Effectiveness of Mobile Based-Educational Exercises on Women's Knowledge, Practices, and Arm Lymphedema Degree Post Mastectomy

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Abstract:

Background: Exercise following mastectomy is crucial for female breast cancer patients' recuperation from both the procedure and radiation therapy. It helps them keep their arm and shoulders flexible and reduces adverse effects like arm lymphedema and radiation-induced fibrosis. These exercises can improve arm and shoulder range of motion and are often initiated within a few days. These women need specialized educational intervention to improve their knowledge and practices regarding post-mastectomy exercise and decrease side effects after mastectomy. **Aim:** To determine the effectiveness of mobile-based educational exercises on women's knowledge, practices, and arm Lymphedema degree post-mastectomy. **Design:** quasi quasi-experimental (one group pre-posttest) research design was utilized in the study. **Setting:** The research was conducted at the outpatient clinic of Sohag Oncology Institution. **Subjects**: A purposive sample of 100 post-mastectomy women was included. **Tools: Tool I**: structured interviewing questionnaire, it included three parts: (1) demographic data; (2) medical data, (3) clinical manifestations of lymphedema, **Tool II:** Women's knowledge regarding mobile based-educational exercises post-mastectomy (pre/post) and **Tool III**: Women's practices regarding mobile based-educational exercises post-mastectomy (pre/post). **Results**: According to the study's findings, doctors were the primary source of information for women who had had mastectomy surgery. Following the mobile-based educational exercises, women's knowledge and practices were improved. The post-mastectomy women's practice scores and overall knowledge showed a statistically significant correlation. There was a significant improvement in the degree of arm lymphedema post the mobile educational exercises**. Conclusion:** A mobile-based educational exercise was effective in improving women's knowledge, practices, and arm lymphedema degree post-mastectomy. **Recommendations:** To increase post-mastectomy exercise knowledge and practices, women who have had mastectomy surgery can benefit from mobile-based educational techniques.

Keywords: Mobile education, Post mastectomy exercise, Women's knowledge and practice; and Arm lymphedema.

Introduction:

Breast cancer ranks as the second most prevalent disease globally, constituting over 45.1% of all malignancies in women and serving as the second biggest cause of mortality among women, following lung cancer (Sung et al., 2021). It is the most prevalent invasive cancer among women internationally, impacting roughly 12% of the female population worldwide, and women with a history of breast cancer are at an increased risk of developing cancer in the contralateral breast **(Sathian et al., 2024).**

The systemic cytotoxic effects of

adjuvant therapy, particularly chemotherapy, can harm both neoplastic and healthy cells, resulting in toxicity and unpleasant effects such as pain, nausea, and alterations in taste and smell, despite its importance in inhibiting tumor cell proliferation **(Ferlay et al., 2021).** These variables may influence patients' dietary intake and nutritional status, thereby worsening their prognoses and heightening the risk of disease recurrence **(Drareni et al., 2022).**

Mastectomy is a prevalent intervention for breast cancer. Mastectomy refers to the surgical excision of one or both breasts, either partially or entirely. **The World Health Organization (2020)** states that a mastectomy is commonly performed to treat breast cancer and prevent the progression of infection. Women who have undergone a mastectomy for breast cancer encounter two significant challenges: the loss of their physical attraction and the reality of their illness. **Chan et al. (2020)** assert that post-mastectomy rehabilitation is crucial for women's overall health.

Bland et al., (2018) stated that breast mass (75%), breast shape and size changes (57%), and lump beneath the armpit (56%), pain in one breast (56%) were the most commonly reported symptom by breast cancer patients, while lack of information and late examination at an advanced stage led to a significant increase in the breast cancer mortality rate. A study to find out the most common symptoms experienced by women post-mastectomy. Results revealed that numbness, pain, tenderness, discomfort, tingling sensation, edema, and limited movement of the operated arm were the most common symptoms reported **(Bakri et al., 2023).**

Breast cancer treatments differ based on their severity whereas, the two most common surgical approaches performed are simple mastectomy and modified radical mastectomy. Lymphedema is the most common complication that can occur within weeks, months, or many years later after mastectomy. It is characterized as edema in the right or left arm due to the collection of fluid rich in protein in the interstitial space as a result of mastectomy **(Kilbreath et al., 2023).**

Lymphedema is a prevalent and anticipated side effect of breast cancer treatments, resulting in enduring physical and psychological consequences for patients. It is marked by an aberrant and localized accumulation of protein-rich fluid in the interstitial space, potentially leading to edema and chronic inflammation. Lymphedema continues to be a principal source of morbidity for breast cancer patients who have undergone axillary lymph node dissection **(Sayegh et al., 2017).**

Healthcare professionals encounter challenges stemming from the progressive nature of certain conditions and the absence of effective treatment options. Another contributing factor to lymphoedema is antineoplastic therapy, which not only necessitates prolonged physical rehabilitation and inflicts psychological distress but also diminishes overall quality of life. Furthermore, it increases the risk of concurrent medical conditions, including infections, inflammations, and erysipelas. Chronic edema, localized discomfort, atrophic alterations in the epidermis, and secondary infections represent several of its clinical manifestations. Upon its manifestation, lymphedema associated with breast cancer constitutes a lifelong challenge. Given that there is currently no cure for lymphedema, the primary treatment objectives are to alleviate discomforting symptoms and decrease inflammation **(World Health Organization, 2020)**.

Various techniques employed in the management of post-mastectomy lymphedema include arm exercises, manual lymphatic drainage (MLD), skin and nail care, self-massage, compression bandage, and/or hand sleeves. Through the provision of patient education regarding the signs and symptoms of lymphedema, as well as the importance of early identification, nurses assume a vital role in the prevention of this condition following mastectomy. All patients diagnosed with breast cancer must receive regular assessments and be inquired about any instances of swelling, diminished

range of motion in the extremities, rigidity in the shoulder joint, as well as other symptoms indicative of lymphedema **(Schmitz et al., 2019)**.

