		Cold aloe vera Gel Compresses (n = 30)		F/ χ^2 (P)
	No.	%	No.	%	
Before intervention:					
- Moderate (4-6)	6	20.0	4	13.3	0.48 (0.488)
- Severe (7-10)	24	80.0	26	86.7	
3 days after intervention:					
- Moderate (4-6)	8	26.7	4	13.3	1.667 (0.197)
- Severe (7-10)	22	73.3	26	86.7	
5 days after intervention:					
- Mild (1-3)	8	26.7	4	13.3	2.424 (0.298)
- Moderate (4-6)	21	70.0	23	76.7	
- Severe (7-10)	1	03.3	3	10.0	
7 days after intervention:					
- No (0)	7	23.3	2	06.7	4.665 (0.097)
- Mild (1-3)	22	73.3	24	80.0	
- Moderate (4-6)	1	03.3	4	13.3	
F/ χ^2 (P)	70.563(0.000)**		69.38(0.000)**		

 χ^2 (P): Chi-Square Test & P for χ^2 Test*: Significant at P \leq 0.05

F (P): Fisher Exact test & P for F Test

**: Highly Significant at P \leq 0.05

Table (VI): Number and percent distribution of postnatal mothers according to their breast edema using Newton's Scale

Breast edema	Warm Ginger Compresses (n = 30)		Cold aloe vera Gel Compresses (n = 30)		F/ χ^2 (P)
	No.	%	No.	%	
Before intervention:					
- Moderate (2.5 cm to <4 cm above basic)	8	26.7	5	16.7	0.884 (0.347)
- Severe (>4 cm above basic)	22	73.3	25	83.3	
3 days after intervention:					
- Moderate (2.5 cm to <4 cm above basic)	10	33.3	5	16.7	2.222 (0.136)
- Severe (>4 cm above basic)	20	66.7	25	83.3	
5 days after intervention:					
- Mild (1.5 cm to < 2.5 cm above basic)	10	33.3	5	16.7	2.886 (0.236)
- Moderate (2.5 cm to <4 cm above basic)	19	63.3	22	73.3	
- Severe (>4 cm above basic)	1	03.3	3	10.0	
7 days after intervention:					
- No (<1.5 cm above basic).	7	23.3	2	06.7	3.969 (0.137)
- Mild (1.5 cm to < 2.5 cm above basic)	22	73.3	25	83.3	
- Moderate (2.5 cm to <4 cm above basic)	1	03.3	3	10.0	
F/ χ^2 (P)	64.011 (0.000)**		68.476(0.000)**		

 χ^2 (P): Chi-Square Test &P for χ^2 Test

F (P): Fisher Exact test &P for F Test

*: Significant at P \leq 0.05**: Highly Significant at P \leq 0.05**Table (VII):** Number and percent distribution of postnatal mothers according to their level of pyrexia using Pyrexia Chart

Level of pyrexia	Warm Ginger Compresses (n = 30)		Cold aloe vera Gel Compresses (n = 30)		F/ χ^2 (P)
	No.	%	No.	%	
Before intervention:					
- Moderate (38-< 38.5 °C)	14	46.7	18	60.0	1.071 (0.301)
- Severe (\geq 38.5 °C)	16	53.3	12	40.0	
3 days after intervention:					
- Moderate (38-< 38.5 °C)	17	56.7	22	73.3	1.832 (0.176)
- Severe (\geq 38.5 °C)	13	43.3	8	26.7	
5 days after intervention:					
- Mild (37.5- < 38 °C)	10	33.3	5	16.7	2.886 (0.236)
- Moderate (38-< 38.5 °C)	19	63.3	22	73.3	
- Severe (\geq 38.5 °C)	1	03.3	3	10.0	
7 days after intervention:					
- No (37- <37.5 °C)	7	23.3	2	06.7	3.969 (0.137)
- Mild (37.5- < 38 °C)	22	73.3	25	83.3	
- Moderate (38-< 38.5 °C)	1	03.3	3	10.0	
F/ χ^2 (P)	44.044 (<0.001)**		19.479 (0.003)*		

