



Efficacy of Non-Thermal Ultrasound on Breast Engorgement in Post-Partum Women

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Abstract:

Background: Breast engorgement is one of the main reasons why women throughout the world stop or reduce the duration of breast feeding. Breast engorgement may result in swelling of the breast, hardness, aching, tenderness, and pain. Breast engorgement occurs in 72% to 85% of women. Purpose: This study was conducted to determine the efficacy of non-thermal ultrasound in the management of breast engorgement.

Subjects: Forty females diagnosed with breast engorgement participated in this study, they were selected randomly from Mubarak General Hospital, Giza Governorate and they were divided into two groups equal in number. Group(A) (twenty patients) All of them treated by non-thermal therapeutic ultrasound along with conventional treatment from the third day after delivery daily for seven days. Also, they advised to do conventional treatment for their breasts in the form of hot packs, massage and ice packs. Group (B) (twenty patients) All of them treated with conventional treatment only daily for 7 days as in group (A).

Materials and Methods: Visual analogue scale for assessing pain level, 6- point self-rated breast engorgement scale for assessing breast engorgement severity, Redness scoring scale for assessing amount of redness and Edema scoring scale for assessing amount of edema, cortisol level in blood plasma and CRP (C- reactive protein) in the blood.

Results: indicate a significant ($P < 0.05$) difference in symptoms of breast engorgement between pre-intervention and post-intervention in both groups, with greater reduction in symptoms in the experimental group(A).

Conclusion: The use of therapeutic non-thermal ultrasound is very effective modality to decrease pain, inflammation, tenderness, redness, and edema in breast engorgement after delivery and is recommended for use in physiotherapy clinical settings.[]

Key words: Breast engorgement, non-thermal ultrasound, postpartum, pain.

1. Introduction

Breastfeeding is the best method to help mothers stay healthy and have a healthy baby. World Health Organization (WHO) recommends that infants should be exclusively breastfed for the first six months of life. However, some of the problems occurring during the early postpartum period have a negative effect on breast sucking and breastfeeding. Therefore, early detection and resolution of breastfeeding problems seen in the postpartum period is essential for maternal and infant health (Karaçam et al., 2018).

Factors affecting breastfeeding in the first week postpartum include breastfeeding problems such as nipple shape, breast pain or injury, inadequate milk supply and breast engorgement. Studies show that approximately 92% of primiparous mother's experience changes in breastfeeding problems. These factors can reduce successful breastfeeding and maternal breastfeeding self-confidence (Monazzami et al., 2019).

After delivery, there is an increment in milk production on the second and third days. At this time if the baby is not fed every 2 h and not well positioned on the breast then milk starts to accumulate in the alveoli that make the breast swollen, hard, warm, and painful and is termed as an engorged breast (Varghese et al., 2020).

Breast engorgement is a common physiological problem during lactation that may cause breast swelling, pain, fever, and eventually cessation of breastfeeding in the early postpartum period (Wong et al., 2017).

Breast engorgement problem was common in early days and also after weeks of breast feeding. This frequent problem can happen to lactating mother who don't or can't breast feed as well as those who do. It is usually caused by an imbalance between milk supply and infant demand, if engorgement left untreated it can lead to potentially serious issues including painful blebs, plugged milk ducts or mastitis (Indrani & Sowmya, 2019).

Breast engorgement can also be termed as the accumulation of milk in the breast. Nevertheless, pain, oedema, and distension in the breast due to fullness prevent breastfeeding in the case of some mothers. This may lead to a sense of failure and cause difficulty in the adaptation process of breastfeeding. If left untreated, it may cause nipple fissure or rupture, mastitis, puerperal fever, and termination of lactation (Karatay et al., 2018).

It generally occurs 2 to 3 days after birth and affects more than two-thirds of women by day 5; however, some women experience this problem on days 9 and 10 postpartum (Khosravan et al., 2017).

Engorgement is most common during the first week of breast-feeding and occurs as a result of delayed, infrequent or interrupted removal of milk from the breast (Lee et al., 2006).

Symptoms of breast engorgement differ from one woman to another. However, breasts that are engorged may feel hard or tight, tender or warm to touch, heavy or full, lumpy and swollen. Usually, the whole of both breasts are affected and painful (Noble & Carole, 2022).

Approximately two days after the baby is born, the mother's breasts are full of milk; this is a normal physiological process where the breasts become heavy and swollen, however, breasts

should not be painful or hard under normal conditions. Breast engorgement occurs when a mother makes more milk than her baby uses. Full breasts can lead to problems such as blocked milk ducts, breast infection, and lack of effective milk supply (Mangesi et al.,2016).

Due to increased secretions, the enlarged alveoli cause damage to milk secreting glands that leads to flattening of nipples or inverted nipples, making it difficult for the newborn to suck the milk that further adds to the engorgement (Yadav et al.,2022).

It is also reported that mothers of newborns who are breastfed more in the first 48 hours have less breast engorgement (Berens et al., 2016).

Breast engorgement associated pain is the second main cause of failure in exclusive breastfeeding in the 1st week after delivery. Its most basic mechanisms are increased vascularization of the breast, milk accumulation in the breast, breast vascular hypertension, and inadequate breast lymphatic drainage (Farshidfar et al.,2020).

Severe Breast engorgement associated pain also results in emotional distress, impaired mother-infant relationships, and increased risk of postpartum depression (Buck et al.,2014).

The risk factors for pathological breast engorgement are related to a late start of breastfeeding, infrequent and short feedings, using supplements, newborn's weak sucking, sudden increase in milk production, nipple lesions, which determining factors include mis-positioning the baby on the breast and a tongue-tie in the infant (Sousa et al.,2012).

Breast engorgement may affect the areola or the main body of the breast (peripheral engorgement) and may affect only one breast or both. Engorged nipple may make the baby unable to breastfeed successfully and this may worsen the engorgement. In the case of concerns about sufficient milk supply, or breast pain and swelling, the problem may become complicated and discourage women from continuing breastfeeding. Women may also receive limited advice and support from health professionals; and the situation may get worse in the case of being unaware of how to manage these conditions (Kamali Moradzade et al.,2013).

Mothers who experience breast engorgement can be treated using either pharmacological or non-pharmacological techniques. Women are increasingly interested in non-pharmacological techniques such as breast milk expression, cool packs, herbal compresses, acupressure, hot and cold compresses, breast massage, and cold cabbage leaves. Because they are more widely accessible, simple to use, convenient, and affordable than medical interventions, these non-pharmacological techniques are gaining more and more attention as effective treatment options (Ketsuwan et al.,2018).

Medication applications, hot and cold applications, cabbage leaf application, breast massage and milking are seen as problem-solving approaches in cases where breasts are overfilled with milk and pain is felt (Gresh et al., 2019).

There are numerous methods for managing breast engorgement as warm application before breastfeeding, cool compresses, cabbage leaves, breast massage, acupuncture, and expressing milk. These methods can help in relieving engorgement symptoms and promote effective latch (Zakarija & Stewart, 2020).

Hot compresses are a safe non-pharmacological technique that offers pain relief along with a rapid natural release of milk without side effects and without requiring the use of any

medication. The heat can reach deep or superficial layers of the skin. Before feeding, applying hot compresses to the breasts and nipples and expressing milk can reduce discomfort and relax blood vessels, resulting in more blood flow to the breast and nipple (Zagloul et al.,2020).

Cold compresses, meanwhile, are used to reduce vascularity and pain and decrease swelling. The first nine to 16 minutes of cold therapy, including cold applications such as ice packs, cold gel packs, and frozen wet towels, initiate a cycle of vasoconstriction where blood flow and local edema are reduced, and lymphatic drainage is improved (Lamadah et al.,2022).

In a study on the effects of cabbage leaf and warm and cold compresses, both treatments were found to reduce the severity of breast engorgement; however, warm and cold compresses were more effective in relieving the pain of engorgement Arora et al (2008).

