

Effect of Virtual Reality- Based Rehabilitation Program Versus Booklet-Based Education on Self-Care Practices and Prevention of Complications among Women after Mastectomy

Mohammed Saied Harfoush¹, Zizi Fikry Mohamed Abdelrasol² Eman Rabie Moustafa Anan³, Eman Ahmed Rashad Elsakka⁴

^{1,4}Lecturer, Community Health Nursing Department, Faculty of Nursing, Damanhour University, Egypt

²Assistant Professor, Medical- Surgical Nursing, Faculty of Nursing, Damanhour University & king Salman International University, Egypt

³Lecturer, Nursing education, Faculty of Nursing, Damanhour University, Egypt

Corresponding Author: Mohamed Saied Harfoush

Email: mohamed.said@nur.dmu.edu.eg

Abstract

Background: Breast cancer is a common malignancy among women worldwide. With an estimated 2.1 million new cases being diagnosed each year and accounting for 24.2% of all cancer diagnoses among women, it is the most frequent disease in women. Virtual reality-based rehabilitation (VRBR) is a relatively new method that might make it easier to simulate doing functional tasks than conventional rehabilitation. **The aim of the study** was to compare the effect of Virtual Reality- based rehabilitation program versus booklet-based education on self-care practices and prevention of complications among women after modified radical mastectomy. **Design:** A quasi-experimental (Case-Control) research design was used to carry out this study. **Setting:** The study was conducted at Damanhour oncology center in El-Beheira governorate. **Sample:** A convenient sample of 100 female patients was included in the study. **Tools of data collection:** Three tools were used for data collection Tool I: Socio-Demographic characteristics and Health Profile Structured Interview questionnaire. Tool II: Self-care practices of modified radical mastectomy structured interview schedule. Tool III: Early post modified radical mastectomy complications checklist. **Result:** Virtual reality group has higher mean scores than the booklet group in relation to all the studied dimensions as well as the total score of the self-care practices. The differences are statistically significant in all studied items ($P= 0.000$), except for some items such as follow-up ($P=0.305$), pain management ($P=0.051$), skin care ($P=0.722$) and proper nutrition ($P=0.794$). **Conclusion:** According to the findings of the current study it can be concluded that virtual reality-based rehabilitation program is more effective than booklet-based rehabilitation program in improving self-care practices and prevention of complications among women after mastectomy. **Recommendation:** The application of virtual reality-based rehabilitation programs after mastectomy should be incorporated into the daily care of post-mastectomy women in oncology centers and hospitals.

Keywords: Breast cancer, Virtual Reality (VR), Self-care practices, prevention of complications, modified radical mastectomy, and rehabilitation program.

Introduction

Breast cancer is a common malignancy among women worldwide. With an estimated 2.1 million new cases being diagnosed each year and accounting for 24.2% of all cancer diagnoses among women, it is the most common disease in women. It affects 1 in 4 women worldwide and is a factor in 15% of fatalities. The incidence of breast cancer is increasing in the developing world due to increased life expectancy, increased urbanization and adoption of western lifestyles^(1,2).

Breast cancer is a term used to describe malignancies that develop from breast tissue, most frequently from the lobules that feed the milk ducts with milk or the inner lining of the milk ducts. Ductal carcinomas are cancers that begin in ducts, whereas lobular carcinomas are cancers that begin in lobules⁽³⁾.

A higher risk of breast cancer is linked to a number of factors. These elements don't always lead to breast cancer. Some are indicators of other risk factors that are still unknown or suspected. Sex, age, absence of pregnancy or nursing, and increased hormone levels have been identified as the main risk factors. A high-fat diet, alcohol consumption, obesity, and environmental variables like smoking, radiation, and endocrine disruptors are additional risk factors. Despite the minimal radiation exposure from mammography, the cumulative effect can lead to cancer⁽⁴⁾.

The interdisciplinary method used today to treat breast cancer includes surgery, radiation, hormone therapy, and chemotherapy. Breast cancer treatment largely involves surgery. It is the fundamental technique to employ for disease local control. The procedure most frequently

used to treat breast cancer was the Halsted radical mastectomy for many years. Halsted's radical mastectomy entails both excision of both pectoralis muscles and removal of the breast along with axillary lymph nodes. Due to the high likelihood of morbidity without a survival advantage, it is no longer advised. The modified radical mastectomy performed on Patey is now more well-known. The whole breast tissue, together with a sizable portion of the skin, the axillary lymph nodes, and the pectoralis major muscle, must be removed⁽³⁾.