Women doing post-mastectomy exercises are those who have undergone a mastectomy or surgical removal of one or both breasts. Following a mastectomy, women are allowed to start exercising immediately. Post-mastectomy exercises might enhance arm and shoulder mobility within a few days. Post-mastectomy, arm-strengthening activities may prove advantageous **(Sagen et al., 2019).** Post-mastectomy exercise can facilitate the care and rehabilitation of cancer patients, enhancing their recovery from treatment. The duration of the follow-up period determines whether the alleviation of shoulder discomfort related to breast cancer in women undergoing exercise therapy is temporary or persistent. Post-complete mastectomy, early shoulder mobilization has demonstrated efficacy in preventing shoulder pain and dysfunction **(Hartmann et al., 2020).**

The establishment of a comprehensive training program for patients, aimed at reinforcing their understanding and addressing their concerns, possesses the potential to significantly improve the quality of patient care **(Erdogan & Bulut, 2020)**. The efficacy of rehabilitation can be markedly enhanced through the integration of knowledge, attitude, and practice (KAP)-oriented rehabilitation education. By evaluating patients' understanding of their condition, their attitudes toward treatment and recovery, as well as their practices in symptom management and adherence to postoperative care, researchers may determine areas where interventions are necessary to enhance patient outcomes. For instance, in cases where patients possess an inadequate understanding of their medical condition, educational interventions may be developed to enhance their knowledge and facilitate informed decision-making **(Wang et al., 2020).**

Conventional health education methodologies demonstrate limited effectiveness in enhancing patient knowledge and influencing behavioral practices **(Parhiz et al., 2023).** Nevertheless, advancements in information technology have created new opportunities for patient education. Mobile and web-based training programs have gained significant popularity, supplanting traditional face-to-face sessions **(McMullan, 2020).** Individuals possessing Internet access can utilize online resources to enhance their healthcare decision-making processes **(Morahan-Martin, 2024).** Researchers globally are investigating the potential of mobile-based training as a means to enhance health outcomes and prevent disease. The quick advancement of mobile phone applications created an innovative approach to health promotion and disease prevention. A large number of research has supported the effectiveness of mobile phones in promoting educational interventions across broad health areas, including type 2 diabetes mellitus **(Garabedian et al., 2020),** weight, and the encouragement of physical activity **(Direito et al., 2020),** the enhancement of self-management behaviors **(Tinschert et al., 2017),** and the prevention of sexually transmitted infections **(Kazemi et al., 2021).** These findings suggest that emerging technologies can significantly contribute to the improvement of patient education and outcomes, especially in the context of post-operative care.

As noted by **Eskandari et al. (2019)**, mobile-based education demonstrates efficacy in improving health outcomes due to their provision of programming flexibility and diversity (i.e., they are multifunctional). Furthermore, this mobile-based education can deliver high-quality information and personalized support continuously, all while incurring minimal costs for both the user and the healthcare provider.

Nurses play an important role in the prevention of post-mastectomy lymphedema by providing patient education prior to the onset of symptoms and facilitating early detection. Arm training is essential for the rehabilitation of patients following mastectomy, as it significantly improves the strength and functionality of the upper limb muscles, alleviates pain and distress, and enhances the overall quality of life and self-confidence **(Hsiao et al., 2024).**

Nurses' primary responsibilities include maintaining current educational models and devising solutions for students' lack of mobility, flexibility, and adaptability to their needs and the necessity for education to be accessible at all times and locations. Thus, mobile education skills can aid in overcoming some of the difficulties. The study examines the key traits, advantages, and current obstacles to the most adaptable learning style by incorporating collaborative learning features and mobile technologies functionalities **(Sagen, 2019).**

Nursing must discuss strategic methods to accommodate diverse learning styles by incorporating advanced technologies into various educational formats and conducting further research to evaluate the effects of booklet-based versus mobile-based education on women's knowledge and practices concerning exercise post-mastectomy **(World Health Organization, 2020).**

Significance of the study:

Exercise can improve blood and lymph circulation after mastectomy and avoid joint stiffness and muscle shortening (**Sagen, et al., 2019**). Breast cancer accounts for 38.8% of all cancers in Egypt's female population, making it the most frequent disease. In 2020, there were an expected 22,700 instances of breast cancer, and by 2050, there would likely be over 46,000 cases **(World Health Organization, 2020)**.

The significance of educating patients through a widely utilized application, and integrating it to facilitate innovative and collaborative learning, was demonstrated. This study also assessed the effects of post-mastectomy exercise on shoulder function and the degree of arm lymphedema in women who have undergone mastectomy. Consequently, this study was conducted to assess the efficacy of mobile based- educational exercises on the knowledge and practices of women post-mastectomy.

Aim of the study

To determine the effectiveness of mobile educational exercises on women's knowledge, practices, and arm lymphedema degree post-mastectomy

Research hypothesis:

Mobile educational exercises will have a positive effect on improving women's knowledge, practices, and arm lymphedema degree post-mastectomy.

Subjects and Method:

Research design:

A quasi-experimental research design (one group pre-posttest) was used in this study.

Setting:

The research was conducted at the outpatient clinic of Sohag Oncology Institution

Subjects:

Sample:

A purposive sample of 100 post-mastectomy women who were attending the outpatient clinic

Inclusion criteria:

All women who were between the ages of 18 and 60, had had a mastectomy within the preceding six months, were educated, available, and willing to engage in the study (100 were using a mobile What's App program).

Exclusion criteria:

The study excluded women who had a mastectomy, did not meet the inclusion criteria, and refused to take part.

Sample size:

The sample size was determined using the statistical formula n = Z2p (1-p) /d2, where z is the level of confidence based on the standard normal distribution (z = 1.96 for a 95%

confidence level). p = the estimated percentage of the population that exhibits the trait (p = 0.5 is used when p is unknown), and d = (d is taken to be 0.05).

