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# Effects of a Breast Cancer Educational Intervention on Fear and Breast Self-Examination: A Randomized Controlled Trial

Müge Sağlık*, Büşra Yolcu, Yasemin Hamlacı Başkaya

*Sakarya University, Institute of Health Sciences, Department of Midwifery, Sakarya, Turkey*

* **Corresponding Author:** Müge Sağlık, Sakarya University, Institute of Health Sciences, Department of Midwifery, Sakarya, Turkey. Email: mge.saglk@gmail.com

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ABSTRACT

**Background:** Breast cancer remains one of the most common cancers among women worldwide. Although regular breast self-examination (BSE) may facilitate early detection, many women have inadequate BSE skills and experience fear related to breast cancer. This study aimed to determine the impact of breast cancer and BSE education on women's breast cancer fear and BSE skills.

**Methods:** This randomized controlled study was conducted between February 1 and May 15, 2024, among 96 women (intervention group, 48; control group, 48) aged 20 to 60 years affiliated with a health center in western Turkey. Data were collected using a personal information form, Champion's Breast Cancer Fear Scale, and a BSE checklist. Baseline characteristics were compared using $\chi^2$ and independent-samples $t$ tests. Within-group changes were analyzed using paired-samples $t$ tests. Postintervention breast cancer fear and BSE skill scores were additionally analyzed using ANCOVA with baseline scores entered as covariates. The study was conducted in accordance with the CONSORT guideline.

**Results:** The intervention and control groups were comparable regarding sociodemographic and breast cancer screening characteristics at baseline. No significant effect of the intervention on breast cancer fear scores was observed. BSE skill scores increased significantly in both groups; however, postintervention scores were significantly higher in the intervention group than in the control group (mean [SD], 88.75 [14.82] vs 57.70 [20.95]; $P < .001$). The number of lumps detected on the breast examination model increased significantly within both groups after the intervention, although no significant between-group differences were found.

**Conclusion:** Breast cancer and BSE education significantly improved women's BSE skills. Practical training supported by breast examination models may be an effective strategy for enhancing breast cancer awareness and promoting accurate BSE performance. Further studies with longer follow-up periods are needed to evaluate the sustainability of these effects.

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## INTRODUCTION

According to a report published by the World Health Organization (WHO), more than 2.3 million breast cancer cases occur each year, making it the most common cancer among adults. Breast cancer is the leading or second leading cause of cancer-related death in women in 95% of all countries in the world.[1] In Turkey, breast cancer is the most common type of cancer among women. The number of breast cancer cases in women was recorded as 74 638 in 2020. In response to this burden, the WHO launched the Global Breast Cancer Initiative Framework in 2023, with the goal of saving 2.5 million lives from breast cancer by 2040. This framework emphasizes the promotion and development of health for early detection, timely diagnosis, and comprehensive management of breast cancer.[1]

One of the most effective ways to reduce breast cancer mortality and morbidity rates is early diagnosis, which is important for identifying cancer before its symptoms and signs appear. Breast self-examination (BSE), clinical breast examination (CBE), and mammography make early detection of breast cancer possible. BSE is an important method for detecting changes in breast tissue and preventing potential complications.[2] It is an easy-to-apply, inexpensive, and noninvasive method. In Turkey,

it is recommended that women perform BSE regularly each month after 20 years of age, have a clinical breast examination every 2 years between 20 and 40 years of age, have a clinical breast examination annually thereafter, and have mammography every 2 years between 40 and 69 years of age. Although breast cancer screening is implemented in many countries, screening is often suboptimal.[3] In one study, the majority of women of reproductive age (88%) were aware that breast cancer is the most common cancer in women; however, 57% of them reported that they had never examined their breasts.[4]

The concept of cancer may cause negative emotions, such as fear and anxiety. Therefore, while some women are willing to undergo early detection, some may be discouraged from doing so.[5] Studies have reported that fear of breast cancer may have both positive and negative effects on early detection behaviors.[6,7] In 2004, Champion et al.[6] found that women with moderate levels of breast cancer fear were more likely to engage in early detection behaviors, while low and high levels of fear had negative impacts on this behavior. A study conducted by Yavan et al.[7] involving 188 women found that 2.3% of the women regularly performed BSE and 78.7% had never had a mammogram. Additionally, 85% of the women in the study reported experiencing fear of breast cancer due to a family history of breast cancer, the possibility of a breast cancer diagnosis, and the presence of risk factors. These results indicate that fear of breast cancer affects screening outcomes.