The quality of life of patients may be impacted by a variety of problems following a modified radical mastectomy, including seroma formation, wound infection, skin flap necrosis, lymph edoema, haemorrhage, hematoma formation, paresthesia, and muscle paralysis. Additionally, even in the absence of preexisting shoulder issues, many breast cancer patients who had surgical excision experience postoperative shoulder pain and decreased range of motion⁽⁵⁻⁶⁾. So, physical therapy activities included in post-operative rehabilitation programs are useful in reversing these alterations. Additionally, educating patients on self-care practices is essential for avoiding post-operative problems⁽⁷⁻⁸⁾.

Virtual Reality Based Rehabilitation (VRBR) is a relatively new method that might make it easier to imitate practicing functional tasks than traditional rehabilitation. When compared to traditional rehabilitation, VRBR aims to imitate real-world activities, which might offer more engaging challenges. It consists of methods that let people explore with their senses using informatics technologies⁽⁹⁾.

Patients can conduct real-time tasks, anticipate and respond to objects or events in

a range of secure 3-dimensional environments using virtual reality, an advanced computer-human interface. Virtual reality (VR) is described operationally as a type of digital technology where users can interact with virtual objects using artificially produced sensory experiences (such as visual, aural, tactile, and olfactory inputs). VR therapy is more engaging than traditional therapy because it gives users the chance to enhance repetitive tasks and boost visual and audio feedback⁽¹⁰⁾. Additionally, the use of virtual reality encourages more workout repetitions and fosters motor learning by providing quick feedback on tasks that are accomplished and are connected to real-world activities⁽⁹⁾.

As a member of the multidisciplinary team, nursing staff bring a variety of abilities to the table. Because they interact with patients more frequently than any other member of the medical staff, they play a crucial role in the physical and psychological treatment of breast cancer patients⁽¹¹⁾. Helping breast cancer patients who have surgery get back to their normal lives is the main objective of nursing care⁽¹²⁾. Community health nurses provide a continuum of care for breast cancer patients, beginning with the promotion of health and awareness and continuing with specialist and expert work in settings that provide services to them, such as health centers, hospitals, and homes⁽¹³⁾. They also have a significant impact on patients' lives by offering high-quality treatment, information, and psychosocial support throughout the post-operative period⁽¹⁴⁾.

Significance of the study

Breast cancer is a significant health concern in Egypt, with an estimated incidence rate of 48.7 cases per 100,000 women in 2020, according to the Global Cancer Observatory

⁽¹⁵⁾. After mastectomy, a significant number of women develop complications that can affect their function and quality of life. Prevention of these complications will help relieve the suffering and improve patients' quality of life⁽¹⁶⁾. Different studies showed that a post-mastectomy rehabilitation program is necessary to control early postoperative complications and increase women's awareness about the importance of self-care practices and adherence to follow the schedule of checkups. Moreover, it helps to decrease complications and emotional disturbances and enhance self-care practice. Furthermore, experiencing a VR encounter through multisensory interactive methods like seeing and hearing offers a novel, immediate, and distinctive setting that can increase people's excitement and improve their ability to perform tasks.

Aim of the study

The aim of this study was to compare the effect of virtual reality- based rehabilitation program versus booklet-based education on self-care practices and prevention of complications among women after modified radical mastectomy.

Research hypotheses

H1: post mastectomy women who involved in virtual reality based program exhibit improvement in self-care practice than those in booklet-based education

H2: post mastectomy women who involved in virtual reality based program experience less complications than those in booklet-based education.

Operational definitions

- In this study early postoperative mastectomy complications refer to seroma formation, lymphedema, wound infection, parasthesia, hematoma, hemorrhage, flap necrosis, deep vein thrombosis and anxiety

among geriatric patients undergoing mastectomy.

- Mastectomy in the study refers to the modified radical type which is the removal of the breast tissue and an axillary lymph node dissection; the pectoralis major and minor muscles remain intact.

Subjects and method

Research design: A quasi-experimental (Case-Control) research design was used to carry out this study.

Setting: The study was conducted at Damanhour oncology center in El-Beheira governorate.

Subjects: The study subjects were the female patients with breast cancer who were undergoing a modified radical mastectomy in the previously mentioned setting. Selection of the subjects was based on the following criteria:

- No previous history for breast cancer,
- No previous injury, or surgery in the affected upper limb,
- No previous chemotherapy or radiotherapy before the surgery,
- Willing to participate in the study and able to communicate.

