

Effect of Olive Oil Massage on Breast Engorgement and Breastfeeding among Primiparous Postnatal Mothers with Cesarean Section Delivery

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Abstract

Background: Breast engorgement can cause considerable discomfort for mothers and hinder successful breastfeeding. This can lead to early discontinuation of breastfeeding, and dangerous medical conditions. Olive oil is one of the non-pharmacological methods used for treating breast engorgement. **Aim of the study:** explore the effect of olive oil massage on breast engorgement and breastfeeding among primiparous postnatal mothers with cesarean section delivery. **Design:** A quasi-experimental research design was adopted. **Setting:** the study was carried out at the maternity outpatient clinics of Damanhour General Hospital in El-Beheira Governorate, Egypt. **Subjects:** A purposive sample of 80 postpartum women with breast engorgement was selected and classified into two equal groups of 40, study and control. **Data collection tools:** three tools were utilized for data collection; tool one: basic data structured interview schedule, which included socio-demographic data and breastfeeding history; tool two: breast engorgement assessment scale, which involved Modified Reeda Scale, Visual Analog Scale, Newton's Scale and Pyrexia Chart; tool three: Latch on scale. **Results:** this study revealed that severe breast engorgement highly significantly fell steadily from 27.5% to 0% among the study group, whereas it reduced slightly from 20 % to 17.5% among the control group. Successful breastfeeding was also highly significantly elevated sharply from 7.5% to 92.5% among the study group, while it remained the same (15%) among the control one. **Conclusion:** this study concluded that olive oil breast massage significantly relieved breast engorgement and enhanced successful breastfeeding. **Recommendations:** Olive oil breast massage could be utilized as an independent nursing intervention to reduce breast engorgement.

Keywords: *Breast engorgement, olive oil massage, Postpartum Mothers & Cesarean Section Delivery*

Introduction

Puerperium is a natural process that causes a slew of undesirable physiological and psychological changes in women, particularly primiparas, who may feel a variety of symptoms. For instance, common breast problems during puerperium include breast engorgement, nipple problems, plugged milk duct, breast infection and insufficient milk supply. Enlargement of the breast is one of the most common concerns in the first week of puerperium, especially among women who have had a caesarean section.. It can be defined as painful sensation due to expansion and pressure exerted by the synthesis and storage of breast milk. Worldwide, the prevalence of breast engorgement in 2019 ranged between 65% -75%, while it was 82% in Egypt, especially among mothers (Abdallah et al., 2018; Folami et al., 2018; Hassan et al., 2020 & Abd El-hady et al., 2021).

Breast engorgement occurs due to delayed initiation of breastfeeding, sudden increase of milk production, infrequent feeds, inadequate suckling, sudden change in breast feeding practice and sudden stopping of

breastfeeding. Breastfeeding may also be delayed in mothers with cesarean section deliveries due to pain or reluctance to hold the baby in a position near the incision. Sometimes, it is delayed due to mothers' misinformation about the received medications. Breast engorgement causes swelling of the tissues surrounding the milk ducts, stasis of milk inside the breast, and increased pressure in the milk ducts, which lead to closure of milk ducts, resulting in decreased blood and milk flow as well as decreased milk production (Powar et al., 2016; Chaudhary et al., 2019; Indrani & Sowmya, 2019). Breast engorgement causes firm, tender, swollen breasts; throbbing pain; taut, shiny, or transparent skin and low-grade temperature. It also caused firm areola and flattened nipple, making it hard for a baby to latch on (Health Wise Staff, 2020 & Abd El-hady et al., 2021).

Prompt treatment of breast engorgement is important for successful breastfeeding, as it improves breastfeeding duration and exclusivity rates as well as resolves extreme symptoms within 24-48 hours.