Therapeutic breast massage in lactation (TBML) provides immediate significant pain reduction for engorgement, plugged ducts, and mastitis. Also, reduces engorgement severity and provides immediate size reduction and, at times, complete resolution for plugged ducts. Furthermore, mothers reported that TBML was helpful both immediately and for future episodes of mastitis and plugged ducts (Witt et al.,2016).

Therapeutic breast massage in lactation provides an immediate, clinically significant reduction in acute breast pain associated with engorgement, plugged ducts, and mastitis (Eidelman et al. 2012).

there are different physical approaches such as ultrasound (pulsed mode), heat and cold compression, lymphatic drainage and K- tapes are found and showed a significantly better option to cure breast engorgement in postnatal women (Zutshi et al.,2023).

Therapeutic ultrasound, education, and massage are the most common interventions provided by physical therapists to mothers with breast symptoms in clinical practice (Diepeveen et al. 2019).

Ultrasound treatments accord a theoretical reason that ultrasound removes the milk by easing milk meltdown from an engorged breast which leads to a reduction in pain and breast hardness (McLachlan et al.,1991).

Subjects, Materials and Methods

Subjects:

This study will be carried out on forty postpartum women suffering from breast engorgement a few days after the birth. They will be selected randomly from the outpatient clinic of gynecology and obstetrics of Mubarak General Hospital. Their ages will be ranged from 25-35 years old; their body mass index (BMI) will not exceed 30 kg \m² and their parity will be ranged from (1-3) children. All of them are experienced normal delivery.

Table (1): Illustrates Demographic characteristics of the two studied groups (A&B).

	Group A (n= 20)	Group B (n= 20)	t value	p value
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Age (yrs.)	29.20 ± 2.02	28.95 ± 2.37	0.359	0.721
Weight (kg.)	82.75 ± 5.04	82.92 ± 5.30	-0.107	0.915
Height (cm)	168.45 ± 4.57	168.85 ± 5.00	-0.264	0.793
BMI (kg/m ²)	29.30 ± 0.72	29.22 ± 0.69	0.360	0.721

Data are expressed as mean ± SD.

NS= p> 0.05= not significant.

Materials:

1-Consent form: (Appendix I):

Each patient in both group (A&B) will be asked to sign on the consent form before participating in this study.

2- Recording data sheet: (Appendix II):

It will be used to record all data of each patient in both groups (A&B) in it before starting the treatment course. It will include name, age, address, occupation, diagnoses, chief complain, number of the parity, type and date of labor, past and present history as well as family history.

3- Weight- height scale:

It will be used to measure weight and height of each patient in both group (A&B) to calculate body mass index (BMI) through this equation.

$BMI = \text{body weight (Kg) / Square of body Height (m}^2\text{)} = \text{kg/m}^2\text{.}$

4- Ultrasonic device: This device will be used to treat all patients of group (A).

5- Sono gel: It will be used as coupling medium for ultrasound.

6- Hot Packs: They will be used to treat all patients in both groups (A&B).

7- Ice Packs or Ice Cups: They will be used to treat all patients in both groups (A&B).

8- Johnson baby oil: It will be used to be placed on the skin before using ice to prevent ice cubes burn.

9- Condoms: They will be used to cover the transducer head of ultrasound to prevent transmission of infection.

10- Visual analog scale (VAS) Appendix III: It will be used by each patient in both groups (A&B) to estimate intensity of her pain in both breasts before and after treatment course (7days).

11- Syringes: They will be used to withdraw blood sample from each patient in both groups (A&B) before and after the treatment course to measure cortisol level in blood plasma and CRP (C- reactive protein) in the blood.

12- Six-point engorgement scale: It will be used by each patient in both groups (A&B) to assess the degree of breast engorgement before and after treatment course (7days).

13- Breast redness and edema around areola assessment scale: It will be used by the researcher to evaluate redness and edema associated with breast engorgement in two breasts of each mother in both groups (A&B). It will be done before and after treatment course (7days).

14- Stopwatch:

It will be used to determine the time of each treatment session.

15- Plinth, white sheets, towels, bottle of alcohol and a bag of cotton.

A) Evaluative Procedures:

- 1) All data of each patient in both groups (A&B) will be recorded in the recording data sheet before starting the treatment course.
- 2) Weight and height of each patient in both groups (A&B) will be measured and BMI will be calculated before starting the treatment course.
- 3) Each patient in both groups (A&B) will be asked to put a mark on visual analogue scale (VAS) to estimate the intensity of her pain in her breasts. This will be done before and after the treatment course.

B) Treatment procedure:

➤ Study group (group A):

Each patient in this group will be asked to take off her T-shirt as well as her supportive bra and lie on the plinth in crock lying position. Then the patient will be covered with a white sheet except the treated areas (her breasts). After that, the ultrasonic device will be adjusted on the following parameters:

- Frequency: 1MHZ.
- Intensity: 0.5 to 1 W/cm².
- Mode : pulsed mode.
- Duration : 10 minutes.

After adjusting the parameters of the ultrasonic device, the skin of both breasts will be cleaned with a piece of cotton immersed in alcohol and sufficient amount of sono gel will be placed on right breast, while the transducer head of the ultrasonic device (treatment head) will be covered by a condom to avoid transferring infection. After that, the physiotherapist will hold the transducer head from its hand and put it in contact with the skin of the right breast. Then, the physiotherapist will switch on the ultrasonic device and start to move the transducer head over the skin of right breast in circular movement, starting from downward near the areola then moving upward towards chest, then descend downward on back of the breast.

This process will be continued for 10 minutes. After that the transducer head will be transferred and placed on the skin of left breast, and the same procedure will be repeated for another 10 minutes. Then, the ultrasonic device will be switched off, the condom will be removed from the transducer head and both breasts will be cleaned with a piece of cotton. After finishing the ultrasonic session, the patient will be asked to use conventional therapy from 8 to 12 times/day for 7days. The conventional therapy will be done as the following:

- Put warm hot packs on your breasts for only 2 minutes before breastfeeding to smooth them and help milk flow. Don't do this for more than 2 minutes as too much heat may worsen swelling.
- Massage your breasts gently during breastfeeding to help the milk drain effectively.
- Put some baby oil on your breasts, then put ice packs or wrap some ice cubes in a towel and start making ice massage for your breasts after breastfeeding for 40 minutes (20 minutes for each).

Also, each mother will receive some instructions about breastfeeding to be followed during treatment course as the following: -

- (1) Feed your baby frequently from your breasts. You should empty your breasts as much as possible to keep milk flowing. So, feed on demand between 8-12 times every 24 hours.
- (2) Express a little milk, either by hand or with a breast pump before breastfeeding to help soften your nipple and the areola so, it is easier to latch on.

(3) Pumping your breast to relieve your engorged breast if necessary. Sometimes your milk production may exceed your baby's needs and you still feel very full, so use a breast pump to pump of some milk to soften your breasts. It is best not to pump too often unless your lactation consultant has advised you to do this. Because doing a lot of pumping can result in oversupply of breast milk.

(4) If you use a pump and you aren't getting much milk, then it is probably swelling that is causing your breasts to be hard. Stop pumping if you don't get any milk within 5 minutes.

(5) Massage your breast gently while feeding to help the milk drain effectively.

(6) If your baby is unable to breast feed, replace the feeds with expressions. Pump your breasts until they feel much softer, a minimum of 8 times every 24 hours.

(7) If your breasts are leaking milk, try a warm shower or apply a warm hot pack just before breastfeeding to sooth them and help milk to flow. Don't do this for more than 2 minutes as too much heat may worsen swelling.

(8) Apply ice packs or use ice cubes wrapped in a towel to make ice massage on your breasts for 40 minutes (20 minutes for each) after a feed to reduce swelling and relieve pain.