Sample size: The World Health Organization and the Centers for Disease Control and Prevention in Atlanta, Georgia, USA, version 2002, developed Epi-Info 7, a statistical programme 25, which was used to determine the sample size and power analysis. The criteria used for sample size calculation were as follows: Total population of 256 women per year, confidence limit of 95%, margin of error of 5%, and population proportion of 50%. The sample size based on the previously mentioned criteria was 100 patients.

Patients were selected conveniently and randomly assigned to one of the two groups (50 women in each one). The study group

(VR group) who received virtual reality based rehabilitation program and the control group (booklet group) who received the hospital conventional educational booklet.

Tools: Three tools were used for data collection.

Tool (I): Structured Interview Questionnaire:

This tool was developed by the researcher based on relevant literature to collect the required data, it included two parts:

Part I: Socio-demographic characteristics:

it included data about the patients such as age, marital status, place of residence, educational level, working status, and family income.

Part II: Health profile: it included data such as the family history of breast cancer, onset of breast cancer's diagnosis, manifestations, compliance with the prescribed medications, and presence of chronic disease.

Tool (II): Self-Care Practices of Modified Radical Mastectomy Structured Interview Schedule.

This tool was developed by **El Garhy S. et al., (2021)** ⁽¹⁶⁾ and it was adapted by the researcher to evaluate the female patients post mastectomy self-care practices. It was used to assess patient's maintenance of self-care practices to prevent early post-operative mastectomy complications. These practices include pain management; wound care, prevention of wound infection, managing fatigue, managing nausea and vomiting, prevention of lymphedema, follow up, anxiety and stress management, prevention of DVT, arm exercises and proper nutrition. The total number of questions was 81 questions. All items were scored using a 5-point Likert scale in terms of frequency as the following: 5 for often, 4 for always, 3 for sometimes, 2 for rarely and 1 for never. Score of all items

were summed together and total score was ranged between 81 and 405.

Tool (III): Early Post Modified Radical Mastectomy Complications Checklist:

This tool was developed by **Awan et al., (2011)**⁽¹⁷⁾ to monitor the presence or absence of early post-operative modified radical mastectomy complications such as (Seroma formation, lymphedema, Paresthesia, Hematoma).

Methods

I- Administrative process

- An official letter was issued from the Faculty of Nursing, Damanhour University to the director of the Damanhur Oncology Centre to facilitate the implementation of the study.
- A meeting was held with the director of the selected facility to obtain his approval after clarifying the purpose of the study, setting the time for the beginning of the study, and gaining his cooperation and support during data collection.
- **Development of study tools**
 - The study tool I was developed by the researchers after an extensive review of the relevant and recent literature. While, tool II and III were adapted by the researchers^(16,17).
 - The content validity of the study tools was tested by a jury of five experts in the fields of community health nursing and medical surgical nursing and their opinions and suggestions were taken into consideration.
 - Reliability of the study tools II and III was tested for internal consistency using Cronbach's alpha test. The reliability result for tool II, (self-care practices of modified radical mastectomy structured interview schedule) was $r=0.93$ and tool III

reliability (early post modified radical mastectomy complications checklist) was $r= 0.97$.

II- Pilot study

To evaluate the applicability, clarity, and viability of the study instruments and those that weren't included in the study subject, a pilot study was conducted on 10 female patients (representing 10% of the sample) who had been diagnosed with breast cancer and were having mastectomy surgery. Accordingly, the necessary adjustments were made.

III- Field work

The program was accomplished in a period of 10 months (from the beginning of March 2022 to the end of December 2022.), and included the following phases:

a) Assessment phase

- The researchers explained the aim of the study and its pathway to all study participants.
- Initial assessment of both groups using study tools (I), and (III) was carried out to assess patients' socio-demographic characteristics and health profile and to exclude the presence of any of the complications before implementation of the program.

b) Planning phase

- The program objectives were determined according to the recent relevant literature and the obtained results from the initial assessment.
- The Plan of the training was formulated.
- The dates of the sessions were planned and scheduled with patients.
- Appropriate equipment and educational materials were prepared:
- Hospital routinely used educational booklet for women undergoing modified radical mastectomy.

- Vision VR™ itek™.
- Cell phone.



Figure I): Vision VR™ itek™

c) Implementation phase

This phase included the execution of the program plan.