If breast engorgement is not treated promptly, it may resolve within 7– 14 days or longer and may cause some complications such as feeding problems or slow baby weight gain; sore and cracked nipple as well as deep breast pain; nipple or breast thrush; plugged milk ducts; destroy of the milk-producing cells, which may decrease milk supply; mastitis and breast abscess (**Infant Feeding Leads, 2019; Hassan et al., 2020; Hables & Mahrous, 2021**)

Several approaches for the treatment of breast engorgement include warm and cold compresses as well as cold cabbage leaves, breast massage, milk expression, and olive oil (**Tristani et al., 2021**). Olive oil, an easily accessible and relatively cheap substance was used by early Mediterranean cultures as a medicine to cure all diseases. The chief active elements of olive oil include oleic acid (a monounsaturated fatty acid), phenolics, and squalene. The major phenolics include hydroxytyrosol, tyrosyls, and oleuropein, which have antioxidant, antibacterial, anti-fungal and anti-inflammatory properties that moisten breast skin, treat breast infection and enhance wound healing (**Lucas et al., 2019; WowEssays, 2019 & Mountains, 2021**). Olive oil breast massage technique is done by massaging the outer sides of the breasts in long strokes up towards the lymph nodes in the axilla (arm pit) and massaging the inner sides of the breasts toward the lymph nodes in the center of the chest. This technique helps remove fluid from the breast and reduces engorgement (**Glahn, 2018**).

Significance of the study

Breastfeeding problems are occurred in up to 80% of nursing mothers. For instance, breast engorgement occurs in 72% to 85% of post-natal mothers. Six out of every ten mothers suffer from it. The importance lies in the fact that the engorged breast can prevent nursing, which leads to a decrease in milk production (**Chaudhary et al., 2019**). So, one of the main aspects of midwifery care is providing accurate and consistent advice on how to prevent breast engorgement and, if the problem occurs, how to overcome it to reduce early cessation of breastfeeding. Olive oil has polyphenols that are advantageous for the skin. In addition, the breast massage promotes blood circulation to the breast and assists in removing toxins from the body (**Sonsale et al., 2022**). Despite this, there have been limited studies on the effectiveness of olive oil massage in relieving breast engorgement. Therefore, this study was undertaken to evaluate the effect of olive oil breast massage on the relief of breast engorgement and successful breastfeeding.

Aim of the study

Explore the effect of olive oil massage on breast engorgement and breastfeeding among primiparous postnatal mothers with cesarean section delivery

Hypothesis

Primiparous postnatal mothers who receive olive oil breast massage exhibit less breast engorgement and more successful breastfeeding than those who don't receive it

Subjects and Method

Research Design:

A quasi-experimental research design was used, where the effect of independent variable (olive oil breast massage) on the dependent variables (breast engorgement & breastfeeding) was examined.

Setting:

The study was carried out at the maternity outpatient clinics of Damanshour general hospital in El-Beheira Governorate, Egypt. This setting was particularly chosen because it has increased turnover of postpartum mothers, which is appropriate for the study.

Subjects:

A purposive sample of 80 postpartum women with breast engorgement was chosen according to the following inclusion criteria:

- Primipara
- Has cesarean section delivery
- Lactating
- Free from medical diseases or conditions that interfere with breastfeeding
- Has a newborn with normal characteristics

Sample size

The EPI Info 7 statistical program was used to estimate the required sample size of postpartum mothers by applying the following parameters:

- Population size = 150 (during the last three months).
- Expected frequency =50%
- Acceptable error = 5%
- Confidence coefficient = 95%
- Minimal sample size = 78

The study subjects were equally assigned to either study or control group:

- The study group included 40 postpartum women, who received breast massage with olive oil.
- The control group involved 40 postpartum women, who received routine post-partum care.

Data collection tools:

Three tools were utilized by the researchers as the following:

Tool one: Basic data structured interview questionnaire, which include the following parts:

Part (I): Postpartum women's socio-demographic data including women's age, education, occupation, current residence, family income/month.

Part (II): Postpartum women's breastfeeding history such as rooming the baby, breastfeeding knowledge, and method, as well as frequency of scheduled breastfeeds, number of breastfeeds/day, giving supplements with breastfeeding and onset of breast engorgement after delivery.

Tool two: Breast engorgement scale, which included four main parts that illustrate the breast's current condition (redness, pain, edema, and pyrexia).

Part (I): Modified Reeda Scale (MRS), which was originally developed by Hill (1990). It was adopted by the researchers to evaluate the breast engorgement status after delivery in relation to redness and it was classified into 4 categories:

0= No redness

1= Mild redness (two-sided < 0.25 cm or one-sided < 0.5 cm)

2= Moderate redness (0.5 cm two-sided or 1 cm one-sided)

3= Severe redness (> 0.5 cm two-sided or > 1 cm one-sided)

Part (II): Visual Analog Scale (VAS), which was originally developed by Woodforde & Merskey (1972) and adopted by the researcher to measure intensity of breast pain. This scale is a self-report scale 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). It was adopted by the researchers to assess breast edema as follows:

0 = No edema (< 2.5 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, where the body temperature was assessed by using a thermometer and 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).