Previous educational interventions have primarily focused on increasing breast cancer knowledge and awareness; however, the combined effects of these interventions on both emotional responses, such as breast cancer fear, and practical BSE performance have not been sufficiently examined. Furthermore, randomized controlled trials evaluating these outcomes among Turkish women are limited. To address this gap, this study aimed to determine the impact of breast cancer and BSE education on women's breast cancer fear and BSE skills.

## METHODS

### Objective

This study aimed to determine the effect of breast cancer and BSE education on women's breast cancer fear and BSE skills. The primary outcome of the study is the improvement in women's BSE skills following the educational intervention. The secondary outcome is the change in women's breast cancer fear levels after the intervention. The following hypotheses were formulated within this scope:

H1: Breast cancer and BSE education provided to women improves BSE skills.

H2: Breast cancer and BSE education provided to women reduces breast cancer fears.

### Study design

This study is a parallel-group randomized controlled study (ClinicalTrials.gov Identifier: NCT06371508). The flow of participants through each stage of the trial is presented in the CONSORT flow diagram (Figure 1).

### Participants

The study enrolled 184 women aged 20 to 60 years who were registered at a health center in the western region of Turkey. Potential participants were approached during routine visits to the health center and informed about the purpose and procedures of the study. Eligibility screening was conducted according to the predefined inclusion and exclusion criteria. Of the 184 women assessed for eligibility, 54 did not meet the inclusion criteria, and 34 declined to participate. The study was conducted between February 1 and May 15, 2024. Sample size was calculated using G*Power software, version 3.1.9.7 (Heinrich-Heine-Universität Düsseldorf). This calculation was based on data from Taylan et al.[8], who reported mean (SD) breast cancer fear scores of 28.83 (7.82) among women who performed BSE and 22.79 (7.86) among those who did not. Using these values, an effect size (Cohen *d*) of 0.77 was calculated. With a 95% confidence level, a 5% margin of error, and 95% statistical power, the minimum required sample size was determined to be 45 participants per group (90 participants in total). The study was completed with 96 participants, consisting of 48 women in the intervention group and 48 women in the control group, all of whom voluntarily agreed to participate.

### Inclusion and exclusion criteria

Inclusion criteria: Women aged 20 to 60 years, literate, and with no prior history of breast cancer.

Exclusion criteria: Pregnant or breastfeeding women and women with communication barriers.

### Data collection tools

The data were collected using a personal information form, Champion's Breast Cancer Fear Scale (CBCFS), and the BSE Checklist.

#### *Personal Information Form*

The personal information form was developed by the researchers based on relevant literature. The form consisted of questions assessing participants' sociodemographic characteristics, including age, education level, marital status, employment status, family income level, and number of children. In addition, information related to breast health and breast cancer screening behaviors was collected, including the presence of a close relative diagnosed with breast cancer, previous mammography experience, clinical breast examination history, prior knowledge about BSE, and BSE practice status.

#### *Champion's Breast Cancer Fear Scale*

The CBCFS, developed by Champion et al.[6], is an 8-item, unidimensional, 5-point Likert-type scale. The Turkish version was psychometrically tested by Seçginli.[9] The items on the scale are scored by the participants as "strongly disagree" (1 point), "disagree" (2 points), "undecided" (3 points), "agree" (4 points), and "strongly agree" (5 points). The total score ranges