- The female patients assigned to the control group received the routine oncology center care provided for all patients with modified radical mastectomy (booklet method). The researcher met the patients during the follow up appointments in the outpatient clinic in order to maintain relationship with patients and assess presence of any complication.
- The program was implemented for VR group through six individual sessions with the patients. Three sessions were conducted in inpatient department at female surgical ward and three sessions were conducted in the outpatient clinic after discharge. The researcher met the patients during the follow up appointments in the outpatient clinic.

Training was conducted over the following sessions

- **First session (in the day of inpatient admission):** It took about 30 minutes. This session was including the following:
 - Provide information about breast cancer such as definition, risk factors, signs & symptoms, diagnosis, and treatment.
 - Showing VR videos about the importance of post mastectomy exercises,

how to develop a successful exercise routine, how to perform the first operational day exercises and deep breathing exercise and how to manage anxiety and stress.

-Re-demonstrate of exercises by using VR games.

- **Second session (zero day of operation):** it took about 30 minutes. It started during the evening shift to the beginning of night shift of the same day of the surgery (7-9 pm) to give a chance for the patient to tolerate pain, regain her ability to communicate and follow the given instructions. This session was including the following:

- Revision of the instructions given in the previous session about deep breathing exercise, and the 1st postoperative day exercise as range of motion or muscle strength exercises.
- Showing VR videos about pain management, positioning after mastectomy management of nausea and vomiting, prevention of deep vein thrombosis (DVT) and warning signs and symptoms that require seeking medical advice.

- **Third session (in the morning of the first post-operative day).** It was focused on:

- Revision of the instructions given in previous session.
- Re-demonstrate of exercises by using VR games.
- Showing VR videos about arm and shoulder exercises which begin with these easy exercises and then move on to the more advanced exercises once feel stronger. By the end of this stage, patients should have full movement of the affected arm and shoulder. It's including: wand

exercise, winging it, snow angels, posture, wall climbing, and side bends and instructed the patients to repeat these exercises 5 or 10 times a day for at least 20-minute period of time and continue during the first 6 weeks after surgery

➤ **Fourth session :** This session was focused on the following:

- Revision of the instructions given in previous session.
- Showing VR videos about proper nutrition and wound care and prevention of wound infection
- Re-demonstrate of exercises by using VR games.

➤ **Fifth session:** This session was focused on the following:

- Revision of the instructions given in previous session.
- Showing VR videos about personal hygiene, proper skin care, and how to manage fatigue.
- Re-demonstrate of exercises by using VR games.

➤ **Sixth session:** This session was focused on the following:

- Revision of the instructions given in previous session.
- Showing VR videos about early post-operative mastectomy complications (Lymphedema, Hematoma, Paresthesia, and Seroma): how to detect and how to prevent.
- Re-demonstrate of exercises by using VR games.

d) **Evaluation Phase**

After 14 days from the operation date, the researcher interviewed the female patients in the VR and booklet groups and reviewed their charts to evaluate the occurrence of early post-operative mastectomy complications by using the

study tool (III) (early post modified radical mastectomy complications checklist). Also, patients in both groups were evaluated regarding their adherence to self-care practices after mastectomy by using the study tool (II) (self-care practices of modified radical mastectomy structured interview schedule).

Ethical considerations

- The Damanshour University nursing faculty's ethics committee granted permission for the study to be carried out.
- Informed written consents were obtained from the women patients in the previously mentioned setting after a brief explanation of the purpose and nature of the research.
- Women's privacy was maintained all the time during all sessions, especially in the outpatient clinic.
- Confidentiality and anonymity of individual responses were guaranteed by a statement in the cover letter and using code numbers instead of names.

Descriptive statistics

1. The qualitative data are described and summarized using count and percentage.
2. The arithmetic mean and standard deviation (Mean SD) are used to describe normally distributed quantitative data as measurements of central tendency and dispersion.

Analytical statistics

1. Chi test (χ^2): used to assess the relationship between two qualitative variables or to identify variations between two or more proportions.
2. Student t-test of significance: used to determine whether the means of two distinct groups are statistically different from one another.