The total score of breast engorgement was determined by summing up the scores of Part I (redness), Part II (pain), Part III (edema), and Part IV (pyrexia). Then, the degree of breast engorgement was estimated as follows:

- No breast engorgement (0-< 3)

- Mild breast engorgement (3-<6)

- Moderate breast engorgement (6-< 9)

- Severe breast engorgement (9-12)

Tool three: Latch on scale, which was adopted by the researchers to evaluate the effectiveness of breastfeeding. **LATCH** denotes; **L**atching of the infant on the breast, **A**mount of audible swallowing, **T**ype of nipple, **C**omfort of mother, and **H**elp required for assisting the mother to hold the baby during breastfeeding. A score of 0- 2 is assigned to the 5 key assessment areas for a total score of 10. The total score of 5-10 points indicates successful breastfeeding, while the total score of 0-<5 indicates unsuccessful breastfeeding (Jensen et al., 1994).

Method

1. Approvals

- An approval from Scientific Research Ethical Committee, Faculty of Nursing, Damanhour University was obtained.

- A written permission to collect data was obtained from the relevant authority of the study setting.

2. Tools development

- The tool (1) was developed by the researchers after reviewing the current related literature.

- Tools 2 & 3 were adopted.

- Tools content validity was tested by a jury of 5 experts in the study field.

- The reliability of the tools was examined using Cronbach's Alpha test (internal consistency). The test results were acceptable for tools two and three (0.758 & 738) respectively.

3. Pilot study

It was conducted on a ten percent of the subjects (8 postpartum women, who were not included in the original study sample) to test the feasibility of the study, ensure the clarity and applicability of the tools, identify obstacles and problems that may be encountered as well as estimate the time needed for data collection. Accordingly, the tools were modified to be suitable for use.

4. Collection of data

- Data were collected from primiparous postnatal mothers with breast engorgement, while attending maternity clinics of the study setting.

- Data of tool one were collected from both the study group and the control one, through an individual interview.

Implementation phase:

- The study group was demonstrated by the researchers to perform breast massage with olive oil through massaging the outer sides of the breasts in long strokes up towards the lymph nodes in the axilla (armpit) and massaging the inner sides of the breasts toward the lymph nodes in the center of the chest (Figure 1) (Glahn, 2018).

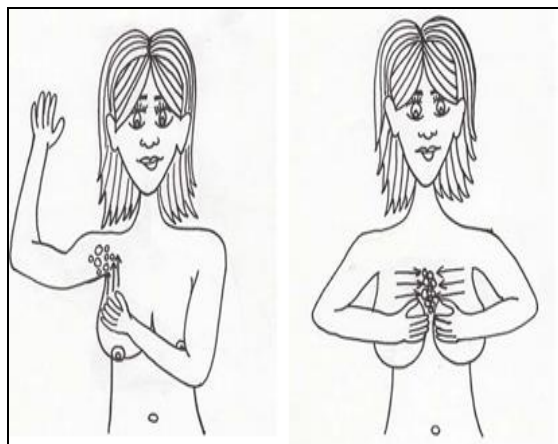


Figure (1): Therapeutic breast massage to relieve breast engorgement

- The study group was also instructed to massage the breast twice a day, with six hours intervals, for 10-15 min. They were also given an illustration materials and a single supply of olive oil as well as they were followed-up through a phone call.
- The control group received routine hospital care.
- Data were collected over a period of six months; from September 2021 till February 2022, 2 days/week; 2-3 postpartum women /day.
- The duration of each interview ranged between 60-75 minutes, depending on the woman's understanding.

Evaluation phase:

- The degree of breast engorgement was assessed for both groups 30 minutes after the second breast massage through phone call or what's app.

- After completion of data collection, comparison between the two groups was done to identify the effect of olive oil breast massage on breast engorgement.