(9) Try reverse pressure softening technique that can move excess fluids from the breast. Also, you can tuck clean cabbage leaves.

(10) Wear a properly fitted nursing bra.

(11) Don't skip feeds or stop breastfeeding suddenly as you could make the engorgement worse.

(12) Seek medical advice if you develop a fever of around 38°C or above.

(13) Avoid any kind of nipple stimulation.

➤ Control group (group B):

Each patient in this group will be asked to use conventional therapy from 8 -12 times /day for 7 days and follow the same instructions as in group (A).

Results

Comparison between the two groups (A&B) regarding to VAS scores before and after treatment course:

Table (2) and Figs. (1&2) illustrate mean \pm SD of VAS scores before and after treatment for both groups (A&B).

Variables	Group A		Group B	
	Before treatment	After treatment	Before treatment	After treatment
Mean \pm SD	3.60 \pm 0.50	0.75 \pm 1.02	3.65 \pm 0.49	2.75 \pm 1.12
MD	2.85		0.90	
t# value	13.656		3.596	
p value	0.001		0.002	
% of $\downarrow\downarrow$ in VAS scores.	79.17 %		24.66 %	
Significance	Highly significant		Highly significant	

MD= Mean difference.

By comparing the two groups (A & B) after treatment regarding to VAS scores, it was found that, both groups showed a decrease in pain sensation after treatment course, group (A) achieved 79.17% while group (B) achieved 24.66% but the percentage of decrease in pain sensation was more pronounced and more noticeable in group (A) when compared with group (B), this means that non-thermal therapeutic ultrasound was very effective in decreasing pain in breast engorgement after delivery.

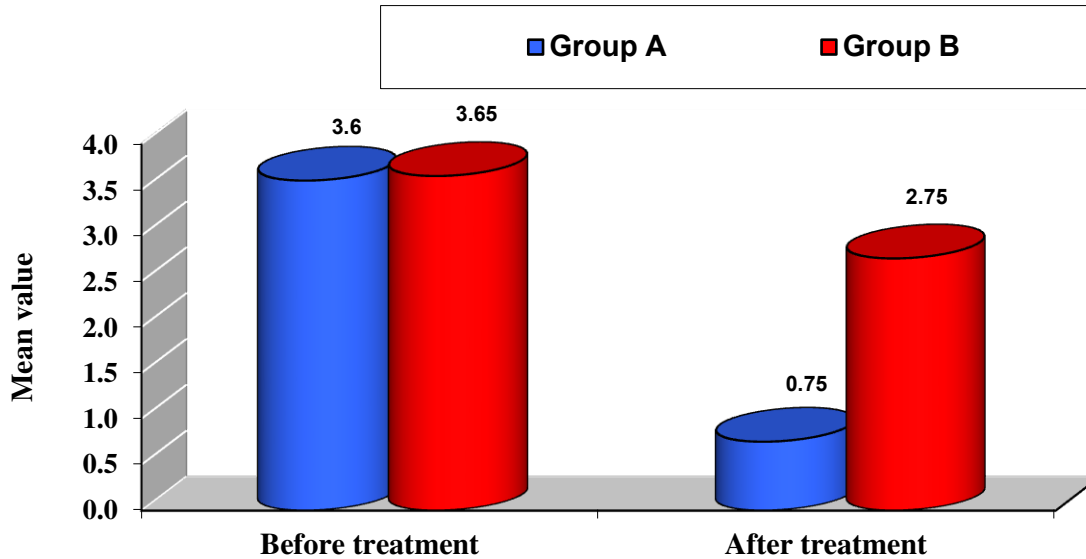


Fig. (1): Illustrates mean values of VAS measured before and after treatment in the two studied groups (A & B).

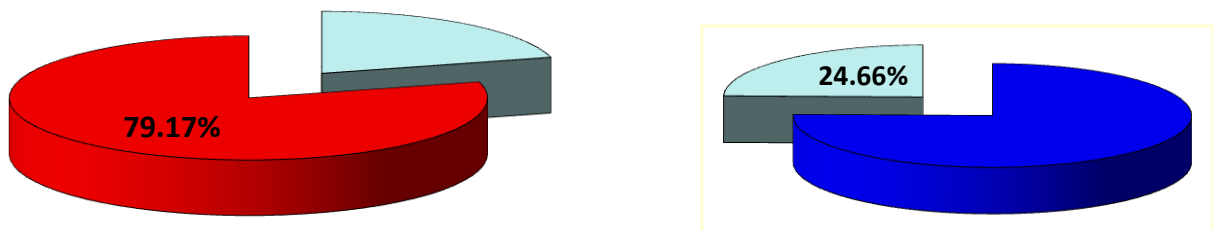


Fig. (2): Illustrates percentage of decrease in pain sensation after treatment in both groups (A & B).

- Comparison between the two groups (A & B) regarding to serum cortisol level in blood plasma before and after treatment course:

Table (3) and Figs. (3&4) illustrate mean ± SD for serum cortisol before and after treatment for both groups (A & B).

Variable	Group A		Group B	
	Before treatment	After treatment	Before treatment	After treatment
Mean ± SD	18.72 ± 2.20	8.52 ± 3.91	19.50 ± 2.30	16.27 ± 4.67
MD	10.20		3.23	
t# value	15.673		4.278	
p value	0.001		0.001	
% of ↓↓ in cortisol level	54.49 %		16.56 %	
Significance	Highly significant		Highly significant	

MD= Mean difference.

By comparing the two groups (A & B) after treatment regarding to serum cortisol level, it was found that, both groups showed a decrease in serum cortisol level after treatment, group (A) achieved 54.49% while group (B) achieved 16.56% but the percentage of decrease in serum cortisol level was more pronounced and more noticeable in group (A) when compared with group (B), this means that therapeutic ultrasound was very effective in decreasing serum cortisol level in breast engorgement after delivery.

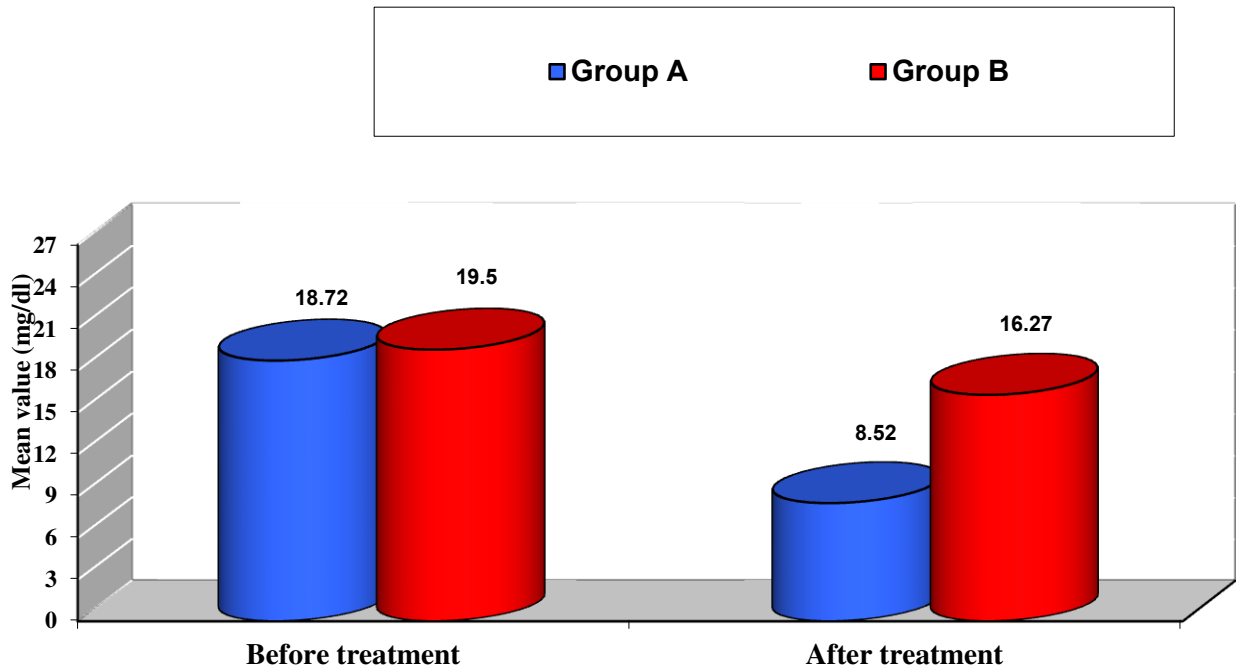


Fig. (3): Illustrates mean values of serum cortisol measured before and after treatment in the two studied groups (A & B).