Results

Table I shows that 40.0% of the VR group and 36.0% of the booklet group ranged from 50 to less than 60 years ,with the mean and standard deviation of the patient's age being $58.8 \pm 3.45.2$. In relation to marital status, 54.0% of the VR group was married, compared to 70.0% of the booklet group. While 36.0% of the study group and 22.0% of the booklet group were widows. Only 2.0% of the VR group and booklet group were single. In relation to education, 26.0% of the VR group and the same in the booklet group were illiterate, read, and wrote. With respect to the place of residence 78.0% of the VR group, compared to 70.0% of the booklet group, lived in rural areas. In addition, 8.0% of the VR group, compared to 16.0% of the booklet group, was currently working. Lastly, 42.0% of the VR group, compared to 46.0% of the booklet group, reported sufficient monthly income.

Table II portrays that, most subjects in VR and booklet groups (72.0% and 62.0 %, respectively) had no family history for breast cancer, and 44.0% of the VR group and 50.0% of the booklet group were diagnosed with breast cancer for less than two months. With regard to manifestations of breast cancer, the change in shape and size of the breast was the main manifestation reported by 56.0% of the VR group compared to 64.0% of the booklet group. As regards to compliance with the prescribed medications, 70.0% of the patients in the VR group and 60.0% of those in the booklet group were taking prescribed medications regularly.

Figure 1 illustrates that, only 20.0% of VR group and 30.0% of the booklet group were free from chronic diseases. Diabetes mellitus and heart disease were the most reported diseases among the total subjects. Diabetes was reported by 30.0% of the VR group and 26.0% of the booklet group. Additionally, heart diseases were

reported by 30.0% of the VR group and 28.0% of the booklet group. On the other hand, only 6.0% of subjects in both groups reported having respiratory diseases and arthritis.

Table III shows that lymphedema occurred in only 6.0% of the VR group compared to 26.0% in the booklet group. Regarding hematoma, it was the most common complication among booklet group (50.0%) compared to only 10.0% in the VR group. As regards Seroma, it occurred more among the booklet group (46.0%) compared to 24.0% among the VR group. Additionally, paresthesia occurred more among the booklet group (24.0%) compared to 16.0% among the VR group. Moreover, the table displays statistically significant differences between both groups in the occurrence of lymphedema, hematoma, and seroma ($P= 0.006$, $P= 0.000$, and $P= 0.021$ respectively).

Table IV shows comparing mean score of self-care practice in both groups. It appears from the table that the VR group has higher mean scores than the Booklet group in relation to all the studied dimensions as well as the total score of the self-care practices. The differences are statistically significant in all studied items ($P= 0.000$), except for some items such as follow-up ($P=0.305$), pain management ($P=0.051$), skin care ($P=0.722$) and proper nutrition ($P=0.794$).

Table V shows the relation between VR groups means score of self-care practices and presence of complications after implementation of the rehabilitation program. The table reveals that self-care practices mean score is higher among female patients who had no complications (355.57 ± 8.406) than those who had complications (349.67 ± 8.505). Moreover, the table demonstrates no statistically significant relationship between self-care practice and presence of complications ($t= 1.331$, $P = 0.191$).

Table I: Distribution of the studied female patients in both groups according to their socio-demographic characteristics.

Items	Group type				Total (n=100)		Test of significant χ^2
	VR group (n=50)		Booklet group (n=50)		No	%	
	No	%	No	%			
Age (in years)							
- 40-	14	28.0	15	30.0	29	29	X= 0.412 P= 0.937
- 50-	20	40.0	18	36.0	38	38	
- 60-	10	20.0	12	24.0	22	22	
- ≥ 70	6	12.0	5	10.0	11	11	
Mean \pm SD	58.25 \pm 3.736		59.5 \pm 2.179		58.87 \pm 3.457		
Marital status							
- Single	1	2.0	1	2.0	2	2.0	X=2.864 P=0.412
- Married	27	54.0	35	70.0	62	62.0	
- Divorced	4	8.0	3	6.0	7	7.0	
- Widowed	18	36.0	11	22.0	29	29.0	
Levels of education							
- Illiterate and Read and write	13	26.0	13	26.0	26	26.0	X=0.905 P=0.824
- Basic education	22	44.0	25	50.0	47	47.0	
- Secondary and technical education	11	22.0	10	20.0	21	21.0	
- University education	4	8.0	2	4.0	6	6.0	
Place of residence							
- Urban	11	22.0	15	30.0	26	26.0	X=0.8310 P=0.361
- Rural	39	78.0	35	70.0	74	74.0	
Current work							
- Working	4	8.0	8	16.0	12	12.0	X=1.515 P=0.218
- Not working	46	92.0	42	84.0	88	88.0	
Income sufficiency							
- Sufficient	21	42.0	23	46.0	44	44.0	X=0.162 P=0.687
- Insufficient	29	58.0	27	54.0	56	56.0	

X²= Chi Square test* Significant P \leq 0.05

Table II: Distribution of the studied female patients in both groups according to their health profile.