Statistical analysis of data

- The collected data were categorized, coded, computerized, tabulated and analyzed using Statistical Package for Social Sciences (SPSS) version 23 program.
- The collected data were analyzed and presented in descriptive and associated statistical forms using the Statistical Package for Social Sciences (SPSS, version 23).
- Cross tabulation was conducted to find the relationships between variables.
- Descriptive statistics were used such as percentages, Mean & Standard Deviation and analytical ones were also used including Chi-square (χ^2), Fisher's exact test (FET) and t-test to find out the difference in the results at p-value <0.05 (5%) level of significance.

Ethical consideration:

For each participant, the following issues were considered: Securing the subject's written informed consent after explaining the study aim; maintaining their privacy and their right to withdraw at any time. Moreover, the confidentiality of their data was assured.

Results

Table (I): Distribution of postpartum mothers according to their socio - demographic data

Socio - demographic data	Study Group (40)		Control Group (40)		t- test (P) F / χ^2 (P)
	No	%	No	%	
Age (years): - Min-max - Mean \pm SD	18-35 25.30 \pm 4.238		19-35 26.55 \pm 3.580		1.425 (0.158)
Level of education: - Illiterate/read & write - Basic - Secondary or its equivalent - University	10 3 13 14	25.0 07.5 32.5 35.0	7 4 21 8	17.5 10.0 52.5 20.0	4.191 (0.241)
Occupation: - Housewife - Working	25 15	62.5 37.5	27 13	67.5 32.5	0.22 (0.639)
Current residence: - Rural - Urban	29 11	72.5 27.5	32 8	80.0 20.0	0.621 (0.431)
Family income/month: - Just enough - Not enough	4 36	10.0 90.0	7 33	17.5 82.5	0.949 (0.330)

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

Table (2): Distribution of postpartum mothers according to their current breastfeeding history

Current breastfeeding history	Study Group (40)		Control Group (40)		F / χ^2 (P) t- test (P)
	No	%	No	%	
Rooming the baby: - Rooming-in - Rooming-out	40 0	100.0 00.0	39 1	97.5 02.5	1.013 (0.314)
Having knowledge about breastfeeding: - Yes - No	10 30	25.0 75.0	12 28	30.0 70.0	0.251 (0.616)
Method of breastfeeding: - Schedule - On-demand	9 31	22.5 77.5	4 36	10.0 90.0	2.296 (0.130)
Frequency of scheduled breastfeeds: - Every 2-4 hours - Every 9-12 hours	(n=9) 7 2	 77.8 22.2	(n=4) 4 0	 100.0 00.0	1.051 (0.305)
Number of breastfeeds/day: 6 times 7-9 times 10-15 times	2 8 30	05.0 20.0 75.0	0 38 2	00.0 95.0 05.0	46.065 (0.000)**
Giving supplements with breastfeeding: - Yes - No	17 23	42.5 57.5	15 25	37.5 62.5	0.208 (0.648)
Onset of breast engorgement after delivery (days): - Min-max - Mean \pm SD	4-12 7.88 \pm 2.554		4-11 7.12 \pm 1.937		1.499 (0.138)

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

Table (3): Distribution of postpartum mothers according to their breast redness using MRS

Breast redness	Study Group (40)		Control Group (40)		F / χ^2 (P)
	No	%	No	%	
Before intervention: - Mild (< 0.25 cm b or < 0.5 cm u) - Moderate (0.5 cm b or 1 cm u) - Severe (> 0.5 cm b or > 1 cm u)	0 7 33	00.0 17.5 82.5	1 11 28	02.5 27.5 70.0	2.299 (0.316)
After intervention: - Mild (< 0.25 cm b or < 0.5 cm u) - Moderate (0.5 cm b or 1 cm u) - Severe (> 0.5 cm b or > 1 cm u)	6 31 3	15.0 77.5 07.5	1 12 27	02.5 30.0 67.5	31.167 (0.000)**

b for bilateral & u for unilateral
F (P): Fisher Exact test &P for F Test

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

Table (4): distribution of postpartum mothers according to their breast pain intensity using VAS