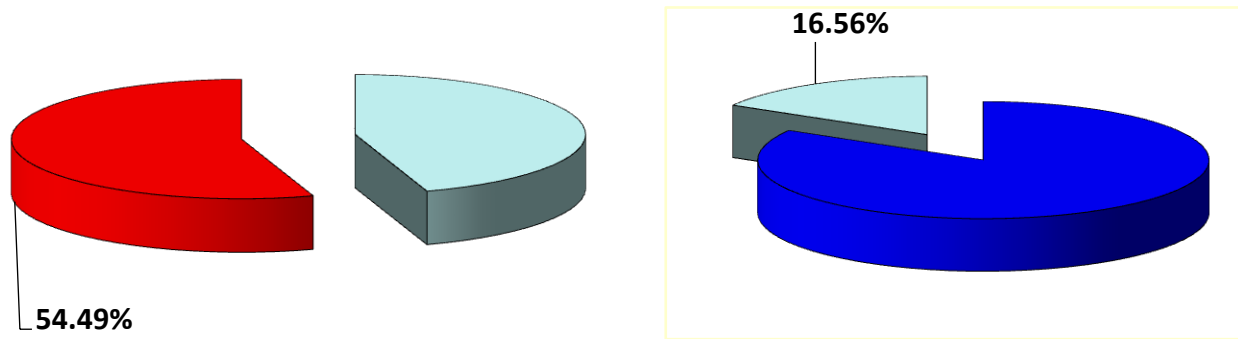


Fig. (4): Illustrates percentage of decrease in serum cortisol level after treatment in both groups (A & B).

- Comparison between the two groups (A & B) regarding to serum CRP level in blood plasma:

Table (4) and Figs. (5 & 6) illustrate mean ± SD for serum CRP before and after treatment for both groups (A & B).

Variables	Group A		Group B	
	Before treatment	After treatment	Before treatment	After treatment
Mean ± SD	27.72 ± 5.98	3.12 ± 6.53	29.55 ± 6.43	24.40 ± 9.92
MD	24.60		5.15	
t# value	14.573		19.000	
p value	0.001		0.001	
% of ↓↓ in CRP	88.74 %		17.43 %	
Significance	Highly significant		Highly significant	

MD= Mean difference.

By comparing the two groups (A & B) after treatment regarding to serum CRP level in blood plasma, it was found that, both groups showed a decrease in serum CRP level after treatment, group (A) achieved 88.74% while group (B) achieved 17.43%, but the percentage of decrease in CRP was more pronounced and more noticeable in group (A) when compared with group (B), this means that therapeutic ultrasound was very effective in decreasing inflammation in breast engorgement after delivery.

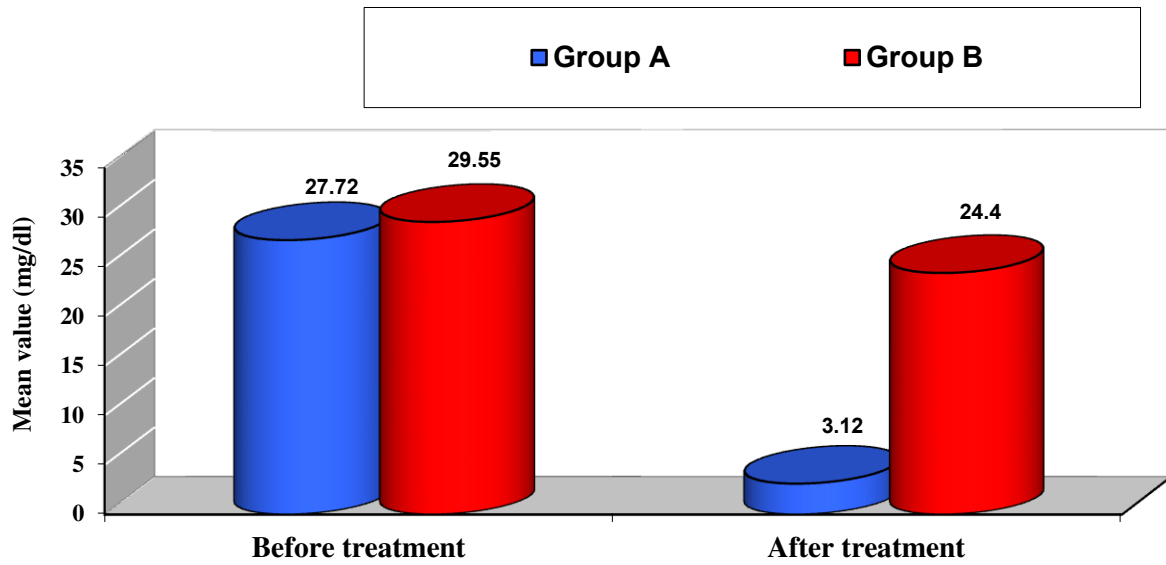


Fig. (5): Illustrates mean values of serum CRP measured before and after treatment in the two studied groups (A & B).

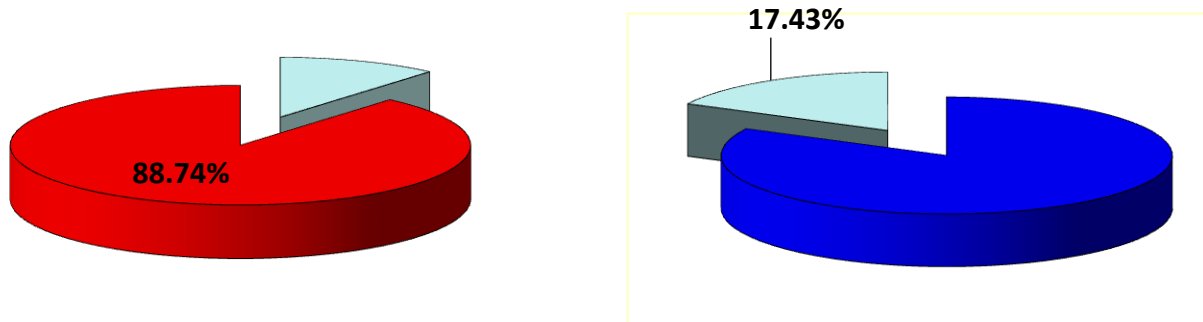


Fig. (6): Illustrates percent of decrease in serum CRP after treatment in both groups (A & B).

- Comparison between right breasts regarding to 6-point scale in both groups (A&B):

Table (5) and Figs. (7&8) illustrate mean \pm SD for 6-point scale in right breasts before and after treatment in both groups (A & B).

Variables	Group A		Group B	
	Before treatment	After treatment	Before treatment	After treatment

Mean ± SD	5.60 ± 0.50	1.90 ± 1.17	5.65 ± 0.49	4.70 ± 1.42
MD	3.70		0.95	
t# value	15.308		3.329	
p value	0.001		0.004	
% of ↓↓ in 6-point scale	66.07 %		16.81 %	
Significance	Highly significant		Highly significant	

MD= Mean difference.