The sample size was calculated based on:

$$N = \frac{N \times p\,(1-p)}{\{N-1 \times (d^2 \div z^2)\} + p\,(1-P)}$$

- Type I error with significant level (α) = 0.5.
- Type II error by power test (1-B) = 95%.

Data collection tools:

Three tools were used to collect the data for the study as the following:

Tool I: A structured interview questionnaire was created by the researchers following a review of relevant research studies and literature (**Brown & Ligibel, 2019; Greenlee et al., 2020**). It was divided into three parts:

Part (1): Demographic data:

It included age, educational level, occupation, and residence.

Part (2): Medical data:

It included duration of disease, stages of the disease, treatment received, type of tumor, family history, site of carcinoma, affected quadrant, type of mastectomy, development of arm lymphedema, and dominancy of the affected arm.

Part (3): Clinical manifestations of lymphedema:

It included the affected limb's edema, indurations, cutaneous alterations, diminished function of the affected limb, and shoulder range of motion. The extent of arm lymphedema can be quantified using Kissin's scale. To measure **the degree of arm lymphedema** as determined by arm circumference measurement, **Kissin et al. (1986)** created the scale. Using a tape measure, the measurement was obtained 10 cm inferior and 15 cm superior to the lateral epicondyle using a tape measure. To preserve the anatomical alignment of the shoulder, the elbow was flexed. The scale proposed the subsequent operational definitions of arm lymphedema post-mastectomy.

Mild lymphedema:

There should be no more than 2 cm between the affected and normal sides' total arm circumferences (C10+C15).

Moderate lymphedema:

The affected side and the normal side should have a total arm circumference (C10+C15) discrepancy of no more than 4 cm.

Severe lymphedema:

The affected side and the normal side should have a discrepancy of more than 4 cm in the entire arm circumference (C10+C15).

Tool (II) Women's knowledge regarding mobile based-educational exercises post-mastectomy (pre/post):

It has ten questions and was created by the researchers. It was created to assess women's knowledge about post-mastectomy exercise, including where to find information, what to do one week after the procedure, how long to do it, how often to do it, and what kinds of exercises to do **(Brown & Ligibel, 2019; Greenlee et al., 2020; Sagen et al., 2019).**

Scoring system:

The woman was rewarded with a 1 when the response was yes, and a 0 when it was no. According to the study, women who scored between 1 and 4 had 50% unsatisfactory knowledge, whereas those who scored between 5 and 10 had 50% satisfactory knowledge.

Tool (III) Women's practice regarding mobile based-educational exercises post-

mastectomy (pre/post):

It was developed by the researcher and was used to assess women's practices about exercise after mastectomy performed on the affected arm and deep breathing exercises. Wear loose-fitting, comfortable clothing and perform the exercises gradually until you experience a mild stretch. Six active assisted range of motion exercises and strengthening exercises, including wand exercises, elbow winging, shoulder blade stretches, shoulder blade squeezes, chest wall stretches, side bends, shoulder stretches, factors to consider following breast surgery, and general guidelines for these exercises are included in this exercise program **(Brown & Ligibel, 2019; Greenlee, et al., 2020).**

Scoring system:

Zero to one for "no answer" and one to one for "yes response" comprised the scoring system. The Overall score ranged between 0 and 6. The overall score was split into "adequate and inadequate" categories, with adequate practices obtaining above 60% and inadequate practices obtaining less than 60%.

Validity of the tools:

Five specialists, including two in medical-surgical nursing, two in community health nursing, and one in the oncology field, evaluated the tools' content validity, clarity, comprehensiveness, appropriateness, and relevance. Sentence clarity and content appropriateness were ensured by making changes in accordance with the panel's ruling.

Reliability of the tools:

The reliability of the knowledge questions, as determined by Cronbach's test, was 0.89, whereas the reliability of the reported practice questions was 0.85.

Fieldwork:

Before beginning this research, the competent authority granted formal permission, outlining the study's objectives. To create data collection instruments and program material, a thorough literature review was conducted. Data collecting began in April 2023 and lasted until the end of October 2023, a period of six months. In order to gain informed written consent, explain the study's objective, and have the women complete the questionnaires (Tool I, Tool II, and Tool III), the researchers conducted private, one-on-one interviews with the women in the outpatient clinics. It took an average of fifty to sixty minutes to complete the questionnaire. Following the mastectomy pretest, the researchers began implementing their findings about exercise knowledge and practices. During the evaluation phase, a post-test was conducted.

A pilot study

A pilot study was conducted on 10% (10 women) of the total sample to assess the feasibility and clarity of the research methodology; no changes were made to the final version of the instruments, and the women who participated in the pilot study were included in the research.

Ethical considerations:

The Faculty of Nursing at Sohag University's Research Ethics Committee gave its approval for this study's execution. Prior to starting the study, the Faculty of Nursing gave its clearance for implementation. The designated facility's medical and nursing directors received formal letters outlining the purpose of the study and requesting their consent. The study's nature and goal were explained to each woman individually, and their agreement was sought. Every woman received assurances regarding the privacy of the data collected and that only the researchers would be able to access their information. A coded system and nameless sheets were guaranteed, and only the study researchers were aware of them. The study guaranteed voluntary participation, and the participant can exit at any time.

Description of the program:

1. Assessment phase:

The instructional content was developed to engage the study sample, and the data collection procedures were developed after a comprehensive literature analysis. Women were introduced, asked questions, and told about the study's goal. Once the participant's eligibility was confirmed, the researchers received a signed consent to participate in the study. To collect information regarding personal data, a structured interview questionnaire was employed. Women's knowledge and practices about post-mastectomy exercise were assessed (pretest).