Breast pain intensity	Study Group (40)		Control Group (40)		F / χ^2 (P)
	No	%	No	%	
Before intervention: - Mild (1-3) - Moderate (4-6) - Severe (7-10)	1 15 24	02.5 37.5 60.0	3 15 22	07.5 37.5 55.0	1.087 (0.581)
After intervention: - Mild (1-3) - Moderate (4-6) - Severe (7-10)	17 21 2	42.5 52.5 05.0	4 17 19	10.0 42.5 47.5	22.231 (0.000)**

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

Table (5): Distribution of postpartum mothers according to their breast edema using Newton's Scale

Breast edema	Study Group (40)		Control Group (40)		F / χ^2 (P)
	No	%	No	%	
Before intervention:					
- No (<1.5 cm above basic)	0	00.0	1	02.5	2.77 (0.427)
- Mild (1.5 - < 2.5 cm above basic)	10	25.0	13	32.5	
- Moderate (2.5 - <4 cm above basic)	28	70.0	22	55.0	
- Severe (>4 cm above basic)	2	05.0	4	10.0	
After intervention:					
- No (<1.5 cm above basic)	0	00.0	1	02.5	16.22 (0.001)*
- Mild (1.5 - < 2.5 cm above basic)	30	75.0	13	32.5	
- Moderate (2.5 - <4 cm above basic)	10	25.0	22	55.0	
- Severe (>4 cm above basic)	0	00.0	4	10.0	

χ^2 (P): Chi-Square Test &P for χ^2 Test F (P): Fisher Exact test &P for F Test *: Significant at $P \leq 0.05$

Table (6): Distribution of postpartum mothers according to their level of pyrexia using Pyrexia Chart

Level of pyrexia	Study Group (40)		Control Group (40)		F / χ^2 (P)
	No	%	No	%	
Before intervention:					
- No (37- <37.5 °C)	20	50.0	29	72.5	5.343 (0.069)
- Mild (37.5- < 38 °C)	18	45.0	11	27.5	
- Moderate (38-< 38.5 °C)	2	05.0	0	00.0	
After intervention:					
- No (37- <37.5 °C)	30	75.0	29	72.5	1.217 (0.544)
- Mild (37.5- < 38 °C)	9	22.5	11	27.5	
- Moderate (38-< 38.5 °C)	1	02.5	0	00.0	

χ^2 (P): Chi-Square Test &P for χ^2 Test F (P): Fisher Exact test &P for F Test *: Significant at $P \leq 0.05$

Table (7): Distribution of postpartum mothers according to their total score of breast engorgement

Total score of breast engorgement	Study Group (40)		Control Group (40)		F / χ^2 (P)
	No	%	No	%	
Before intervention:					
- Mild (3-<6)	1	02.5	5	12.5	3.159 (0.206)
- Moderate (6-< 9)	28	70.0	27	67.5	
- Severe (9-12)	11	27.5	8	20.0	
After intervention:					
- Mild (3-<6)	30	75.0	5	12.5	33.38 (0.000)**
- Moderate (6-< 9)	10	25.0	28	70.0	
- Severe (9-12)	0	00.0	7	17.5	

χ^2 (P): Chi-Square Test &P for χ^2 Test F (P): Fisher Exact test &P for F Test *: Significant at $P \leq 0.05$

Table (8): Distribution of postpartum mothers according to their total score of successful breastfeeding using Latch on scale

Total score of successful breastfeeding	Study Group (40)		Control Group (40)		F / χ^2 (P)
	No	%	No	%	
Before intervention:					
- Successful (5-10)	3	07.5	6	15.0	1.127 (0.288)
- Unsuccessful (0-<5)	37	92.5	34	85.0	
After intervention:					
- Successful (5-10)	37	92.5	6	15.0	48.322 (0.000)**
- Unsuccessful (0-<5)	3	07.5	34	85.0	

χ^2 (P): Chi-Square Test &P for χ^2 Test F (P): Fisher Exact test &P for F Test *: Significant at $P \leq 0.05$

As shown in Table (1), the mean age was 25.30 ± 4.238 years for the study group and 26.55 ± 3.580 years for the control group. Level of education revealed that 52.5% of the control group had secondary level or its equivalent, compared to 32.5% of the study group. On the other hand, 35% of the latter group had university level, compared to 20% of the former group. In addition, occupation and current residence manifested that a sizable proportion of the study and the control groups (62.5% & 67.5%) respectively were housewives and 72.5% & 80% of them respectively were rural residents. Finally, family income/month illustrated that the vast majority of the study group and control groups (90 % & 82.5 %) respectively had not enough family income. The two groups were homogenous, where no statistically significant differences were found between the two groups' socio-demographic data.