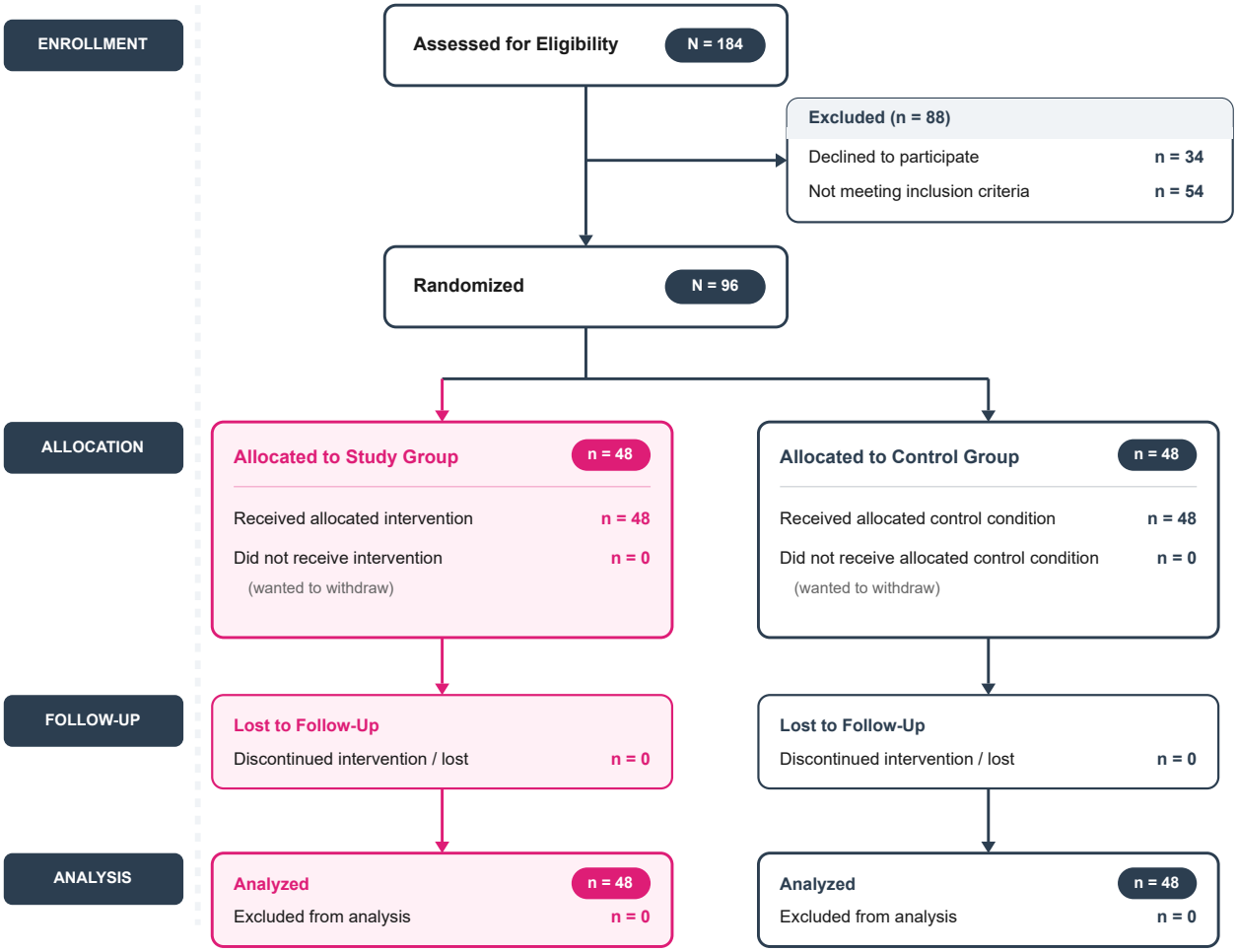



**Figure 1.** CONSORT Flow Diagram of Participant Progress Through the Trial.
The diagram illustrates the phases of the randomized clinical trial, including enrollment, allocation, follow-up, and data analysis. A total of 184 women were assessed for eligibility, with 96 ultimately randomized to either the study (intervention) group or the control group. All 96 randomized participants completed the trial and were included in the final analysis.

from 8 to 40, with higher scores indicating higher levels of fear of breast cancer. Scores between 8 and 15 indicate a low level of fear; 16 and 23, a moderate level of fear; and 24 and 40, a high level of fear. Because the scale was administered both before and after the educational intervention, internal consistency reliability was evaluated separately for each measurement point. The scale demonstrated good internal consistency, with Cronbach α values of 0.850 at preintervention and 0.882 at postintervention.