2. Planning phase:

The pre-test results were analyzed during this phase, and the booklet's aims and content were created by the researchers taking into account the women's learning requirements. The researchers created and wrote the pamphlet in Arabic. It was distributed following the program's implementation and printed based on the number of women. It was distributed to all 100 women who were added to the mobile WhatsApp group following the assessment and intervention of the first session. This pamphlet included vivid illustrations and the main points of each training session.

Aim of the booklet: Upon completion of this booklet, the post-mastectomy women will gain knowledge and practices regarding post-mastectomy exercise.

Specific objectives:

- To enhance post-mastectomy women's knowledge and practices about exercise following mastectomy.
- To improve the ability of women to conduct post-mastectomy exercises and their compliance with the recommended exercise schedule.
- Reduce the prevalence of lymphedema linked to breast cancer in women who have had mastectomy, in all its manifestations.

Post Mastectomy mobile-based-educational exercises content:

A. Post-mastectomy Exercise Theoretical Overview

1. Overview of post-mastectomy exercises.
2. Post-mastectomy workout definition.
3. Post-mastectomy Exercise Types
4. Post-mastectomy Exercise Timing
5. Arrange for post-mastectomy workouts
6. Particular wardrobe requirements and the significance of dressing comfortably and loosely when performing exercises
7. Important information on post-mastectomy exercises
8. Affected post-mastectomy workouts and arm care protocols.
9. The lymphedema associated with breast cancer

B. Post-mastectomy Exercise Practical section

1. Perform deep breathing exercises
2. Personal cleanliness of the afflicted arm
3. Skin and bathing care
4. Injection and exposure to heat
5. A post-mastectomy exercise program consists of six active assisted range-of-motion and strengthening exercises, including wand exercises, elbow winging, shoulder blade stretches, shoulder blade squeezes, chest wall stretches, side bends, shoulder stretches, advice for these exercises, and things to consider following breast surgery.

3. Implementation phase:

Data was collected from all post-

mastectomy women who visited a pre-established location three days a week between 9 a.m. and 1 p.m. The knowledge and techniques after mastectomy were the main topics of the program. As part of the educational guidelines for fitness after mastectomy, the researchers developed and implemented a theoretical and practical component. The first session started with an overview of the mobile-based- educational exercises that addressed fitness after mastectomy, and each session started with a recap of the previous session's feedback.

After conducting in-person interviews with the post-mastectomy ladies to gather data for the study, the women's phone numbers were added to a mobile What's App group, which was then used to provide education. Using an online Google form spreadsheet, the researchers created the online questionnaire and began the investigation. The researchers linked the post-mastectomy women to an online survey and gathered the research sample's phone numbers during their first interview with them when they were at the previously described location. All of the information was acquired in order to compare the impact of mobile-based - educational education on the knowledge and exercise practice of post-mastectomy women before and after the education.

Arm circumference measurements were used to determine the degree of arm lymphedema in both groups of post-mastectomy women prior to treatments. With the elbow flexed 90 degrees and the shoulder in its anatomical position, the limb circumference was measured using a tape measure, measuring 15 cm above the lateral epicondyle bone (C15) and 10 cm below the lateral epicondyle bone (C10). When the difference in the width of the arm circumference is expressed as the sum of the differences in the circumferences below and above the lateral epicondyle bone (C10+C15) of the affected side minus (C10+C15) of the free side, the tape measurement assessment is obtained **(Kissin's et al., 1986).**

Figures illustrate the teaching content. The women in the What's App group were trained to utilize the instructional information together with a recorded PowerPoint presentation, audio, and animation. Using an Android phone, women in the What's App group can access these resources following a mastectomy.

The study used a mobile application that provided instructional information about exercising after mastectomy. Text and images in the booklet and text, images, and video in the mobile application were used to simplify and convey the educational content; the content used in the instructional techniques was gathered based on the needs of the learners.

Post-mastectomy women filled out the pre-test's instruments. All of the individuals re-completed the questionnaire during the post-test via the mobile phone application after using it for one month.

4. Evaluation phase:

The program was reviewed after one month. To assess the impact of the mobile-based- educational exercises on women's knowledge, practices, and lymphedema degree post-mastectomy, the post-mastectomy women were given a post-test using the same pre-test instruments, which were scored in the same manner as before the mobile education was implemented.

Statistical analysis:

SPSS (version 20) was used to analyze the data. The findings were presented as frequencies and percentages after an investigation into the individuals' demographic traits and information sources. The two-sample Kolmogorov-Smirnov and Chi-square tests were used to assess the homogeneity of demographic characteristics. The subscales measuring knowledge and practice were compared using the U test and analysis of covariance. A significant criterion of P 0.05 was established.

Results:

Table (1): Shows that 56% of the studied post-mastectomy women were between the ages of 40 and 60, with a mean age of 48.5±4.7 and 53% of them had secondary education, 70 % of

post-mastectomy women were housewives, and 72% of them lived in urban areas.

Table (2): In relation to medical data, it was determined that 60% of the women examined had cancer for over a year, 39% were in stage 3 of the disease, and 40% had undergone chemotherapy and surgery. Additionally, 55% of post-mastectomy women had a familial history of cancer, while 63% of post-mastectomy women presented with a non-spreading tumor. The data indicated that the left breast was the most commonly affected side of cancer among the post-mastectomy women investigated, accounting for 63% of women. Regarding the type of mastectomy, it was noted that 92% of women underwent modified radical mastectomy, 80% experienced arm lymphedema, and 58% exhibited dominance of the affected arm.

Figure (1): Shows severity of arm lymphedema after post-mastectomy exercise pre and post-mobile-based- educational exercises, it was noted that 60% of the post-mastectomy women had mild arm lymphedema following the mobile educational exercises, in contrast to 30% before the intervention. Additionally, 14% experienced severe arm lymphedema post-education, compared to 28% pre-education. The figure demonstrated a significant improvement in the degree of arm lymphedema pre and post-mobile-based- educational exercises.

Figure (2): Revealed that (73%) of the studied post-mastectomy women reported that the main source of information regarding post-mastectomy exercises knowledge was doctors.