According to Table (2), Rooming in was observed among all or almost all of the study and control groups (100% & 97.5%) respectively. On the contrary, a sizeable proportion of the two groups (75% & 70%) respectively didn't have knowledge about breastfeeding. On-demand method of breastfeeding was used by a sizeable proportion and most of the study and the control groups (77.5% & 90%) respectively. Among the remaining (22.5% & 10%) of the two groups respectively, who used schedule method, frequency ranged between 2-4 hours as reported by a sizeable proportion and all of the study and the control groups (77.8% & 100%) respectively. In addition, number of breastfeeds/day ranged between 7-9 times among 95% of the control group, compared to 20% of the study group. In contrast, it ranged between 10-15 times among 75% of the latter group, compared to 5% of the former group. Moreover, supplements were not given with breastfeeding by almost three-fifths and more (57% & 62.5%) of the study and the control groups respectively. Finally, the mean onset of breast engorgement after delivery was 7.88 ± 2.554 days & 7.12 ± 1.937 days for the former and the latter groups respectively. However, the relationship between the two groups' current breastfeeding history was not statistically significant, except for the number of breastfeeds/day ($P = 0.000$).

Table (3): Presents postpartum mothers' breast redness using MRS. The relationship between the study and control groups was not statistically significant before intervention. However, it was highly statistically significant between them after intervention ($P=0.000$), where severe redness declined sharply from 82.5% to 7.5% among the study group, while it decreased slightly from 70 % to 67.5% among the control group.

Table (4): Display the postpartum mothers' breast pain intensity using VAS. No statistically significant difference was observed between the study and control groups before intervention. But, a highly statistically significant difference was noted between them after intervention ($P=0.000$), where severe pain reduced sharply from 60% to 5% among the study group, while it diminished slightly from 55 % to 47.5% among the control group.

Table (5): Clarifies postpartum mothers' breast edema using Newton's Scale. The relationship between the study and control groups was not statistically significant before intervention. Yet, it was highly statistically significant between them after intervention ($P=0.001$), where moderate edema dropped sharply from 70% to 25% among the study group, while it remained the same (55%) among the control group.

Table (6): Elucidates postpartum mothers' level of pyrexia using Pyrexia Chart. Although no statistically significant difference was observed between the study and control groups before and after intervention, mild pyrexia declined from 45% to 22.5% among the former group, while it didn't change (27.5%) among the latter group.

Table (7): Illustrates postpartum mothers' total score of breast engorgement. The relationship between the study and control groups was not statistically significant before intervention. Nevertheless, it was highly statistically significant between them after intervention ($P=0.000$), where severe breast engorgement fell sharply from 27.5% to 0% among the study group, while it reduced slightly from 20 % to 17.5% among the control group.

Table (8): Sheds line upon postpartum mothers' total score of successful breastfeeding using Latch on scale. No statistically significant difference was detected between the study and control groups before intervention. However, a highly statistically significant difference was noticed between them after intervention ($P=0.000$), where successful breastfeeding elevated sharply from 7.5% to 92.5% among the study group, while it remained the same (15%) among the control group

Discussion

Breast engorgement is considered the commonest health issue that affects a large number of postpartum women. It is a painful, unpleasant, and particularly distressing condition for them as well as it may suppress successful breastfeeding, leading to premature cessation of breastfeeding, decreased milk production. Breast engorgement can also lead to cracked nipples, mastitis, and breast abscess. Therefore, the effective treatment of breast engorgement may provide an avenue for health care

providers to improve postpartum care, including breastfeeding (Sousa et al., 2012; Mangesi&Zakarija-Grkovic, 2016 & Gresh et al., 2019).

Various forms of breast engorgement interventions have been studied (i.e., cold cabbage leaves, cold gel packs, warm and cold compresses, breast massage, and milk expression), but, limited consistent evidence has been found on effective interventions. Thus, more evidence-based investigation of non-pharmacologic remedies for the management of breast engorgement is needed because these tend to be popular (Berens et al., 2016; Zakarija-Grkovic & Stewart, 2020). Therefore, this study was performed to explore the effect of Olive oil breast massage on breast engorgement and breast feeding among primiparous postnatal mothers with cesarean section delivery.