By comparing the two groups (A & B) after treatment regarding to 6 point scale, it was found that, right breasts in both groups (A&B) showed a decrease in 6 point scale after treatment, group (A) achieved a percentage of decrease about 66.07% while group (B) achieved a percentage of decrease about 16.81% but the percentage of decrease in 6 point scale was more pronounced and more noticeable in right breast in group (A) when compared with group (B), this means that therapeutic ultrasound was very effective in decreasing tenderness and hardness in breast engorgement after delivery.

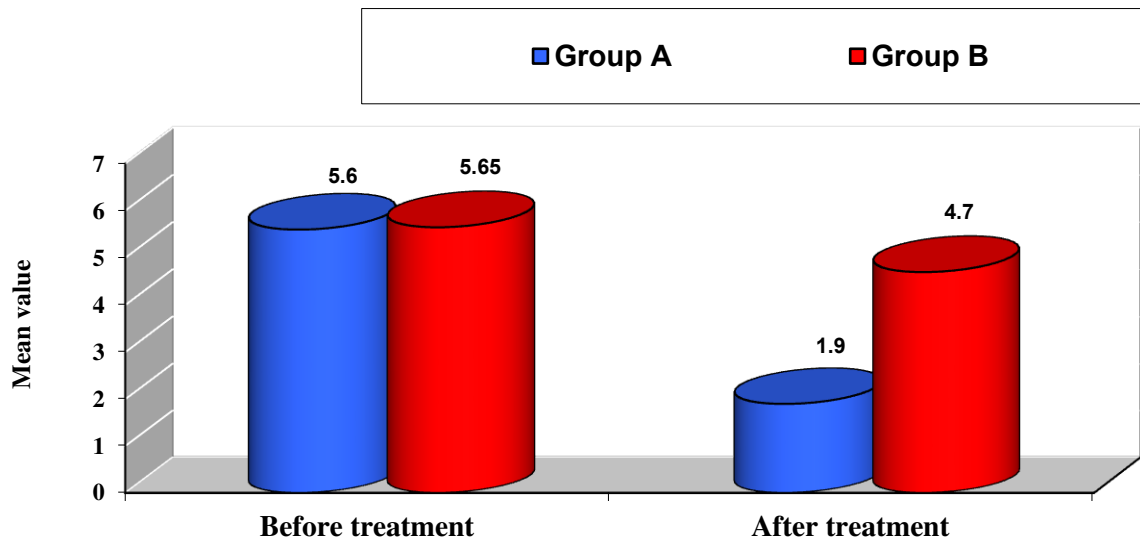


Fig. (7): Illustrates mean values of 6-point scale measured before and after treatment in the two right breasts in both groups (A & B).

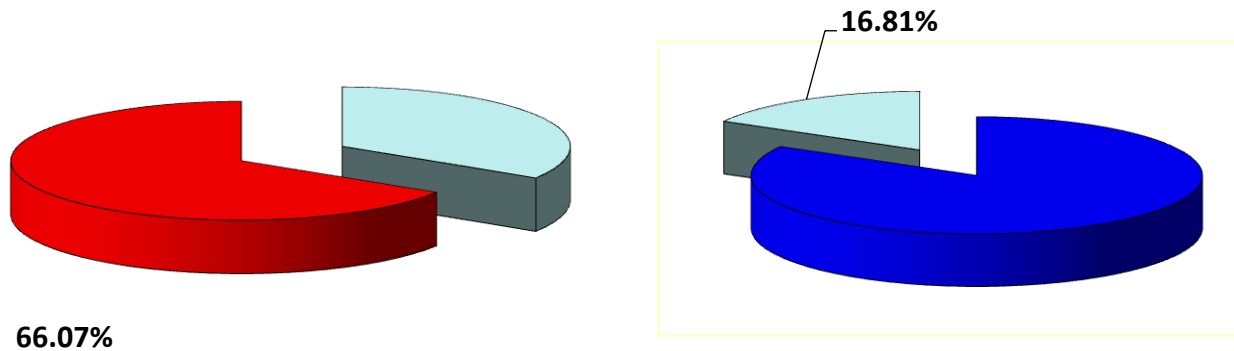


Fig. (8): Illustrates percentage of decrease in 6-point scale after treatment in right breasts in both groups (A & B).

- Comparison between the two groups (A & B) regarding to 6-point scale for left breasts in both groups (A&B):

Table (6) and Figs. (9& 10) illustrate mean ± SD for 6-point scale for left breasts before and after treatment for both groups (A & B).

Variables	Group A		Group B	
	Before treatment	After treatment	Before treatment	After treatment
Mean ± SD	5.65 ± 0.49	1.70 ± 1.03	5.70 ± 0.47	4.70 ± 1.38
MD	3.95		1.0	
t# value	15.415		3.082	
p value	0.001		0.006	
% of ↓↓ in 6-point scale	69.91 %		17.54 %	
Significance	Highly significant		Highly significant	

MD= Mean difference.

By comparing the two groups (A & B) after treatment regarding to 6 point scale for left breasts in both groups (A&B), it was found that, left breast in both groups (A&B) showed a decrease in 6 point scale after treatment, group (A) achieved 69.91% while group (B) achieved 17.54% but the percentage of decrease in 6 point scale was more pronounced and more noticeable in group (A) when compared with group (B), this means that therapeutic ultrasound was very effective in decreasing tenderness and hardness in breast engorgement after delivery.

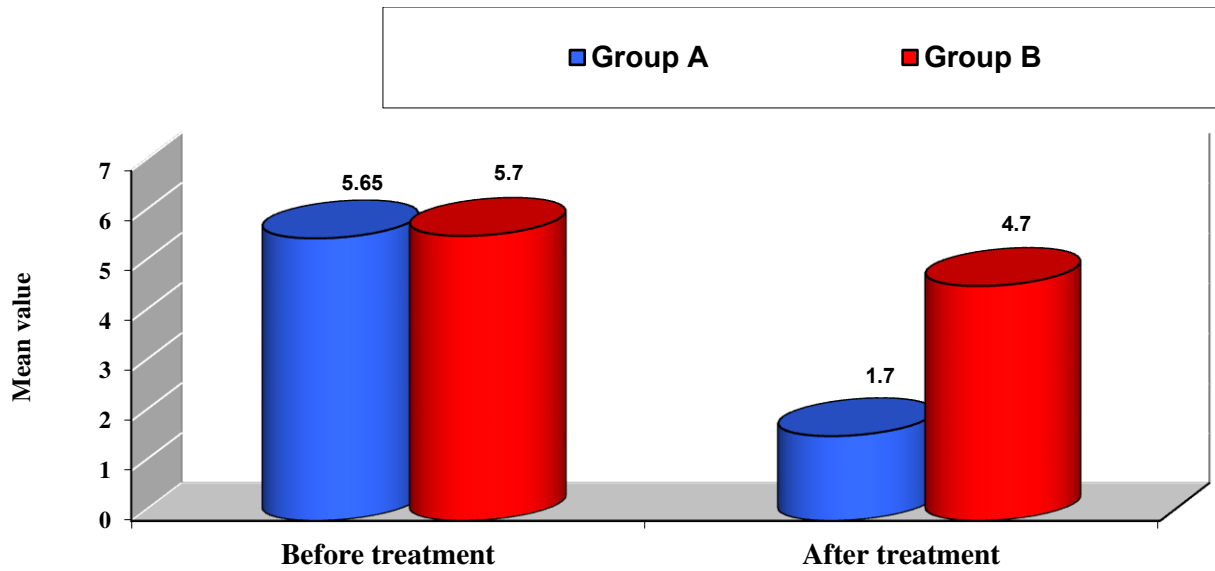


Fig. (9): Illustrates mean values of 6-point scale measured before and after treatment in the two studied groups (A & B).