Table (3): indicates that the knowledge mean scores among post-mastectomy women improved after mobile-based- educational exercises. This demonstrated that the post-mobile-based- educational exercises phase had the highest mean scores compared to the pre-mobile-based -educational exercises at p-<0.001**.

Figure (3): Indicates that before the mobile-based- educational exercises, 75% of women had unsatisfactory knowledge. Moreover, the mobile-based- educational exercises demonstrated an enhancement, with 85% of participants women attaining a satisfactory level of knowledge.

Table (4): Represents that highly statistically significant differences were seen among all practice items for post-mastectomy women pre and post mobile-based- educational exercises at p-<0.001**

Figure (4): demonstrated a highly significant improvement in practice level for exercises after mastectomy compared to before mobile education with (p = 0.001). Before the mobile-based- educational exercises, only (20%) of post-mastectomy women had adequate practice, while (80%) had inadequate practice. However, the most of patients (90%) had adequate practice following mobile-based-educational exercises.

Table (5) showed no association between the studied women's age with their total knowledge and practices with p>0.001, While there was a statistically significant correlation between studied women's occupation, residence & practice score and their total knowledge with p <0.001.

Table (6): showed that there was a significant positive correlation between the knowledge and practice scores with statically significant differences pre and post-mobile-based- educational exercises with (p <0.05**).**

Table (1): Personal data of the studied post-mastectomy women (n=100)

Personal data	No.	%
Women' age		
- 18 < 30	20	20.0
- 30 ≤ 40	24	24.0
- 40 ≥ 60	56	56
Mean ±Stander deviation	48.5±4.7	
Women' education		
-Primary education	25	25.0
-Secondary education	53	53.0
-University education	22	22.0
Occupation:		
-Working	30	30
- Housewives	70	70
Residence:		
-Urban	72	72
-Rural	28	28

Table (2): Medical data of the studied post-mastectomy women (n=100)

Medical data	No	%
Duration of disease:		
< one year	40	40
≥ one year	60	60
Family history		
Yes	55	55
No	45	45
Stages of disease		
Stage 1	25	25
Stage 2	26	26
Stage 3	39	39
Stage 4	10	10
Type of tumor		
Non-spreading	63	63
Spreading	37	37
Treatment received		
Radiotherapy	18	18
Chemotherapy	25	25
Chemotherapy and surgery	40	40
Surgery	27	27
Site of carcinoma:		
Right breast	37	37
Left breast	63	63
Affected quadrant:		
UOQ	62	62
UIQ	9	9
LOQ	5	5
LIQ	11	11
Central	13	13
Type of mastectomy:		
Modified radical mastectomy	92	92
Simple mastectomy	8	8
Development of arm lymphedema		
Yes	80	80
No	20	20
Dominance of the affected arm:		
Yes	42	42
No	58	58

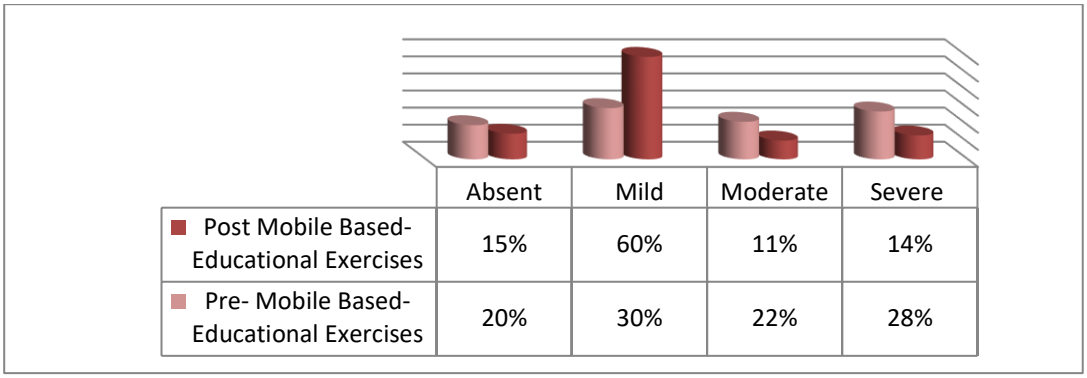

Figure (1): Total severity of arm lymphedema among the studied post-mastectomy women pre and post-mobile-based- educational exercises.

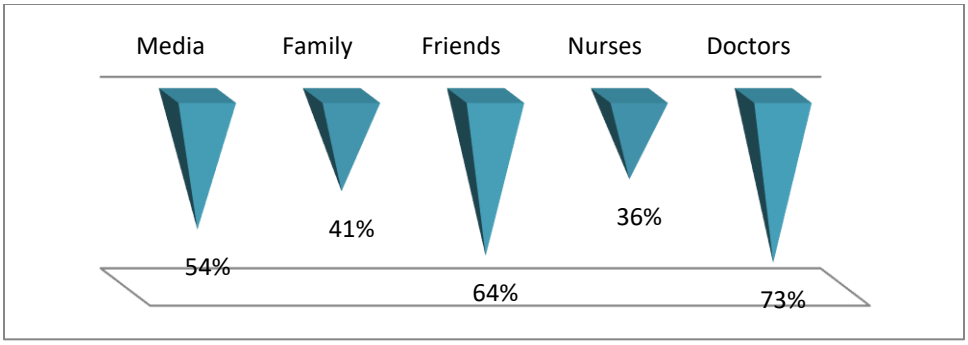

Figure (2): Source of knowledge about post-mastectomy exercise among the studied post-mastectomy women (n=100).

Table (3): knowledge mean scores of post-mastectomy women pre- and post-mobile-based- educational exercises (n=100).