Items	Group type				Total (n=100)	
	VR group (n=50)		Booklet group (n=50)			
	No	%	No	%	No	%
Family History of cancer						
- Yes	14	28.0	19	38.0	33	33.0
- No	36	72.0	31	62.0	67	67.0
Onset of breast cancer's diagnosis						
- Less than 2 months	22	44.0	25	50.0	47	47.0
- 2-4 months	14	28.0	17	34.0	31	31.0
- 4-6 months	9	18.0	4	8.0	13	13.0
- More than 6 months	5	10.0	4	8.0	9	9.0
Manifestations#						
- Change shape/size of breast	28	56.0	32	64.0	60	60.0
- Abnormal nipple discharge	10	20.0	5	10.0	15	15.0
- Change texture of breast	3	6.0	7	14.0	10	10.0
- Swelling of lymph nodes	7	14.0	5	10.0	12	12.0
- Pain	9	18.0	11	22.0	20	20.0
Compliance with the prescribed medications						
- Yes	35	70.0	30	60.0	65	65.0
- No	15	30.0	20	40.0	35	35.0

Responses are NOT mutually exclusive.

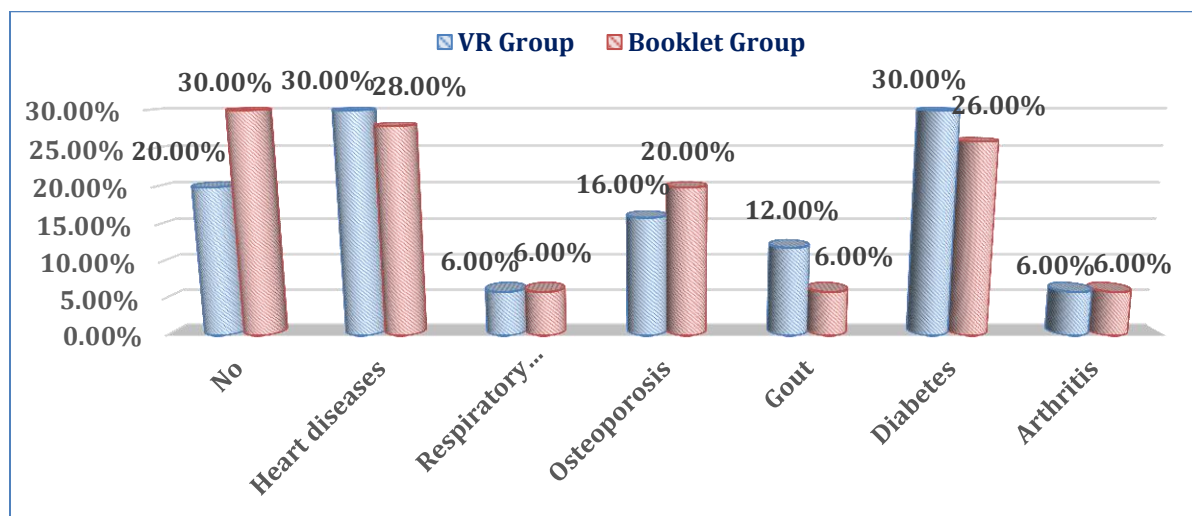
**Figure 1: Distribution of the studied female patients in both groups according to presence of chronic diseases.**

Table III: Distribution of the studied female patients in both groups according to presence of post mastectomy complications.

Items	Group type				Total (n=100)		Test of significance
	VR group (n=50)		Booklet group (n=50)		No	%	
	No	%	No	%			
Lymphedema							
- No	47	94.0	37	74.0	84	84.0	$X^2 = 7.4405$ P= 0.006*
- Yes	3	6.0	13	26.0	16	16.0	
Hematoma							
- No	45	90.0	25	50.0	70	70.0	$X^2 = 19.047$ P= 0.000*
- Yes	5	10.0	25	50.0	30	30.0	
Paresthesia							
- No	42	84.0	38	76.0	80	80.0	$X^2 = 0.999$ P= 0.317
- Yes	8	16.0	12	24.0	20	20.0	
Seroma							
- No	38	76.0	27	54.0	65	65.0	$X^2 = 5.318$ P= 0.021*
- Yes	12	24.0	23	46.0	35	35.0	