 χ^2 (P): Chi-Square Test &P for χ^2 Test

F (P): Fisher Exact test &P for F Test

*: Significant at P \leq 0.05**: Highly Significant at P \leq 0.05

Table (VIII): Number and percent distribution of postnatal mothers according to their total score of breast engorgement

Total score of breast engorgement	Warm Ginger Compresses (n = 30)		Cold aloe vera Gel Compresses (n = 30)		F/ χ^2 (P)
	No.	%	No.	%	
Before intervention:					0.000 (1.000)
- Severe (9-12)	30	100.0	30	100.0	
3 days after intervention:					2.069 (0.150)
- Moderate (6-<9)	2	06.7	0	00.0	
- Severe (9-12)	28	93.3	30	100.0	
5 days after intervention:					2.886 (0.236)
- Mild (3-<6)	10	33.3	5	16.7	
- Moderate (6-<9)	19	63.3	22	73.3	
- Severe (9-12)	1	03.3	3	10.0	
7 days after intervention:					3.969 (0.137)
- No (0-<3)	7	23.3	2	06.7	
- Mild (3-<6)	22	73.3	25	83.3	
- Moderate (6-<9)	1	03.3	3	10.0	
F/ χ^2 (P)	106.436 (<0.0001)**		101.136 (<0.0001)**		

χ^2 (P): Chi-Square Test & P for χ^2 Test

*: Significant at P \leq 0.05

F (P): Fisher Exact test & P for F Test

**: Highly Significant at P \leq 0.05

Discussion:

Breast engorgement is a problem that is commonly encountered in breastfeeding mothers and it can lead to potentially serious issues, including painful breast, plugged milk ducts or mastitis. Severe breast engorgement may even cause milk fever as well as make it difficult to baby to latch on to the breast properly and feed well (Indrani & Sowmya, 2019). Maintaining the flow of breast milk is the key element of breast engorgement prevention, which can be accomplished by making sure that milk, is removed efficiently from the breast. This can be achieved through effective positioning and attachment, frequent breastfeeding and avoiding infant formula (UNICEF, 2020). Approaches for managing breast engorgement involve pharmacological management, which is considered to be beneficial, but its side effects sometimes outweigh their benefits as well as non-pharmacological management, which is harmless during the long-term use and has minimal side effects (Rondanelli et al., 2020; Zagloul et al., 2020). Therefore, this study aimed to investigate the effect of warm ginger versus Cold aloe vera gel compresses on breast engorgement among postnatal mothers.

The results of the present study revealed that postpartum mothers, who applied warm ginger compresses on their engorged breasts, experienced less breast redness, pain, and edema, as well as less pyrexia and generally, less breast engorgement than those, who applied cold aloe vera gel compresses, although the relationship was not statistically significant (Tables IV-VIII). This may be attributed to the fact that ginger has anti-inflammatory, anti-bacterial, anti-fever, anti-swelling and anti-angiogenic effects; therefore, it decreases breast pain and increases milk production. Warm ginger compresses also improve blood circulation by vasodilatation of the blood vessel and lactiferous duct, as well as increasing cell metabolism and relaxing muscles; so that pain can be reduced, and the ejection of the breast milk may become smooth (Monazzami et al., 2019; Wahyuningsih & Liliana, 2019). In addition, it was emphasized that applying warm ginger compresses on the engorged breast for a minimum of 30 to 40 minutes or more, improve circulation, which will move the stagnant milk and give great relief (Lim, 2021).

However, cold aloe vera gel compresses are effective in relieving breast engorgement related pain through stimulating the immune

system body and decreasing prostaglandins responsible for pain. They also work by constricting blood vessels as well as decreasing lymph and blood flow to the breast, which can significantly reduce inflammation and swelling that causes pain. In addition, Cold aloe vera gel compresses can temporarily reduce nerve activity, which can relieve pain (Wizia & Susanti, 2021).