Items	**Pre-** mobile-based- educational exercises	**Post-** mobile-based- educational exercises	t. test	P-value
Knowledge means scores	**4.01±0.55**	**9.11 ±1.33**	**67.22**	**<0.001****

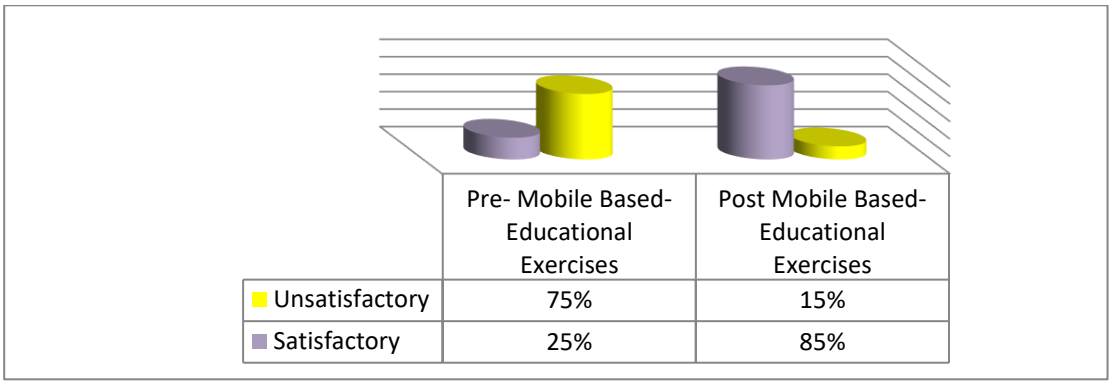

Figure (3): Total knowledge level among studied post-mastectomy women pre and post-mobile-based-educational exercises.

Table (4): Practices mean scores of post-mastectomy women pre- and post-mobile-based- educational exercises (n=100).

Items	**Pre-** mobile-based-educational exercises	**Post-** mobile-based- educational exercises	**t. test**	**P-value**
Practices mean scores	2.45 ±0.03	4.07±1.46	65.210	<0.001**

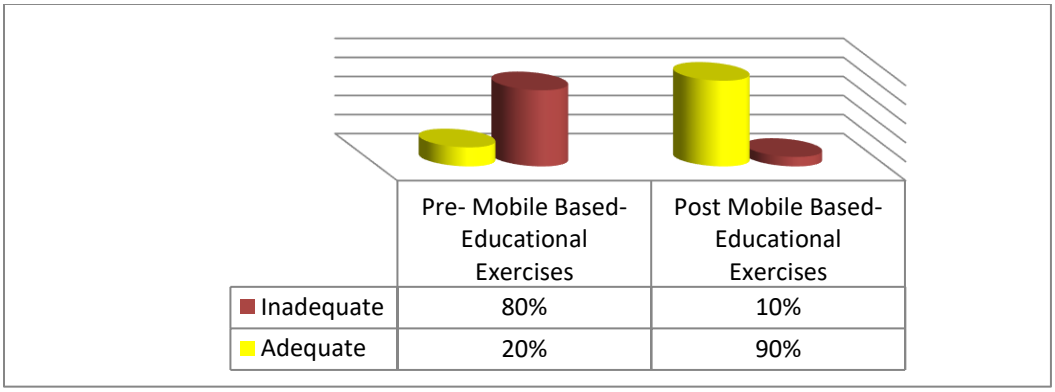

Figure (4): Total practice level among studied post-mastectomy women pre and post- mobile-based-educational exercises.

Table (5): Correlation between demographic data of post-mastectomy women, total knowledge, and their practice

Variables		**Total knowledge**	**Total practice**
Age	**R**	0.068	0.214
	P	0.358	0.059
Education	**R**	0.12	0.15
	P	0.33*	0.25
Residence	**R**	.183 *	-
	P	.037	-
Occupation	**R**	0.35*	0.43**
	P	0.003	0.001
Practice score	**R**	.169 *	-
	P	.045	-

. Correlation is significant at the 0.05 level* **.**

Table (6): Correlation Coefficient between the knowledge and practice scores pre and post-mobile-based- educational exercises.

Correlation	**Practices scores**	
	R	**P**
Knowledge score		
Pre mobile-based- educational exercises.	0.162	0.377
Post mobile-based- educational exercises.	0.384	0.045*

**. Correlation is significant at the 0.05 level*

Discussion:

Globally, breast cancer ranks as the second leading cause of cancer-related mortality among women. Recent improvements in breast cancer treatment that have improved survival have now shifted the focus to rehabilitation and quality enhancement. Currently, educational initiatives are crucial for ensuring patients achieve an adequate quality of life, both psychologically and physically. Post-modified radical mastectomy, exercise is essential for patient rehabilitation to reduce arm function impairment and promote a swift reintegration

into an active social life **(Bray et al., 2022)**.

Arm exercises are crucial for the rehabilitation of patients who have undergone mastectomy, as they contribute to the enhancement of muscular strength and upper limb functionality, alleviate pain and discomfort, and improve self-confidence. Furthermore, the National Lymphedema Network (NLN) advocates for a series of precautions and measures, which include refraining from aggressive skin care practices to avoid trauma or injury (such as avoiding needle sticks, blood withdrawals from the affected arm, or intravenous access), preventing constriction of the limbs (including the inflation of blood pressure cuffs and the wearing of tight clothing), managing extreme temperatures, and consistently donning compression garments, particularly during air travel **(Saleh et al., 2018).** Compression bandaging, aerobic or resistance exercise, self-administered manual lymphatic drainage (MLD), intermittent pneumatic compression therapy (IPCT), elevation of the afflicted limb, and weight management constitute several self-care strategies for patients experiencing breast cancer-related lymphedema (BCRL) **(Kaufmann et al., 2020).**

The research conducted by **Borman et al. (2019)** revealed that breast cancer survivors, especially in developing countries, lack awareness regarding Breast Cancer-Related Lymphedema (BCRL) and its associated risks. This underscores the necessity for breast cancer patients to receive education on fundamental preventive and prophylactic strategies post-mastectomy, facilitated by oncologists and nursing professionals, in order to mitigate potential complications. Furthermore, the study underscored that the early implementation of lymphedema preventive measures in the postoperative period can reduce or delay its onset. Similar research has emphasized the advantages of postoperative exercise and lymphedema prevention strategies in reducing the risk of lymphedema following mastectomy **(Gamee et al., 2019).**

The present study indicated that the majority of women post-mastectomy were aged between 40 and 60 years. These findings parallel that of **Saleh et al. (2020),** who did a study in Egypt titled "Upper limb cancer related to breast cancer therapy: incidence, risk factors, diagnostic techniques, risk reduction, and optimal management." The mean age of the study participants was 48.65±8.17 years.

