

Mobile-Health Intervention on Body Image Fear and Fatigue in Women with Breast Cancer: A Randomized Controlled Trial

Abstract

Background: Breast cancer represents a major public health concern and is associated with significant psychological challenges. This study aimed to evaluate the effect of a mobile health (mHealth) intervention on fatigue and body image fear among breast cancer survivors. **Materials and Methods:** This randomized controlled trial was conducted with 104 women with breast cancer in Mazandaran Province, Iran during 2023-2024. Participants were randomly assigned to an intervention group ($n = 52$) or a control group ($n = 52$). The intervention was delivered through social media platforms. Data were collected at pretest, post-test, and follow-up using a demographic questionnaire, the Cancer Fatigue Scale (CFS), and the Littleton Body Image Concern Inventory (BICI). Independent t -tests, ANCOVA, and repeated-measures ANOVA were used for data analysis at a 0.05 significance level using SPSS software. **Results:** The mean (SD) age of participants was 51.43 (8.47) years, and 91 (87.50) had a diploma-level education or lower. Results showed that body image fear and fatigue scores at post-test and follow-up were significantly lower in the intervention group compared to the control group ($F = 300.1, p < 0.001$). *Post hoc* tests indicated that the mean total fatigue score in the intervention group differed from the control group by 8.83 points, and the mean total body image fear score differed by 19.30 points. **Conclusions:** The findings demonstrate that the mHealth intervention had a positive effect on reducing fatigue and body image fear in breast cancer survivors. These results support the incorporation of mHealth as an effective approach within the health sector for decision-making and policy development.

Keywords: Body image, breast cancer, clinical trial, education, fatigue, Iran, mobile health

Introduction

According to the World Health Organization report in 2022, breast cancer is the most common cancer in the world (with 2.3 million women diagnosed and 670,000 deaths).^[1] The Global Cancer Burden Project also predicted an increasing trend in breast cancer among Iranian women in 2025. In recent years, the latest report from the Cancer Registry Center indicates that breast cancer in Iranian women has increased from 25% to 26.47% of all cancers.^[2-4] Despite reductions in mortality due to early detection and advancements in treatment over the past decades, it remains the second leading cause of cancer deaths in women. Breast cancer emerges in Iranian women nearly a decade earlier than in women from developed countries,^[3] with the highest incidence occurring in the 40-49 age group.^[4] Patients endure complex experiences during and

after treatment, often suffering from both physical and psychological symptoms.^[5] The psychological effects in these women are more significant compared to those suffering from other types of cancer.^[6]

Moderate to severe cancer-related fatigue affects one-third of women, even 10 years after their treatment has ended. Another significant issue faced by breast cancer patients is body image anxiety.^[7] Many breast cancer survivors struggle with a negative body image, a loss of femininity, and feelings of reduced sexual attractiveness, particularly among those who have undergone a mastectomy.^[8] Research has shown that 15% to 30% of women with breast cancer experience body image disorders.^[9] To address this issue, cognitive interventions, meditation, and health education programs can significantly help reduce negative emotions and enhance the quality of life for these women. One

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effective approach is the use of mobile health technologies. In recent years, the use of mobile phones, pocket computers, and smartphones has increased dramatically. These portable devices allow for quick access to information and facilitate easier communication among individuals. The application of these technologies in health education, prevention, treatment, and patient follow-up has been explored in various studies.^[10,11]

There are a few studies that explore the integration of mobile health in addressing the physical and psychological challenges faced by breast cancer survivors, most of whom are referred from clinics or hospitals.^[10,12,13] Ghanbari in breast clinics in Shiraz, Iran and Bandani in a hospital in Ahvaz, Iran, indicated the effectiveness of mHealth in managing breast cancer patients, particularly in addressing the psychosocial and physical effects associated with the disease.^[12,13]

Given the extensive accessibility and user-friendly design of mobile phones across various educational levels, this technology represents a viable and cost-effective strategy for disease prevention and control. By leveraging mobile technology, we can facilitate the timely dissemination of health information, enhance community engagement in health initiatives, and empower users with tools for effective self-management of health conditions. Additionally, the integration of mobile health (mHealth) solutions is anticipated to foster improved communication between healthcare providers and patients, resulting in more efficient resource allocation and enhanced health outcomes.^[10-13] In this study, researchers aimed to educate breast cancer survivors in the community and primary care settings about fatigue management and body image disorders through a mobile application. This approach was compared to routine care in these settings, with the potential for integration into standard care practices. The present study aims to rigorously evaluate the effectiveness of this approach, with the expectation that it will lead to significant reductions in the psychological burdens experienced by individuals, families, and communities.