On investigating breast redness using MRS, the current findings showed that the study group experienced highly significantly sharp decline after intervention, in comparison to the control group (Table III). This might be attributed to the anti-inflammatory properties of olive oil, which is rich in polyphenols, the plant-based substances that reduce breast inflammation, moisturize breast skin, and keep it hydrated (Lin et al., 2017 & Cherney 2018). The current finding is relatively similar to a study done in California, USA, where it was concluded that olive oil is associated with greater anti-inflammatory benefits. Olive oil has the ability to reduce inflammatory markers in the blood as measured by greater drops in an inflammatory marker referred to high-sensitivity C-reactive protein (Mateljan et al., 2012).

When breast pain was assessed using VAS, the results of the present study also revealed highly significantly sharp reduction among the study group after intervention, as opposed to the other group (Table IV). This may reflect the fact that olive oil has anti-inflammatory and analgesic properties as oleic acid components, strikingly similar to ibuprofen, reduces and prevents inflammation by inhibiting pro-inflammation enzymes COX-1 & COX-2, and in turn reduces pain associated with inflammation (Lin, 2018).

Breast massage also reduces pain by provocation of nerve endings that occlude the pathway of pain and stretches the soft tissue, which reduces tension. In addition, removal of metabolic waste can help relieve pain by increasing drainage in the massaged area. Moreover, increased blood flow after massage reduces tissue anoxia due to vascular compression caused by sustained muscle contraction (Powar et al., 2016).

The present study is compatible with Cho et al., (2012) who conducted a study in Korea about

"Effects of Oketani Breast Massage on Breast Pain, the Breast Milk pH of Mothers, and the Sucking Speed of Neonates" which indicated that Oketani breast massage is effective in relieving breast pain and increasing breast milk pH as well as the sucking speed of neonates. It is also in line with Witt et al., (2016) who did a study in Cleveland Ohio, USA entitled "Therapeutic Breast Massage in Lactation for the Management of Engorgement, Plugged Ducts, and Mastitis" and found that therapeutic breast massage in lactation can help to relieve acute breast pain associated with milk stasis or breast engorgement. In addition, the current findings is congruent with Chaudhary et al., (2019) who investigated "The Effectiveness of Olive Oil Massage in Reducing Breast Engorgement and Pain among Postnatal Mothers with LSCS Admitted in Selected Hospital at Meerut" and illustrated that breast massage with olive oil is tacit in relieving breast pain among postpartum women with lower Cesarean section. Moreover, it conforms to a study done in India by Sonsale et al., (2022) who studied "The Effectiveness Of Olive Oil Massage On Prevention Of Breast Engorgement Among Post Natal mothers, Admitted In Selected Hospital, At Jalna, Maharashtra" and revealed that olive oil breast massage is a simple, safe, cheap and easy technique of breast pain management.

In addition, breast edema was evaluated by using Newton's Scale in the present study, whereas it was significantly decreased sharply among the study group after intervention, compared to their counterparts (Table V). Breast edema is associated with breast engorgement due to vascular and lymphatic stasis. Therefore, breast massage may help prevent blockage of milk ducts and stimulate lymphatic system as well as increase blood flow to breast tissue and improve the flow of milk. If breast edema is not relieved, milk production will be interrupted, with later re-absorption of residual milk. Increased pressure in milk ducts also make the remaining milk to undergo an intermolecular transformation and become thicker (Powar et al., 2016; Marcin, 2019 & Eske, 2020). The present study is remarkably congruent with Ahmed et al., (2020) who did the study in menoufia entitled "A randomized Controlled Study on the Effects of Extra Virgin Olive Oil Compared to Breast Milk on Painful and Damaged Nipples during Lactation" and indicated that the application of extra virgin olive oil has better effect on painful and damaged nipples during lactation. Similarly, the current study is consistent with the study done in El-Beheira governorate by Hables&Mahrous, (2021) who investigated the "Effect of Olive Oil, Coconut Oil, Breast Milk on Nipple Soreness among Lactating Mothers" and found that olive oil, coconut oil and

breast milk had positive effect on management of nipple soreness, breast milk had least effect while olive oil had highest effect.