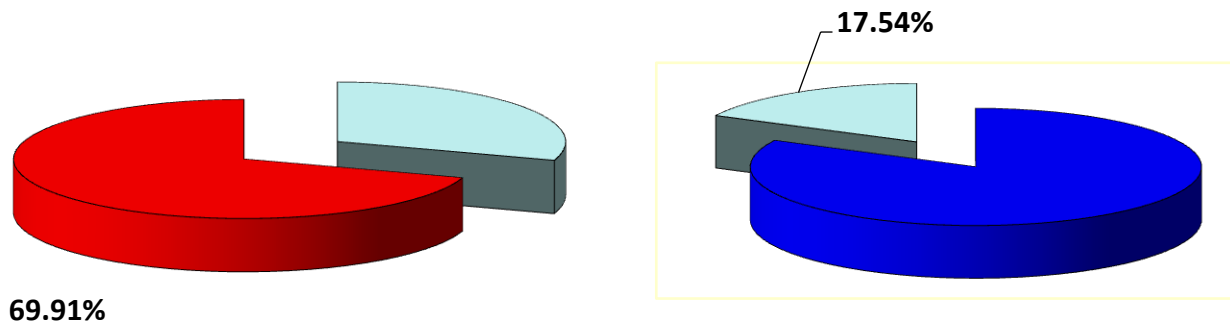


Fig. (10): Illustrates percentage of decrease in 6-point scale in left breasts after treatment in both groups (A & B).

- Comparison between the two groups (A & B) regarding to redness scoring scale for all (right breasts):

Table (7) and Figs. (11 &12) illustrates mean ± SD for redness scoring scale for all (right breasts) before and after treatment in both groups (A & B).

Variables	Group A		Group B	
	Before treatment	After treatment	Before treatment	After treatment

Mean ± SD	3.60 ± 0.50	1.30 ± 0.57	3.75 ± 0.44	3.00 ± 0.92
MD	2.30		0.75	
t# value	18.006		3.943	
p value	0.001		0.001	
% of ↓↓ in redness scoring scale	63.89 %		20.0 %	
Significance	Highly significant		Highly significant	

MD= Mean difference.

By comparing the two groups (A & B) after treatment regarding to redness scoring scale for all (right breasts), it was found that, both groups showed a decrease in redness scoring scale after treatment, group (A) achieved 63.89% while group (B) achieved 20.0% but the percentage of decrease in redness scoring scale was more pronounced and more noticeable in group (A) when compared with group (B), this means that therapeutic ultrasound was very effective in decreasing redness in breast engorgement after delivery.

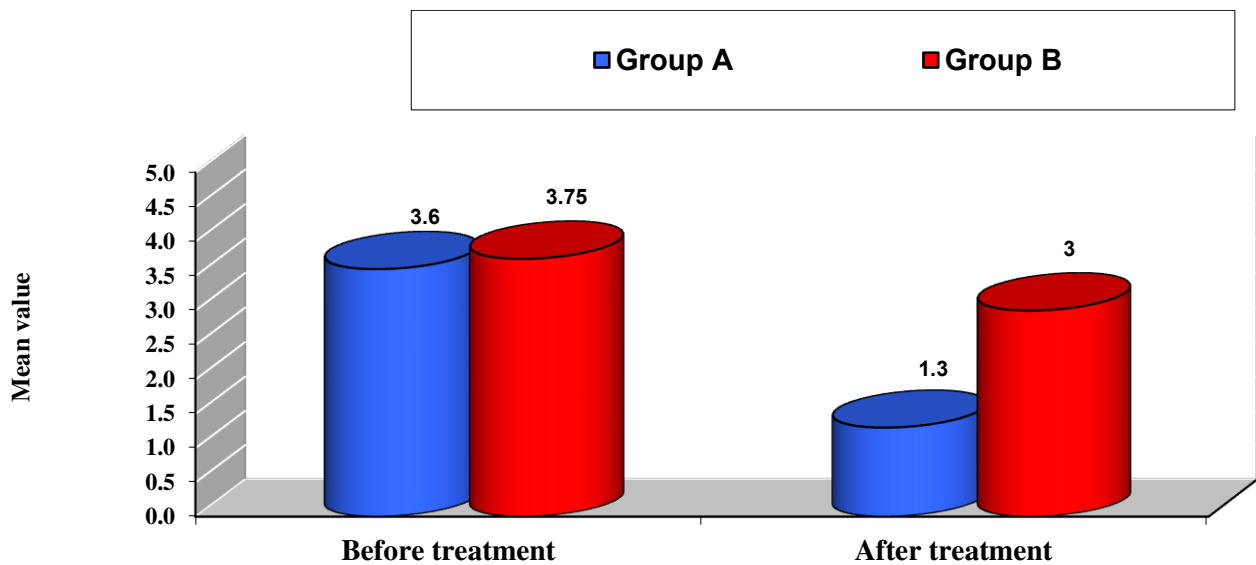


Fig. (11): Illustrates mean values of redness scoring scale for all (right breasts) measured before and after treatment in the two studied groups (A & B).

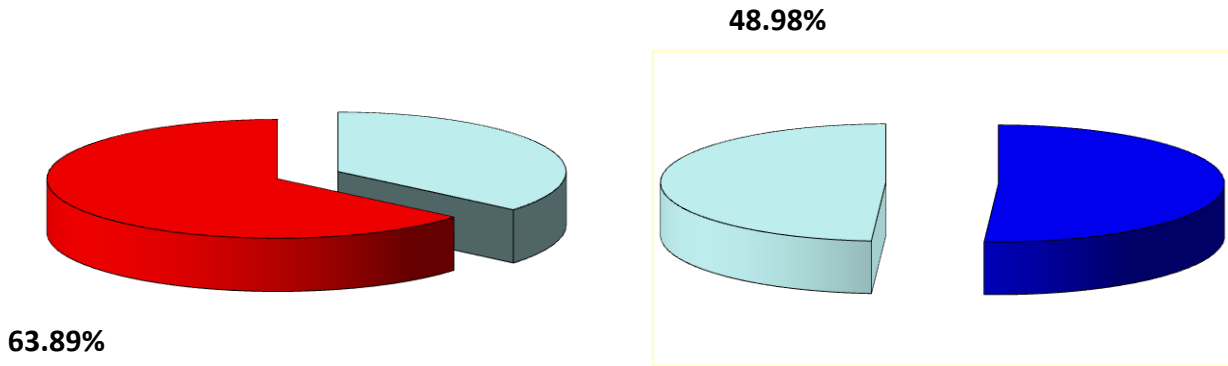


Fig. (12): Illustrates percentage of decrease in redness scoring scale in (right breasts) after treatment in both groups (A & B).

- Comparison between the two groups (A & B) regarding to redness scoring scale for all (left breasts):

Table (8) and Figs. (13 &14) illustrate mean ± SD for redness scoring scale for (left breasts) before and after treatment in both groups (A & B).

Variables	Group A		Group B	
	Before treatment	After treatment	Before treatment	After treatment
Mean ± SD	3.65 ± 0.49	1.25 ± 0.44	3.70 ± 0.47	3.20 ± 0.77
MD	2.40		0.50	
t# value	15.771		3.249	
p value	0.001		0.004	
% of ↓↓ in redness scoring scale	65.75 %		13.51 %	
Significance	Highly significant		Highly significant	

MD= Mean difference.

By comparing the two groups (A & B) after treatment regarding to redness scoring scale for (left breasts), it was found that, both groups showed a decrease in redness scoring scale after treatment, group (A) achieved 65.75% while group (B) achieved 13.51%, but the percentage of decrease in redness scoring scale for (left breasts) was more pronounced and more noticeable in group (A) when compared with group (B), this means that therapeutic ultrasound was very effective in decreasing redness in breast engorgement after delivery.