Materials and Methods

This study is a randomized controlled trial (IRCT20241015063368N1) conducted among women with breast cancer referred to comprehensive urban and rural health service centers in Mahmood Abad city in Mazandaran Province, Iran, during 2023-2024. In this study, all women diagnosed with breast cancer who were referred to the health centers were considered, totaling 133 participants. The inclusion criteria included willingness to participate, age between 18 and 75 years, having undergone surgical treatment for breast cancer, and collaboration of a family member with an appropriate level of education. The exclusion criteria included unwillingness to participate, incomplete questionnaires, and lack of desire to continue the study. Of the 113 participants initially enrolled, 9 were

found ineligible and were not included in the study. Based on a computer-generated random number sequence, the 104 participants were equally allocated to the intervention group ($n = 52$) and the control group ($n = 52$) to ensure a representative sample. Participants in both groups were assessed for homogeneity regarding age, disease duration, education level, marital status, and number of children ($p > 0.05$).

Before the educational sessions, baseline data from both groups were collected through questionnaires completed face-to-face by the researcher at the healthcare centers. This collaborative approach ensured accurate and reliable data collection. Following this step, training sessions began for the intervention group, with education delivered via the social media platforms ETA and WhatsApp. The educational sessions for the intervention group were structured as follows: in the first week, participants received an introduction and general information about the disease and treatment-related complications. Weeks 2 to 4 focused on cancer-related fatigue, and weeks 5 to 7 addressed appearance and body image. The educational intervention lasted for 7 weeks, with each session lasting 45 to 90 minutes. The content was initially prepared by researchers using references from the Ministry of Health and was subsequently validated and approved by specialists in health education, health promotion, psychology, and oncology. The content was sent via email to experts for feedback until a consensus was reached. Educational messages were designed to address cancer-related fatigue and body image concerns, while also encouraging patients by highlighting positive experiences. The validity of the messages was evaluated qualitatively by experts using a message validity checklist. The expert panel consisted of seven health education specialists, one message design specialist, one oncologist, and psychologists. These messages were sent daily to the intervention group through social media, while the control group did not receive any messages. Two mobile phone numbers were collected from each participant for sending the messages and for follow-up. If researchers did not receive confirmation within one day, the team either contacted the second mobile number or resent the educational messages. A unique text message was sent daily for 7 weeks. At the end of the intervention and again two months after completing the program, questionnaires were completed by both groups.

To gather information, three questionnaires were used: a demographic questionnaire (age, disease duration, education level, marital status, and number of children), the Cancer Fatigue Scale (CFS) with 15 questions, and the Body Image Concern Inventory (BICI) with 19 questions. Okuyama *et al.*^[14] developed the CFS questionnaire to provide a brief, self-report scale of cancer-related fatigue. The CFS includes 15 questions that evaluate three components: physical (7 items), emotional (4 items), and cognitive fatigue (4 items). It uses a five-point scoring system ranging from 0 (not at

all) to 4 (very much), assessing the patient's current fatigue level. Physical fatigue scores range from 0 to 28, emotional from 0 to 16, cognitive from 0 to 16, and the overall score ranges from 0 to 60.^[14] Aghayousefi *et al.*^[15] assessed the questionnaire's validity using internal consistency. The Cronbach's alpha coefficients were 0.88 for physical, 0.92 for emotional, 0.85 for cognitive components, and 0.90 for the entire questionnaire. Additional evaluation found the internal consistency coefficient of the complete scale to be 0.88.^[16] The Body Image Concern Inventory (BICI) was developed by Littleton *et al.*^[17] It consists of 19 items; each scored from 1 (never) to 5 (always). The first dimension evaluates dissatisfaction and embarrassment about appearance, including 11 questions. The second dimension evaluates the extent to which body image concerns impede social functioning, comprising a total of eight questions. The scoring for this dimension ranges from 19 to 95, categorized as follows: scores between 19 and 37 indicate minimal to no fear of body image, scores from 38 to 52 reflect low levels of fear, scores ranging from 53 to 69 signify moderate fear, and scores of 70 or higher denote high fear. Littleton *et al.*^[17] reported Cronbach's alpha of 0.93 for overall reliability. In the present study, reliability was confirmed with Cronbach's alpha values of 0.86 for the entire questionnaire, 0.84 for the first subscale, and 0.71 for the second subscale.^[18,19]

The data were analyzed at a 0.05 significance level using IBM SPSS Statistics Version 20. Descriptive statistics (mean and standard deviation) and analytical tests, including independent *t*-tests, ANCOVA, and repeated measures ANOVA, were employed.