### *BSE Checklist*

The Breast Self-Examination Proficiency Rating Instrument (BSEPRI), developed by Wood[10] in 1994, was used in the study to assess the women's skills in performing BSE according to appropriate stages and their ability to detect lumps in the breast. The form includes 10 statements related to the stages of performing BSE. Each correctly performed stage is scored 10 points, while incorrectly performed or omitted stages are scored 0 points, resulting in a total score ranging from 0 to 100. Scores of 90 or higher are considered correct BSE performance, whereas scores of 80 or lower are considered incorrect. Because internal consistency may vary across repeated measurements, Cronbach α coefficients were calculated separately for the preintervention and postintervention assessments. Cronbach α coefficients were 0.724 for the preintervention assessment and 0.704 for the postintervention assessment.

## Randomization and allocation concealment

To minimize selection bias, an independent individual who was not involved in participant recruitment, intervention delivery, or outcome assessment generated a computer-based randomization sequence using NCSS Statistical Software before participant enrollment. The randomization list was kept exclusively by this individual and was not accessible to the researcher. Eligible women were enrolled by the researcher. After each participant had been enrolled, the researcher contacted the independent individual, who revealed the group al-

location according to the pre-generated randomization sequence. Thus, group allocation remained concealed from the researcher until each participant had been enrolled.

## Data collection procedure

The data were collected through face-to-face interviews and survey forms. In the first stage of the study, a personal information questionnaire, the CBCFS, and the BSE Checklist were administered as pretests. In the second stage of the study, the researcher delivered an educational PowerPoint (Microsoft Corp) presentation to the women in the intervention group. The training content included information on breast cancer, breast cancer screening programs, and BSE. The researcher provided training on BSE using a breast examination model prepared for the study, and at the end of the training, participants were asked to identify masses in the breast model. The training sessions lasted approximately 40 minutes. Women were informed about breast cancer, its symptoms and early diagnosis, and breast cancer screening programs, and their misconceptions were corrected. The training was conducted in groups of approximately 10 participants each. In the final stage of the study, 1 month after the initial training, a posttest was administered to both the intervention and control groups. In the posttest, the CBCFS and the BSE Checklist were administered for the second time. The effectiveness of the provided training, the acquisition of BSE skills, and the impact on breast cancer fear were assessed.

To minimize the risk of contamination bias, the intervention and control groups attended separate sessions on different dates. Participants in the intervention group were instructed not to share the educational content or materials with women in the control group until all postintervention assessments had been completed. In addition, the control group did not receive the educational intervention until the study was completed. All training sessions were conducted in accordance with the same standard training protocol, which included identical training content, PowerPoint presentations, breast models, session durations, and presentation flows. Furthermore, to ensure instructor consistency, all sessions were led by the same researcher. Attendance was recorded for all educational sessions, and all participants assigned to the intervention group completed the full educational program.

## Blinding

Because of the nature of the educational intervention, blinding of participants and the researcher delivering the intervention was not feasible. Assessment of BSE skills using the BSE Checklist was performed by the same researcher who delivered the intervention; therefore, assessor blinding could not be implemented. To minimize assessment bias, BSE performance was evaluated using the standardized BSEPRI, which includes predefined objective scoring criteria. In addition, statistical analyses were performed independently by an experienced statistician using coded data.

## Statistical analysis

Data were analyzed using SPSS, version 26.0 (IBM Corp). Descriptive statistics were calculated for all variables. Baseline characteristics were compared using independent-samples $t$ tests and $\chi^2$ tests, as appropriate. Within-group changes were evaluated using paired-samples $t$ tests. Because baseline breast cancer fear scores differed significantly between the groups, and to provide a more robust estimate of intervention effects, postintervention breast cancer fear and BSE skill scores were additionally analyzed using analysis of covariance (ANCOVA), with baseline scores entered as covariates. Adjusted means, $F$ statistics, $P$ values, and partial $\eta^2$ were reported. Statistical significance was set at $P < .05$. All statistical analyses were performed independently by an experienced statistician using coded data.

# RESULTS

The sociodemographic characteristics and breast cancer screening–related variables of the participants are presented in Table 1. No statistically significant differences were found between the intervention and control groups regarding age, marital status, education level, number of children, family income level, family history of breast cancer, previous clinical breast examination, or BSE practice ($P > .05$), indicating that the groups were comparable at baseline.