X²:Chi square test

t= student t test

* Significant p at ≤0.05

Table IV: Comparing mean score of self-care practice in both groups

Items	Group type		Test of significance
	VR group (n=50)	Booklet group (n=50)	
	Mean ±SD	Mean ±SD	
Pain management	28.15±1.88	28.75±1.75	t = 1.6518 P= 0.051
Wound care	31.55±1.887	29.50±2.28	t = 4.8979 P= 0.000*
Prevention of wound infection	30.27±1.882	23.91±1.18	t = 20.2455 P= 0.000*
Managing fatigue	14.87±1.817	12.68± 2.25	t = 5.354 P= 0.000*
Managing nausea and vomiting	19.30±0.661	17.32±3.78	t = 3.6485 P= 0.004*
Prevention of lymphedema	42.75±2.845	34.75±4.68	t = 10.333 P= 0.000*
Follow up	51.45±3.716	50.15±8.11	t = 1.030 P= 0.305
Anxiety and stress management	20.61 ±0.829	16.87 ±3.19	t = 8.023 P= 0.000*
Prevention of DVT	25.80±1.224	21.98±5.91	t = 4.475 P= 0.000*
Proper nutrition	17.65±2.070	17.83±4.42	t = 0.2608 P= 0.794
Arm exercises	27.70±1.220	21.78±5.91	t = 4.465 P= 0.020*
Skin care	19.20± 2.066	19.43± 4.08	t = 0.355 P= 0.722
Total self-care practices	301.15±20.874	273.13±41.63	t = 4.2501 P= 0.000*

t= student t test

* Significant P ≤0.05

Table V: Relation between VR groups means score of self-care practices and presence of complications after implementation of the rehabilitation program.

Items	Self-Care Mean Score (Mean ± SD)	Test of significance
Presence of complications		
- Yes	349.67± 8.505	t= 1.331
- No	355.57± 8.406	P= 0.191

t = Student t test

* Significant p at ≤ 0.05 **Discussion**

The second greatest cause of death for women worldwide and one of the most often diagnosed malignancies is breast cancer. There is an urgent need to incorporate the most recent developments in breast cancer treatment that can increase patient survival and quality of life due to the high prevalence of severe physical and psychological symptoms, functional deficits, and adverse effects in patients with breast cancer both during and after treatment **Weiderpass et al (2020)** ⁽¹⁸⁾. Using VR technology for rehabilitation is a novel approach to postoperative breast cancer rehabilitation. In this regard, the primary goal of the current study was to examine the impact of rehabilitation programs based in virtual reality and booklet-based education on post-mastectomy women's self-care behaviors and the avoidance of problems.

Regarding the demographic characteristics of the studied women, the majority were between the ages of 40 and 60 in both groups (VR group and booklet group), This finding is justified by increases breast cancer incidence of women over 40 years due to changes in reproductive patterns, menopausal hormone use, the rising prevalence of obesity and genetic damage (mutations) in the body at this age **Weiderpass et al (2020)** ⁽¹⁸⁾. These findings are in line with **Tsuchiya et al. (2017)** ⁽¹⁹⁾ and **Hunter et al. (2009)** ⁽²⁰⁾, who showed

that less than half of the studied patients were in the age group between 40 and 50 years. This finding is also consistent with **Saleh et al. (2018)** ⁽²⁰⁾, who, in their study "Upper limb cancer related to breast cancer therapy: incidence, risk factors, diagnostic techniques, risk reduction, and optimal management," conducted in Egypt, reported the same median age. Additionally, this result was consistent with a study on the "Effect of educational program regarding therapeutic exercises for women undergoing mastectomy," ⁽²²⁾ which noted that the majority of the analyzed samples were women between the ages of 40 and 55.

Concerning marital status, the present study revealed that the majority of the studied group was married; this result is in line with **Zhang X. et al. (2023)** ⁽²³⁾, who reported that most breast cancer women were married.

Concerning the educational level, the findings of the present study revealed that 44% of the VR group and half of the booklet group had basic education. This finding disagreed with a study conducted by **Beiki et al. (2012)** ⁽²⁴⁾ about "Women with the greatest educational level had a significantly greater incidence of breast cancer compared to those with lesser education, according to a study titled "Breast cancer incidence and case fatality among 4.7 million women in relation to social and ethnic background.".