Ethical considerations

This study was conducted after obtaining the Ethics Code (IR.SBMU.SME.REC.1402.043). Ethical principles

were observed, including explaining the study objectives, maintaining confidentiality, anonymous completion of questionnaires, general publication of results, and voluntary participation and withdrawal. To uphold ethical considerations, educational messages were provided to the control group for several weeks after the post-test was completed.

Results

Demographic characteristics are presented in Table 1. The study found that the mean (SD) age of the participants was 51.43 (8.47) years, and the majority of women 73 (69.90) had less than a high school diploma. Among the participants, 91 (87.50) were married, and 55 (52.88) had two children. The control and intervention groups were well-balanced in terms of demographic and background variables, indicating that random allocation between the groups was adequate [Table 1].

Table 2 presents the comparison of body image fear and general fatigue scores between the intervention and control groups at each time point, showing significant differences between the two groups.

The results indicate that in the intervention group, the scores related to body image fear—including dissatisfaction and embarrassment concerning one's appearance, as well as behaviors such as checking and concealing perceived defects—were significantly lower in both the post-test and follow-up assessments compared to the control group. Regarding the extent to which appearance concerns interfered with social functioning, the intervention group also showed significantly lower scores than the control group at all three time points.

The results further indicate that physical fatigue scores in the pretest phase were significantly higher in the intervention

Table 1: Comparison of background variables in the two intervention and control groups

Variables		Number (%)			Statistics	
		Total	Intervention group	Control group	χ^2	<i>p</i>
Educational level	Diploma and Lower	91 (87.50)	42 (80.77)	49 (94.23)	8.29	0.14
	Associate degree	4 (3.88)	3 (5.88)	1 (1.92)		
	Bachelor's degree	8 (7.77)	6 (11.76)	2 (3.85)		
Marital status	Married	91 (87.50)	47 (90.38)	44 (84.62)	1.38	0.71
	Single	4 (3.85)	2 (3.85)	2 (3.85)		
	Widow	7 (6.73)	2 (3.85)	5 (9.62)		
	Divorced	2 (1.92)	1 (1.92)	1 (1.92)		
Number of children	0	9 (8.65)	3 (5.77)	6 (11.54)	6.74	0.24
	1	19 (18.27)	13 (25)	6 (11.54)		
	2	55 (52.88)	29 (55.77)	26 (50)		
	3	18 (17.31)	6 (11.54)	12 (23.08)		
	4	2 (1.92)	1 (1.92)	1 (1.92)		
	5	1 (0.96)	0 (0)	1 (1.92)		
		Mean (SD)	Mean (SD)	Mean (SD)	<i>t</i>	
Age		51.43 (8.47)	49.79 (8.96)	53.08 (7.69)	2.00	0.05
Duration of illness		6.14 (3.88)	5.59 (3.95)	6.69 (3.76)	1.44	0.15

group 14.29 (4.03) than in the control group 9.35 (3.32). However, during the post-test and follow-up stages, the intervention group's scores were significantly lower than those of the control group. In the other two domains—emotional fatigue and cognitive fatigue—the intervention group consistently reported lower scores than the control group at all three assessment points [Table 2].

A repeated-measures ANOVA was conducted to compare body image fear and fatigue between the two groups. Before analysis, the assumptions underlying the test were carefully evaluated, including the equality of the covariance matrix. The results showed that the assumption of variance homogeneity was not met (Box's $M = 85.60$, $F = 13.82$, $p < 0.001$). However, Mauchly's Test of Sphericity indicated that the sphericity assumption was satisfied at the Greenhouse–Geisser epsilon level ($W = 0.004$, $p = 0.501$). As presented in Table 3, the intervention group demonstrated significantly greater improvement than the control group ($F = 300.1$, $p < 0.001$) [Table 3].

A subsequent repeated-measures ANOVA comparing mean differences between groups and across time for fatigue and body image revealed that the intervention group had a significantly lower mean overall fatigue score compared to the control group (mean difference = 8.83). The intervention group also had a significantly lower mean overall body image fear score (mean difference = 19.30) [Table 4].