Table 2 presents the comparisons of breast cancer fear, BSE skills, and the number of lumps detected on the breast examination model before and after the intervention. Because baseline breast cancer fear scores differed significantly between groups, postintervention fear scores were reanalyzed using ANCOVA, with baseline fear scores entered as a covariate. After adjustment, no significant difference was observed between the intervention and control groups (adjusted mean, 27.77 vs 27.37; $F_{1,93} = 0.40$; $P = .53$; partial $\eta^2 = 0.004$). Similarly, postintervention BSE skill scores were analyzed using ANCOVA while controlling for baseline BSE skill scores. After adjustment, women in the intervention group demonstrated significantly higher BSE skill scores than those in the control group (adjusted mean, 88.93 vs 57.53; $F_{1,93} = 102.09$; $P < .001$; partial $\eta^2 = 0.52$).

Within the intervention group, breast cancer fear scores did not change significantly from preintervention to postintervention (mean [SD], 28.56 [5.50] vs 29.00 [5.71]; paired $t = -0.78$; $P = .44$). Similarly, no significant change was observed in the control group (mean [SD], 25.56 [5.40] vs 26.19 [4.97]; paired $t = -1.88$; $P = .07$). BSE skill scores increased significantly within both groups following the intervention. In the intervention group, mean (SD) scores increased from 40.00 (21.43) to 88.75 (14.82) (paired $t = -15.71$; $P < .001$), whereas in the control group, scores increased from 40.83 (25.33) to 57.70 (20.95) (paired $t = -6.18$; $P < .001$).

When the total number of masses detected on the breast examination model was compared between

**Table 1.** Baseline Sociodemographic and Breast Cancer Screening Characteristics of the Participants

| Characteristic | Intervention group (n = 48), no. (%) | Control group (n = 48), no. (%) |
|---|---|---|
| **Age, mean (SD) [range], y**[a] | 44.27 (10.62) [29–60] | 47.52 (8.84) [21–60] |
| **Marital status**[b] | | |
| **Married** | 36 (75.0) | 38 (79.2) |
| **Single** | 12 (25.0) | 10 (20.8) |
| **Education**[b] | | |
| **Primary school** | 20 (41.7) | 27 (56.3) |
| **Secondary school** | 7 (14.6) | 6 (12.5) |
| **High school** | 13 (27.1) | 7 (14.6) |
| **University** | 8 (16.7) | 8 (16.7) |
| **Number of children**[b] | | |
| **None** | 11 (22.9) | 9 (18.8) |
| **1** | 12 (25.0) | 4 (8.3) |
| **2** | 15 (31.3) | 23 (47.9) |
| **≥ 3** | 10 (20.8) | 12 (25.0) |
| **Income**[b] | | |
| **Poor** | 4 (8.3) | 3 (6.3) |
| **Moderate** | 34 (70.8) | 37 (77.1) |
| **Good** | 10 (20.8) | 8 (16.7) |
| **Family history of breast cancer**[b] | | |
| **Positive** | 9 (18.8) | 9 (18.8) |
| **Negative** | 39 (81.3) | 39 (81.3) |
| **Previous clinical breast examination**[b] | | |
| **Yes** | 14 (29.2) | 20 (41.7) |
| **No** | 34 (70.8) | 28 (58.3) |
| **Knowledge about mammography**[b] | | |
| **Yes** | 43 (89.6) | 47 (97.9) |
| **No** | 5 (10.4) | 1 (2.1) |
| **Previous mammography**[b] | | |
| **Yes** | 23 (47.9) | 31 (64.6) |
| **No** | 25 (52.1) | 17 (35.4) |
| **Knowledge about BSE**[b] | | |
| **Yes** | 43 (89.6) | 45 (93.8) |
| **No** | 5 (10.4) | 3 (6.3) |
| **Previous practice of BSE**[b] | | |
| **Yes** | 32 (66.7) | 39 (81.3) |
| **No** | 16 (33.3) | 9 (18.8) |
| **Total** | 48 (100.0) | 48 (100.0) |

Abbreviation: BSE, breast self-examination.
[a] Independent-samples *t* test.
[b] $\chi^2$ test.