Moreover, the findings of the current study indicated that more than a third of the women examined were housewives. The research by **Velaga et al. (2021)** in Bhubaneswar, India, examined the knowledge of post-mastectomy mothers on danger signs and revealed that more than two-thirds of the participants (68.8%) were housewives. Furthermore, this finding corresponds with the research conducted by **El Sayed and Badr (2019)**, which revealed that over fifty percent of breast cancer patients in their study were married, obtained a secondary education, and were unemployed.

According to the study's findings, the majority of post-mastectomy women lived in cities. Similar results were obtained by **Sayed et al., (2021**), who studied the "Informational Needs of Newly Diagnosed Breast Cancer Women" in Egypt and discovered that less than 25% of the women they interviewed had joint families and 76% of them lived in cities. Additionally, the current result is in line with **Hawash's, (2020)** study, "Assessment of health-related knowledge and habits among female cancer women after mastectomy," also indicated that most females with breast cancer were from metropolitan areas. While A cross-sectional study called "Trends in demography and reproductive variables in breast cancer in Egypt" by **Abo-Elazm et al., (2020**), found that slightly more than half of the study patients were from rural areas. Rural lifestyles and cultures may be to blame for this.

Regarding the duration of time to get a breast cancer diagnosis, the current study found that almost two-thirds of the women assessed had been diagnosed for more than a year. The same conclusion was reached by **Abo-Elazm et al. (2020)** in their study "Trends in Demographics and Reproductive Factors in

Breast Cancer" in Egypt, which found that over the past 25 years, there has been a notable change in the reproductive and hormonal patterns of Egyptian females with breast cancer. These trends should be taken into account when creating future national programs for breast cancer screening and prevention.

According to the current study, more than one-third of the women being investigated had stage III breast cancer. **Saleh et al. (2020**) conducted a study on upper limb cancer with regard to breast cancer therapy incidence, risk factors, diagnostic methods, risk reduction, and optimal management, which confirmed this finding. They found that women with stage III breast cancer who underwent a modified radical mastectomy had a lower risk of recurrence. The study by **Hawash et al. (2020**), "Effect of nursing rehabilitation program on the prevention of lymphedema among post-mastectomy women," in Alexandria contradicts this finding. They confirmed that more than half of the women in Alexandria had stage 2 breast cancer. The majority of study participants were not aware of the significance of breast self-examination in the early detection of cancer, which may account for this finding, which led to a stage III diagnosis of breast cancer.

Less than half of the post-mastectomy women who got mobile-based- educational exercises had a family history of cancer in the current study. Along the same line, Most patients had a family history of breast cancer, according to the findings of the study "Assessing the Level of Breast Cancer Awareness among Recently Diagnosed Patients in Ain Shams University Hospital" by **El-Shinawi et al. (2023).** They also found that risk factors like family history raise the chance of developing breast cancer which might be the result of hereditary elements that promote the disease's generational development.

According to the study's findings, the majority of post-mastectomy women who were the subject of the study got information about post-mastectomy activities from their doctors. This could be a result of the medical staff providing adequate knowledge to the patients.

The result revealed that the most frequently affected side of carcinoma among the studied post-mastectomy women was the left breast. Concerning type of mastectomy, it was observed that almost of women had modified radical mastectomy, the majority of them had arm lymphedema, and more than half had dominancy of the affected arm.

The results of the study were consistent with **Togawa et al., (2021).** The result revealed that the most common symptoms experienced by patients with breast cancer post-mastectomy were arm heaviness 52%, numbness 47%, and arm tightness 45%. **Games et al., (2019),** study results showed that in comparison with the control group, arm lymphedema symptom was significantly reduced in the study group and none of the study participants developed arm lymphedema post-mastectomy. This might be because patients performed post-mastectomy exercises daily. The results of the present study were supported by a study conducted by **Bakri et al., (2023).** Their result revealed that at the pretest 96.67% of participants had mild lymphedema, and 3.33% had moderate lymphedema whereas, during the posttest none of the participants had lymphedema.

Similarly, **Kothe et al., (2022**) conducted a study. Results revealed that at pre-intervention 13.3% reported mild, 50% moderate, and 36.7% with severe lymphedema, whereas the post-test conducted on the 7th post-operative day showed that 40% had no lymphedema, 46.7% had mild and 13.3% had moderate lymphedema and none of the participants had severe lymphedema.

According to the researchers, the majority of participants achieved a satisfactory level of knowledge one month following the mobile-based- educational exercises, suggesting that the effectiveness of this educational approach may be ascribed to the availability of instructional information that is not restricted by time or place. This outcome is a testament to the beneficial impact of mobile-based- education, which satisfied the women's needs and gave them the knowledge they needed to stay healthy. It also explains the significance of mobile-based- education and represents the requirement for the women under study to become more conscious and practice enough to

improve their knowledge of exercises following mastectomy surgery.

A study conducted by **Lu et al. (2018)** matched the findings of our research. The majority of changes in mean scores occurred within the first 6 weeks, according to this study. The elevated scores in the experimental group can be attributed to their increased utilization of audio-visual training techniques. This is related to their entertainment services. A further benefit of these programs is that patients can repeatedly watch videos to reinforce their understanding. The majority of participants in the current study indicated that they appreciated Internet-based training and would endorse similar programs to others.