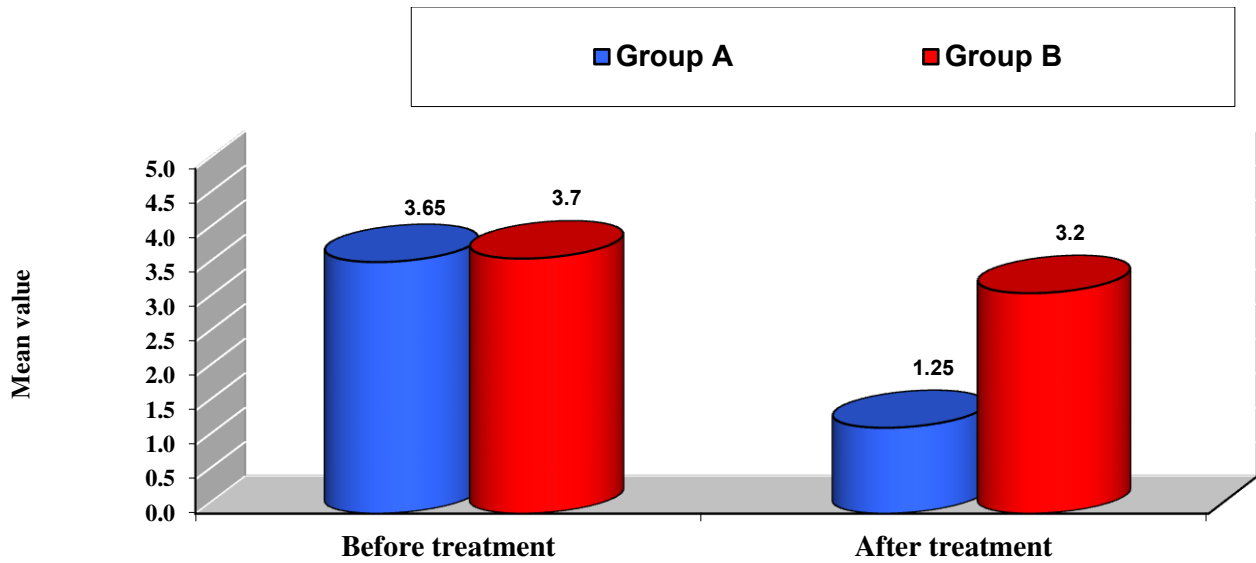


Fig. (13): Illustrates mean values of redness scoring scale of (left breasts) measured before and after treatment in the two studied groups (A & B).

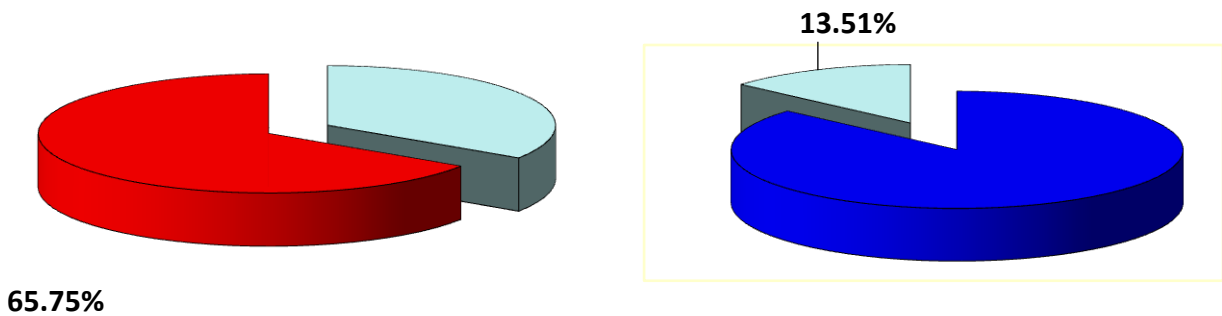


Fig. (14): Illustrates percentage of decrease in redness scoring scale in (left breasts) after treatment in both groups (A & B).

- Comparison between the two groups (A & B) regarding to edema scoring scale for (right breasts):

Table (9) and Figs. (15&16) illustrates mean ± SD for edema scoring scale (right breast) before and after treatment for both groups (A & B).

Variables	Group A		Group B	
	Before treatment	After treatment	Before treatment	After treatment
Mean ± SD	3.60 ± 0.50	1.25 ± 0.55	3.70 ± 0.47	2.90 ± 0.97
MD	2.35		0.80	
t# value	15.667		4.00	
p value	0.001		0.001	
% of ↓↓ in edema scoring scale (Rt. breast)	65.28 %		21.62 %	
Significance	Highly significant		Highly significant	

MD= Mean difference.

By comparing the two groups (A & B) after treatment regarding to edema scoring scale for (right breasts), it was found that, both groups showed a decrease in edema scoring scale after treatment, group (A) achieved 65.28% while group (B) achieved 21.62%, but the percentage of decrease in edema scoring scale was more pronounced and more noticeable in group (A) when compared with group (B), this means that therapeutic ultrasound was very effective in decreasing edema in breast engorgement after delivery.

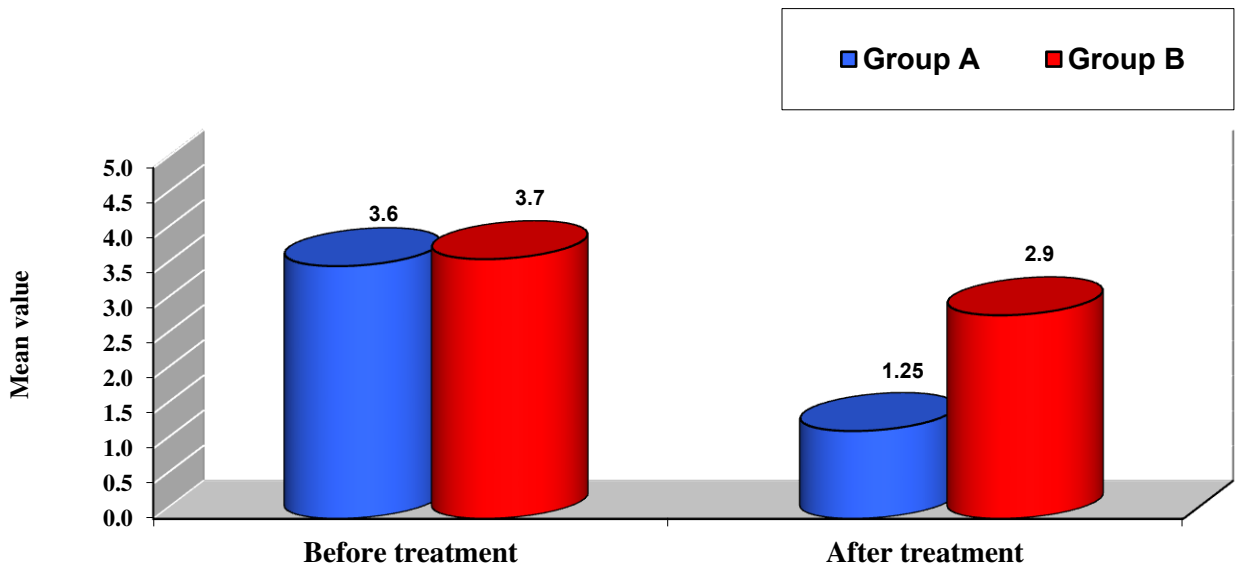


Fig. (15): Illustrates mean values of edema scoring scale for (right breasts) measured before and after treatment in the two studied groups (A & B).