Moreover, concerning residence, the findings of the present study revealed that the majority of the studied women in both groups lived in rural areas. This finding is consistent with **Sayed et al. (2018)**⁽²⁵⁾, They carried out a study in Egypt on the "Informational Needs of Newly Diagnosed Breast Cancer Women" and discovered that 76% of their participant women resided in cities.

Regarding the occupation of the studied women, the results of the current study showed that the majority of the studied women in both the VR-based education group and the booklet-based education group were not working. This result might be due to an increased percentage of unemployment, and most of the participants lived in rural areas. This result was supported by the study done by **Mohammed et al. (2021)**⁽²⁶⁾ about "effect of booklet-based education versus mobile-based education on women's arm lymphedema and their knowledge and practices regarding post mastectomy exercise", which revealed that more than two-thirds of the participant women (68.8%) were housewives.

The study's findings showed that the VR group outperformed the Booklet group in terms of mean scores for the majority of the aspects that were examined as well as the overall score for self-care practices. Self-care practices such as managing vomiting and nausea, caring for wounds, preventing wound infections, performing arm exercises and preventing lymphedema differ significantly between the VR group and the Booklet group. These results agreed with **Mohammed et al. (2021)**⁽²⁶⁾ who found that mobile education was more effective in improving post-mastectomy practices

regarding exercise than those who received booklet-based education.

Moreover, these results are consistent with **Buche et al. (2021)**⁽²⁷⁾, who confirmed that no matter whether immersive or participatory VR is used, it is different from traditional methods and can be provided to the patients engaged. Patients' perceptions of time shift, they experience titer-induced well-being improvements, anxiety levels drop, and they become more focused on the virtual experience, which is separated from the stressful surroundings and unpleasant stimuli.

Furthermore, valuable studies have been conducted on the effects of VR, and our results are in agreement with those of previous review studies, showing the positive effects of VR exercise therapy. **Qian et al. 2020**⁽²⁸⁾ showed that the positive effect of VR-based exercise therapy on health outcomes was greater than 60%. Moreover, **Asadzadeh et al. (2021)**⁽²⁹⁾ illustrated that virtual reality-based exercise therapy is effective in improvement of rehabilitation outcomes.

The current study showed that the VR-based education group after implementation of the rehabilitation program had a lower incidence of lymphedema and hematoma than the booklet-based education group, and there are statistically significant differences between the two groups. This may be due to the effect of VR, which led to good adherence to self-care practices such as exercises and arm care. These results came in line with **Gautam et al. (2011)**⁽³⁰⁾, who reported that the intervention group met the instructions better than the control group during the next evaluation and after eight weeks, which helped prevent the appearance of lymphedema in the study group. Also,

consistent with these findings are **Baumann et al. (2018)**⁽³¹⁾, who reported that there was a possible preventive effect of physical exercise on the appearance of lymphedema. Also, **Salime et al. (2022)**⁽³²⁾, revealed that, after implementing a health education intervention, there was a significant improvement and increase in all of the studied women's knowledge about arm lymphedema post-mastectomy and prevention strategies. Contrary to current findings by **Paskett et al. (2021)**⁽³³⁾, which found no difference in the incidence of lymphedema in breast cancer patients randomized to a physiotherapy intervention with educational materials.

Regarding the association between the women's mean self-care practice score and the existence of problems following the implementation of the VR program (the study group), the current study finds no evidence of a meaningful link between these variables. However, the findings showed that women with no difficulties following mastectomy are more likely to engage in high self-care behaviors. This is supported by **Gamee et al. (2019)**⁽³⁴⁾ who noted a significant inverse relationship between exercise performance, post- and follow-up recommendations for preventing arm lymphedema, and upper extremity functional index restriction. This indicates that the patient experiences less functional restrictions or disabilities when she complies with instructions, including exercise performance and other self-managements.

Conclusion

Based on the results of the current study, it can be stated that a virtual reality –based rehabilitation program is superior to a booklet-based rehabilitation program in terms of helping women improve their self-

care habits and prevent difficulties following mastectomy

Recommendations: In light of this study's findings, the following recommendations are suggested:

- Application of virtual reality based rehabilitation program after mastectomy should be emphasized and encouraged in oncology centers and hospitals.
- Application of comprehensive health education programs for women following mastectomy should be adopted to maintain good adherence to self-care practices to prevent complications.

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