Moreover, when level of pyrexia was estimated using Pyrexia Chart in the current study, decline was observed among the study group after intervention, in comparison to the other group, although the relationship between them was not statistically significant (Table VI). Actually, olive oil was used as a traditional medicine for the treatment of fever, since it is one of the essential oils that can help protect against bacterial and fungal infections. Olive oil has four important components (peroxide, anisidin, iodine and aldehyde), which carry antibacterial and antifungal properties. It also has phenolic and very high vitamin E components that are naturally able to remove toxins from the body and reduce inflammatory reactions (Caramia et al., 2012; Iftikhar, 2019; Tristanti et al., 2021; Andayani & Saleh 2022). The current study is fairly conformable with the two studies carried out in Menoufia and El-Beheira governorates, Egypt, where it was detected that olive oil application on breast nipples has greater effect on erythema associated with nipples' trauma and soreness during lactation (Ahmed et al., 2020; Hables & Mahrous, 2021).

Generally, the degree of breast engorgement was determined in the present study by summing up the previously discussed parameters (breast redness, pain, edema & pyrexia). It was discovered that severe breast engorgement highly significantly fell sharply among the study group after intervention, as opposed to the control group (Table VII). As mentioned before; olive oil contains oleic acid and antioxidants, which can help fight inflammation. On the other hand, breast massage may help prevent blockage of milk ducts, stimulate lymphatic system, increase blood flow to breast tissue and improve the flow of milk. It also reduces pain by nerve ending stimulation, stretching the soft tissue and removing of metabolic wastes (Lin, 2018; Marcin, 2019 & Eske, 2020).

The present finding relatively supported with the study implemented in India by Krishnaveni, (2014) titled in "Effectiveness of Breast Massage on Reduction of Breast Engorgement among Mothers Undergone Caesarean Section Admitted In Selected Hospital at Tirunelveli" who found that breast massage with olive oil was successful in relieving breast engorgement among post-partum women with cesarean section. It also matches a study conducted in Uttar Pradesh, India, where it was noticed that olive oil massage was effective in breast engorgement management among post-partum women with LSCS (Chaudhary et al., 2019). In addition, the current finding is in accordance with a study fulfilled in Maharashtra, India, where it was evidenced that olive

oil breast massage is a simple, safe, cost effective and easy method of breast engorgement treatment (Sonsale et al., 2022).

Finally, successful breastfeeding was evaluated in the current study using latch on scale, whereas it was highly significantly increased sharply among the study group after intervention, contrasted to the other group (Table VIII). This was expected since latch on is difficult in case of too hard breasts due to engorgement. Therefore, breast massage with olive oil helps in softening the breast tissue and ensuring much easier latch on as well as making nursing easier and more effective (Ratnam, 2020). The present finding relatively agrees with a study done in Tehran, Iran by Mahdizadeh-Shahri et al., (2021) titled in "The Effect of Oketani Breast Massage on Successful Breastfeeding, Mothers' Need for Breastfeeding Support, and Breastfeeding Self-Efficacy: an Experimental Study" who illustrated that breast massage has a positive effect on the breastfeeding success rate.

To sum up, the present study findings indicate the effectiveness of Olive oil massage in reducing the degrees of severity of breast engorgement among postpartum mothers and promotes successful breastfeeding.

Conclusion

According to the existent study findings, the research hypothesis is accepted. Olive oil breast massage considerably lowers the signs and symptoms of breast engorgement (redness, discomfort, edema, and pyrexia) and assist in good latch on or effective breastfeeding.

Recommendations

The following recommendations are made based on the findings of the current study:

- Health education programs through mass media, especially TV, is needed to raise awareness of lactating mothers regarding the beneficial effect of olive oil breast massage and how to apply it
- Maternity nurses should receive in-service training and attend conferences to raise their awareness of the factors that cause breast engorgement and the importance of employing olive oil breast massage to relieve it
- Specific policies, procedure manuals or posters about the use of olive oil breast massage to reduce breast engorgement should be provided in maternity health agencies

Further studies are needed to:

- Replicate the study on a larger sample size for better generalization.

- Evaluate the efficacy of other complementary and alternative therapies for minimizing breast engorgement.
- Identify predisposing factors for the development of breast engorgement

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