Discussion

Breast cancer represents a significant public health challenge, with profound physical and psychological

implications.^[20] The psychological impact of treatment, particularly mastectomy, is considerable, as many survivors report heightened anxiety related to body image. This emotional distress often correlates with increased rates of depression and diminished quality of life. Evidence highlights these psychological ramifications, underscoring the necessity for a holistic approach to patient care that integrates mental health support alongside physical treatment.^[21-23]

The current study indicated the effect of mHealth education on fatigue and body image in breast cancer patients visiting primary care health centers, comparing it to the routine education provided in these centers. Results of this study indicated that the body image fear score in the intervention group was significantly lower than that of the control group at both the post-test and follow-up assessments. Additionally, for all dimensions of body image fear (three components: physical, emotional, and cognitive fatigue), scores differed significantly between the intervention and control groups at all three measurement points (pretest, post-test, and follow-up).

Our study's findings align with the study of Bandani, Aydin, and Soleymani Moghadam. Bandani-Susan *et al.*^[12] indicated that an mHealth education intervention significantly reduced mean scores for cancer-related fatigue and body image in the intervention group. This study, conducted at a hospital in Ahvaz, compared the effectiveness of mobile training to a control group that received no training.

Aydin *et al.*^[10] conducted a quasi-experimental study using a mobile phone-based supportive method in breast cancer patients after surgery, which showed that during the

Table 2: Comparison of body image fear and fatigue scores in the intervention and the control groups

Variables	Times points	Groups Mean (SD)		Statistics	
		Intervention group	Control group	<i>t</i>	<i>p</i>
Body image fear	Pretest	59.21 (9.19)	57.37 (9.62)	1	0.32
	Post-test	27.67 (3.48)	57.35 (9.61)	−20.94	<0.001
	Follow-up	27.54 (3.36)	57.62 (9.47)	−21.58	<0.001
Fatigue	Pretest	26.38 (7.67)	27.19 (8.39)	−0.51	0.609
	Post-test	14.31 (3.87)	27.15 (8.41)	−10.01	<0.001
	Follow-up	14.31 (3.87)	27.15 (8.41)	−10.01	<0.001

Table 3: Results of repeated-measures analysis of variance for body image fear and fatigue

Variables	Sources	Sum of squares	Degrees of freedom	Mean sum of squares	<i>F</i>	<i>p</i>	Eta squared
Body image fear	Study group	29058.10	1	29058.10	300.10	<0.001	0.75
	Between-group error	9877.40	102	96.84			
	Time	17188.70	2	8594.35	182	<0.001	
	Interaction of time and group	17443.50	2	8721.75	184.70	<0.001	
	Within-subject error	9631.80	204	47.21			
Fatigue	Study group	6086.20	1	6086.20	48.50	<0.001	0.32
	Between-group error	12797.70	102	125.47			
	Time	2544.20	2	1272.10	102.60	<0.001	
	Interaction of time and group	25120.00	2	12560.00	101.30	<0.001	
	Within-subject error	2530.40	204	12.40			

Table 4: Mean differences between groups and times for fatigue and body image fear (*post hoc* analysis)

Variables	Groups	Assessment comparisons	Mean differences	Standard error	Significance level	95% confidence interval	
Fatigue	Intervention group	Pretest–post-test	–12.08	0.69	<0.001	(–13.44, –10.72)	
		Pretest–follow-up test	–12.08	0.69	<0.001	(–13.44, –10.72)	
		Post-test–follow-up test	0.00	0.69	0.99	(–1.36, 1.36)	
	Control group	Pretest–post-test	–0.04	0.69	0.96	(–1.4, 1.32)	
		Pretest–follow-up test	–0.04	0.69	0.96	(–1.4, 1.32)	
		Post-test–follow-up test	0.00	0.69	0.99	(–1.36, 1.36)	
	Intervention group compared to control group	Intervention vs. control	–8.83	1.268	<0.001	(–9.50, –6.75)	
Body image fear	Intervention group	Pretest–post-test	–31.54	1.35	<0.001	(–34.19, –28.88)	
		Pretest–follow-up test	–31.67	1.35	<0.001	(–34.33, –29.01)	
		Post-test–follow-up test	–0.13	1.35	0.921	(–2.79, 2.52)	
	Control group	Pretest–post-test	–0.02	1.35	0.989	(–2.67, 2.63)	
		Pretest–follow-up test	0.25	1.35	0.853	(–2.40, 2.90)	
		Post-test–follow-up test	0.27	1.35	0.842	(–2.38, 2.92)	
		Intervention group compared to control group	Intervention vs. control	–19.30	1.11	<0.001	(–21.51, –17.09)

follow-up period, the intervention was effective in boosting women's body image in the experimental group compared to the control group.