The current finding relatively coincides with a study conducted in Mashhad, Iran, where it was concluded that the effect of warm ginger compresses was significantly higher than the routine care in decreasing the severity of breast engorgement symptoms in lactating women (Monazzami et al., 2019). It also relatively agrees with a review study performed in Mashhad, Iran, where it was reported that ginger was effective for treatment of breast engorgement in lactating women (Razmjouei et al., 2020). In addition, the present finding is partly and relatively conformable with a study fulfilled in Mashhad, Iran, where it was emphasized that ginger compresses are more effective than hot compresses in reducing breast engorgement associated pain among breastfeeding women (Monazzami et al., 2021).

On the other hand, the current finding is partly and relatively not in line with a case study executed in Kadipiro, Surakarta, Indonesia, where it was found that cold aloe vera gel compresses are effective for reducing pain associated with breast engorgement in postpartum mothers (Aini, 2019). The incongruity between the finding of this study and the present one may demonstrate different research design (case study) and descriptive approach of cold aloe vera gel compresses only, without determining whether they are warm, natural or cold. The present finding doesn't also coincide with a study implemented in Harapan Raya, Indonesia, where it was shown that cold aloe vera gel compresses are effective in decreasing the pain intensity of swollen breasts of postpartum mothers with breast engorgement (Sari et al., 2019). The distinction between the finding of this study and the present one may be referred to using cold aloe vera gel compresses only, without identifying whether they are warm, natural or cold.

In addition, the present finding doesn't relatively tally with a Cochrane database of systematic reviews, which reported that combining cold aloe vera gel compresses with breast massage effectively improve breast pain and hardness as well as increase breastfeeding rate than using cold aloe vera gel compresses or massage separately (Zakarija-Grkovic & Stewart, 2020). The disparity between the finding of this study and the present one may be attributed to different research design (Cochrane database of systematic reviews), and research method (combining cold aloe vera gel compresses with breast massage). Moreover, the current finding is partly not consistent with a study fulfilled in Sarolangun, Indonesia, where it was indicated that cold aloe vera gel compresses brought positive impact on reducing pain associated with breast engorgement in postpartum lactating women (Wizia & Susanti, 2021). The discrepancy between the finding of this study and the current one may be due to different research design (experimental with one group pretest-posttest) and method (Cold aloe vera gel compresses) as well as small sample size (12 postpartum women with breast engorgement)

Conclusion:

Based on the findings of the present study, it can be concluded that warm ginger compresses were more effective in relieving breast engorgement and its associated symptoms (redness, pain, edema, pyrexia) among postnatal lactating mothers than Cold aloe vera gel compresses, although the relationship was not statistically significant. So, the study aim and hypothesis 1 were achieved within the framework of the present study.

Recommendation:

Based on the findings of the present study, the following recommendations are suggested:

- Lactating women should be encouraged to empty the breast as often as possible, typically every 2 to 3 hours, to maintain milk supply.
- The role of maternity nurses should be very helpful in informing and encouraging lactating women to reduce the severity of

breast engorgement through non-pharmacological management in the form of warm ginger compresses therapy with the hope of improving their health status during postpartum period.

- The use of warm ginger compresses can be beneficial for lactating women as they accelerate the relief of breast engorgement and reduce its associated pain with no side effects.
- Warm ginger compresses can be created as one of alternative choices to decrease intensity of breast engorgement because they are non-pharmacologist treatment, which are easy to use, available, and have no side effect for lactating mothers.
- Extraction of colostrum before the appearance of transitional milk could lower the risk of excessive breast engorgement in breastfeeding women.
- Future trials should aim to include larger sample sizes to justify widespread implementation of warm ginger compresses to treat breast engorgement problem.
- More researches and detailed analysis should be urgently carried out on the effect of different non-pharmacological methods used for the treatment of breast engorgement.

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Conflict of Interest Disclosure

Researchers declared that there is no conflict of interest in the research.

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