Numerous studies advocate for the utilization of smartphone applications to educate users and enhance knowledge with sustained efficacy for up to one year. This pattern resembled that observed for knowledge and aligns with similar studies. Despite the experimental group in this study demonstrating enhanced practice capacity, the results indicated that the practice following the discharge of patients trained with the app-assisted program was markedly superior. The higher practice of patients in the experimental group can be attributed to their reduced pain levels, increased questions directed toward the consultant, and higher information scores resulting from the training videos on pain and movement management, which facilitated the practical application of knowledge (**Wang et al., 2020; Erdogan & Bulut, 2020).**

A review of prior studies in Iran reveals a lack of investigation into the effects of app-based training programs. Researchers have indicated that interactive training programs might be utilized more efficiently to improve knowledge among patients. This includes patients with burns (Lo et al., 2020), prostate cancer (Salonen et al., 2024), orthopedic conditions **(Heikkinen et al., 2018),** and breast cancer **(Ryhänen et al., 2020).** The convenience of smartphones has led to a rise in users. Nevertheless, limited research has assessed the efficacy of health education via mobile applications **(Jeong et al., 2017).** Consequently, it is essential to create contemporary smartphone applications and utilize them to assess the efficacy of patient education. This study has significant implications due to the scarcity of similar research in Iran. Prior research indicates that mobile phones significantly enhance patients' health behaviors **(Schnall et al., 2019).** This current study advocates that effectively designed connected health technologies, including digital health, mobile applications, and telehealth, can enhance patient rehabilitation and encourage improved adherence to care and rehabilitation practices **(Hou et al., 2019).**

The women said that after the deployment of mobile-based- educational exercises, their level of knowledge improved. These results align with **Salimi et al., (2021**), who investigated "Comparing the effects of mobile-based education and booklet-based education", on Iranian students and they found that mobile-based education may significantly increase understanding in the experimental group. Moreover, **AlKlayb et al. (2021)** conducted a study in Saudi Arabia titled "Comparison of the effectiveness of a mobile phone-based education program in educating mothers as oral health providers." They found that the mobile educational approach produced favorable outcomes.

The results of the current study showed that most post-mastectomy women's practice levels increased post the mobile-based-educational exercises and there was a highly significant improvement in women's practice level for exercises after mastectomy compared to before mobile-based- educational exercises. These results are in contrast to those of a study of "A randomized study of a mobile behavioral parent training application" conducted by **Feil et al., (2018).** The tiny sample size may have contributed to the findings, which showed that the mobile phone application intervention in China did not significantly enhance practice.

On the other hand, The findings of the current research study, similar to a study conducted by **Sarina et al., (2024)** highlighted that discharge teaching was effective for patients with breast cancer undergoing mastectomy in improving the self-care practice

of patient health-related issues with breast cancer also reducing the symptoms of arm lymphedema of those affected individuals.

everal studies have assessed the effectiveness of nursing programs on patient's self-care practice and prevention of lymphedema post-mastectomy. **Ramadan et al., (2023)**, reported that study participants did not develop breast cancer-related lymphedema during 3 and 6-month follow-ups after the implementation of the nursing program. **Anishya & Appavu, (2021)**, reported an overall decrease in shoulder pain by the end of the fourth week after the implantation of post-mastectomy exercise. In addition, **Kamath et al., (2019) studied the** "perception and practice regarding breast cancer among post-mastectomy women" in Southern India. He found that the majority of their respondents (95%) began exercising right after their mastectomy.

From the researchers' perspective, education has a discernible positive impact on making better behaviors. These findings supported significant improvements in women's practices that reflected the main objectives of the education implementation. This finding further supports the positive impact of mobile-based educational exercises, and the efficiency of these teaching strategies may be related to how easy it is to obtain instructional materials in the shortest period of time.

The results of this research demonstrate that women can enhance their knowledge in a range of care areas through mobile-based-education; therefore, it is important to establish a sustainable educational program that enables women to develop their knowledge by routinely consulting instructional materials. These findings concurred with those of **Ango et al., (2021**), who investigated the "knowledge and practice of post-mastectomy women", in Nigeria and discovered that the majority of women regularly consulted educational content whenever they needed it, using Smartphone applications to enhance their knowledge and practice.

The results of the current study showed that post-mastectomy women's knowledge and practice scores before and after mobile-based educational exercises had a significant positive correlation and that the differences between the knowledge and practice scores were statistically significant. According to **Kamath et al. (2019),** who investigated "perception and practice regarding breast cancer among post-mastectomy women" in the South, several factors, including knowledge and practice, have a major impact on women's exercise habits following a mastectomy.

These results demonstrated how important it is to improve women's practice and knowledge in order to help them acquire and use sound knowledge. This connection can be explained by the fact that the women in the study were able to practice successfully when they had gained enough knowledge.

The knowledge and practice scores after the mobile-based educational exercises showed a strong positive connection with statistically significant differences ($p < 0.05$). According to the researchers, this outcome shows the benefits of mobile-based-educational exercises that enhance post-mastectomy women's understanding and are linked to appropriate exercise habits following mastectomy.

Conclusion:

Based on the results of the present study, it can be concluded that mobile-based-educational exercises were effective in improving post-mastectomy women's knowledge, practice, and lymphoedema degree post-mastectomy.

Recommendations:

Considering the present study results, the following recommendations are proposed:

- For post-mastectomy women, a mobile-based-educational exercises approach can be utilized to enhance their understanding and practice of exercise following mastectomy.
- Women who have had a mastectomy should have access to a simple illustrated booklet that provides information on exercising after the procedure.

- Because mobile phones may reach a large number of students from a variety of social groups and because healthcare professionals can utilize them in a number of ways to enhance health, using one is advised.
- For more generalizable findings, the current work should be replicated on a larger probability sample.

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