Soleymani Moghadam *et al.*^[24] examined the impact of cognitive behavior therapy on women with breast cancer in the oncology department of Imam Reza Hospital in Kermanshah, Iran. The research indicated that this type of therapy positively affects body image. However, in the control group, no significant difference was observed in the average post-test scores compared to the pretest and follow-up ($p < 0.05$).

The results of the current study indicated that, in terms of dissatisfaction and embarrassment regarding one's appearance, as well as the tendency to check and conceal perceived flaws, the intervention group had a significantly lower score than the control group.

The study by Lewis-Smith *et al.*^[25] reveals that an educational intervention can significantly improve body image among breast cancer patients. Participants experienced lasting enhancements in body appreciation, reduced concerns about weight and shape, greater acceptance of age-related changes, and boosted self-esteem. This study demonstrates that the adapted educational interventions are acceptable and feasible and provide primary effectiveness in improving body image and secondary outcomes among breast cancer patients. That provides a vital resource for supporting breast cancer patients on their path to recovery and self-acceptance.

The results of this study showed that in comparing the body fatigue scores and their dimensions in the two intervention and control groups in the post-test and follow-up test stages, the score of the intervention group was significantly lower than that of the control group.

This finding is consistent with the findings of Bandani-Susan *et al.*,^[12] who showed that mHealth text

messages can manage cancer-related fatigue. In the study of Lozano-Lozano *et al.*,^[11] an mHealth educational intervention was effective on the emotional, cognitive, and physical dimensions of fatigue in women with breast cancer.

Our study finding is also consistent with the study of Cario *et al.*^[26] utilized a nonrandomized 2-group control design with pre – post measures to evaluate the effectiveness of a health app for breast cancer survivors, comparing it to a self-guided toolkit. The results indicated that the app group experienced greater reductions in fatigue and improvements in depression; however, these changes were not statistically significant.

Additionally, many women with breast cancer report challenges in fully participating in social, physical, or daily living activities after their cancer treatment.^[5,24,25] Many review studies highlight the effectiveness of mobile apps in managing these issues, showing they are frequently used and beneficial for survivors. This underscores the role of technology in supporting breast cancer patients in coping with treatment challenges.^[27,28]

A study by Soloe *et al.*^[29] demonstrated that education delivered through mHealth or e-learning significantly boosts knowledge, self-confidence, and behaviors linked to the diagnosis, treatment, and care of cancer survivors. This approach can truly transform their experiences and outcomes. However, further studies are necessary to explore the impact of mHealth interventions and other digital or AI-based educational tools on various cancer types and among diverse populations. Furthermore, practice-based learning is fundamental for all health science professions, as it empowers professionals to enhance their clinical skills and remain informed about the latest advancements in patient care, thereby significantly improving the overall quality of health services provided.^[30,31]

One of the notable strengths of this study, conducted in primary healthcare centers and in comparison, with routine care, is the vital role these centers play in delivering preventive care. Their strategic positioning enables them to provide cost-effective services that can significantly improve health outcomes within the community. The high response rate of the research community was one of the strengths. The follow-up, obtaining a support phone number from a family member, and ensuring that the received content was reviewed could have improved the intervention.

Many studies in the country have shown the importance of mobile education in cancer prevention and care, yet screening rates remain low despite free programs, highlighting the need for effective intervention assessments.^[32-36] The impact of educational software and health coaches can be evaluated across different cities by implementing comparable studies. These studies would focus on providing ongoing support and education for cancer survivors, allowing for a comprehensive assessment of the effectiveness of digital health interventions.

One of the key limitations of this study is the use of self-reported questionnaires for data collection. This approach may introduce various biases, including recall bias and information bias, which can affect the accuracy of the responses. Additionally, the influence of the pretest on participants' answers could further impact the validity of the findings. Another limitation of the study is its lack of generalizability to the entire Iranian society; however, this issue can now be mitigated, considering the widespread access to mobile phones among different economic and social demographics.

Conclusion

The current study demonstrated that mHealth interventions positively impacted fatigue and body image among breast cancer survivors, reducing psychological burdens to a manageable extent. Given the widespread availability of mobile phones across various levels of society, it is recommended to incorporate mHealth interventions into educational health planning. Furthermore, mHealth should be recognized as an effective and efficient approach within the health sector when making decisions and developing health policies.

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Conflicts of interest

Nothing to declare.

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