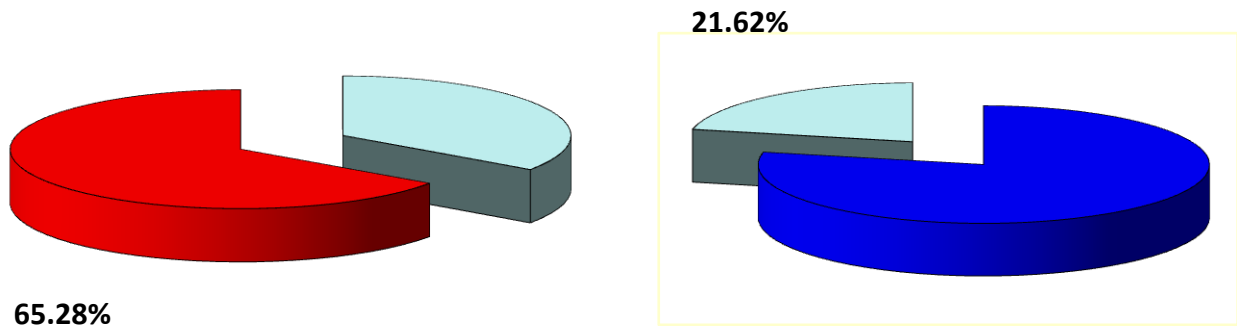


Fig. (16): Illustrates percentage of decrease in edema scoring scale in all (right breasts) after treatment in both groups (A & B).

- Comparison between the two groups (A & B) regarding to edema scoring scale for all (left breasts) in both groups (A&B):

Table (10) and Figs. (17&18) illustrate mean ± SD for edema scoring scale of (left breasts) before and after treatment in both groups (A & B).

Variables	Group A		Group B	
	Before treatment	After treatment	Before treatment	After treatment
Mean ± SD	3.50 ± 0.51	1.25 ± 0.55	3.70 ± 0.47	3.00 ± 0.92
MD	2.25		0.7	
t# value	14.047		3.621	
p value	0.001		0.002	
% of ↓↓ in edema scoring scale (Lt. breast)	64.29 %		18.92 %	
Significance	Highly significant		Highly significant	

MD= Mean difference.

By comparing the two groups (A & B) after treatment regarding to edema scoring scale for all (left breasts), it was found that, both groups showed a decrease in edema scoring scale after treatment, group (A) achieved 64.29% while group (B) achieved 18.92%, but the percentage of decrease in edema scoring scale was more pronounced and more noticeable in group (A) when compared with group (B), this means that therapeutic ultrasound was very effective in decreasing edema in breast engorgement after delivery.

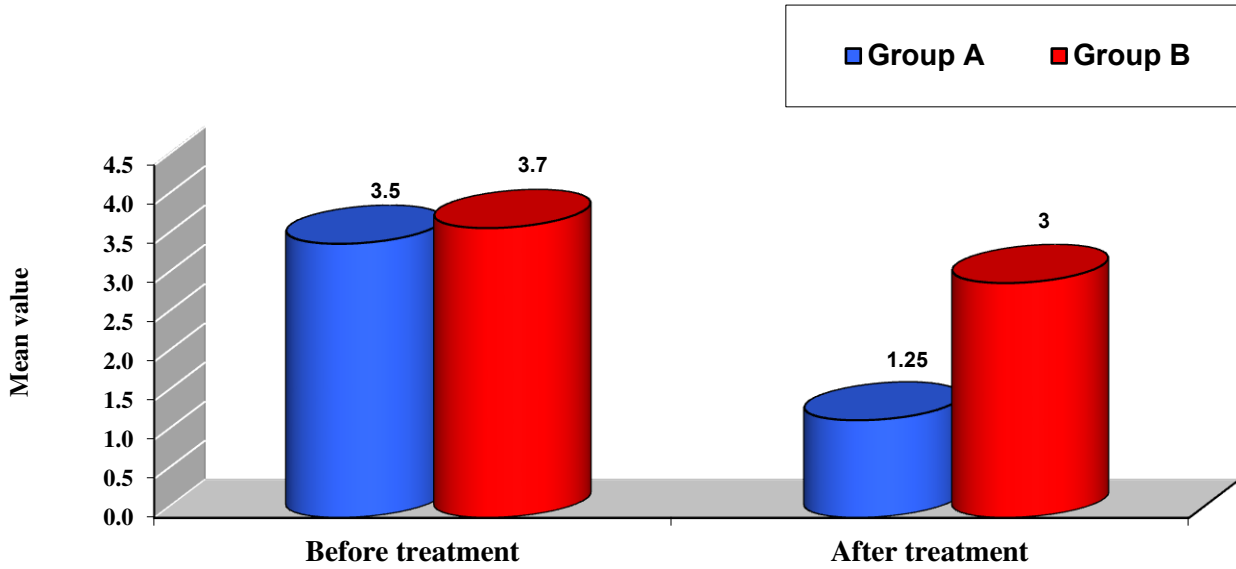


Fig. (17): Illustrates mean values of edema scoring scale for (left breasts) measured before and after treatment in the two studied groups (A & B).

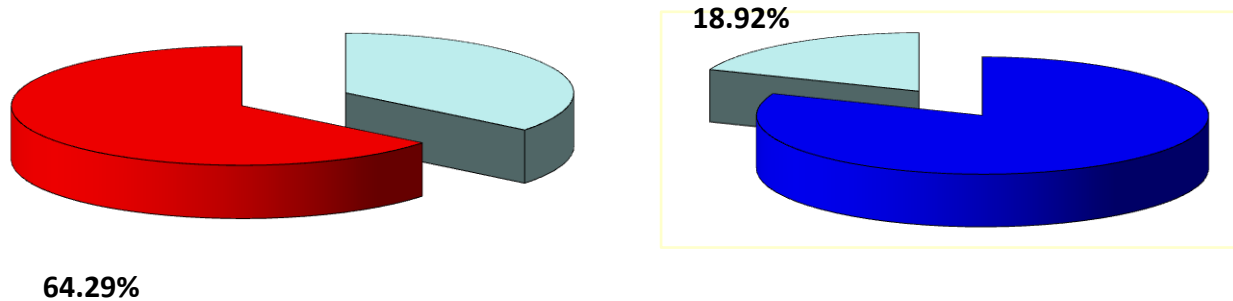


Fig. (18): Illustrates percentage of decrease in edema scoring scale in all (left breasts) after treatment in both groups (A & B).

Discussion

Breast engorgement is a common postpartum problem that has been identified as the third maternal factor that leads to a decrease or discontinuation of breastfeeding and breast abscess (Razmjouei et al.,2020).

Habibu et al. (2017) stated that “ The use of therapeutic non-thermal ultrasound is safe and effective in the management of postpartum breast engorgement by, comparing the effect of non-thermal Ultrasound with conventional treatment and conventional treatment in the treatment of breast engorgement in postpartum mother using VAS and Six- point engorgement scale (SPES) and reported that there was a significant decrease in the pain in ultrasound group” this agrees with results of the present study.

Sankanagoudar et al. (2011) had made an experimental study to investigate the effect of therapeutic non-thermal ultrasound on breast engorgement, by two groups underwent treatment for engorgement which consisted of massage, manual expression of milk and advice on appropriate latching technique for period of two days successively. The experimental group was additionally intervened with therapeutic non thermal ultrasound using Visual Analog Scale (VAS) for pain and Six Point Engorgement Scale (SPES) for engorgement. The results indicated that experimental group showed statistically significant relief in symptoms, and this agrees with results of the present study.

Lin et al. (2023) who found that “participants with breast symptoms and engorgement who received a physical therapy program consisting of therapeutic pulsed ultrasound, education, and massage demonstrated greater improvement in the severity of breast engorgement than the usual care group”. this agrees with results of the present study.

According to dos Santos et al. (2019) by Cross-sectional study, which evaluated the breast engorgement, besides evaluating the pain. The protocol with therapeutic ultrasound was administered at a frequency of 1Mh, pulsed mode, intensity / dose of 0.5w / cm², active cycle of 20%. After application, the infant was submitted to breastfeeding and a new breast evaluation was performed. He stated that “Therapeutic ultrasound has been shown to be effective in reducing pain, increasing milk availability, and improving the stiffness characteristic of breast engorgement” this agrees with results of the present study.

Conclusion

Therapeutic ultrasound is very effective modality to decrease pain, inflammation, tenderness, redness and edema in breast engorgement after delivery.

5. References

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