**Table 2.** Comparison of Breast Cancer Fear, BSE Skills, and Number of Lumps Detected Before and After the Intervention

| Outcome | Time | Intervention group (n = 48), mean (SD) | Control group (n = 48), mean (SD) | Adjusted mean[a] (intervention vs control) | ANCOVA $F_{1,93}$ | *P* value | Partial $\eta^2$ |
|---|---|---|---|---|---|---|---|
| Breast cancer fear | Preintervention | 28.56 (5.50) | 25.56 (5.40) | NA | NA | .008[b] | NA |
| | Postintervention | 29.00 (5.71) | 26.19 (4.97) | 27.77 vs 27.37 | 0.40 | .53 | 0.004 |
| BSE skill score | Preintervention | 40.00 (21.43) | 40.83 (25.33) | NA | NA | .86[b] | NA |
| | Postintervention | 88.75 (14.82) | 57.70 (20.95) | 88.93 vs 57.53 | 102.09 | < .001 | 0.52 |
| Number of lumps detected on the breast model | Preintervention | 1.72 (0.53) | 1.62 (0.60) | NA | NA | .37[b] | NA |
| | Postintervention | 1.97 (0.14) | 1.95 (0.20) | NA | NA | .56[b] | NA |

Abbreviation: BSE, breast self-examination; NA, not applicable.
[a] Adjusted means estimated by analysis of covariance (ANCOVA) using baseline scores as covariates.
[b] Independent-samples *t* test.

the groups, there was a statistically significant difference between preeducation (1.72 [0.53]) and posteducation (1.97 [0.14]) scores of the intervention group ($t = -3.58$; $P < .001$). Similarly, there was a statistically significant difference between preeducation (1.62 [0.60]) and posteducation (1.95 [0.20]) scores of the control group ($t = -4.45$; $P < .001$). There was no significant difference between the 2 groups before education ($P = .37$) or after education ($P = .56$).

## DISCUSSION

This study examined the impact of breast cancer and BSE training on breast cancer fear and BSE skills. The intervention and control groups were well matched at baseline. While the educational intervention did not significantly reduce breast cancer fear, it was associated with a significant improvement in BSE skills. Unlike many previous studies that primarily focused on knowledge improvement, this study contributes to the literature by simultaneously evaluating both psychological outcomes (breast cancer fear) and objective skill performance using a structured checklist and breast model assessment.

BSE is an important skill that increases awareness among women about preventing deaths caused by breast cancer and encourages them to take responsibility.[11] While the WHO and the American Cancer Society do not routinely recommend BSE, this does not mean it should never be done. In low- and middle-income countries, BSE is encouraged due to practicality, inadequate access to health care, and unequal mammography availability. Women should use BSE to learn about the signs of breast cancer and the normal appearance and feel of their breasts.[12] Studies particularly highlight that breast cancer can be prevented through BSE for women in rural areas, emphasizing the importance of awareness and education on this issue.[13] In developing countries like Turkey, BSE is a standard method for early detection of breast cancer.[14] In a study by Abo Al-Shiekh et al.[2], nearly all participants were aware of BSE, yet only 31.4% reported performing it regularly. The majority of participants cited reasons for not performing BSE as "I don't have any breast problems" (39.7%; n = 23) and "I don't know how to perform BSE" (37.9%; n = 22). Another study found a high rate of noncompliance with BSE even after education in both the intervention and control groups.[15] Women expressed reasons for not performing BSE, such as "I heard about it but didn't pay attention because I have no complaints" and "I'm afraid of finding something."

Early screening for breast cancer is critical for improving health outcomes and reducing mortality rates.[16] The role of fear in breast cancer screening is well recognized. Specifically, fear of a breast cancer diagnosis and the potential loss of a breast can significantly influence whether women adhere to recommended early detection and diagnostic practices.[16,17] In a 2019 study by Kayar, mean CBCFS scores did not differ significantly between the intervention and control groups; however, breast cancer fear levels were higher in the intervention group at posttest.[22] A study conducted in Nigeria found that women had low rates of performing BSE and undergoing mammography, yet they reported high levels of fear according to the CBCFS.[18] In the current study, it was determined that the mean CBCFS scores of women in both the intervention and control groups increased after education. Increased knowledge or awareness of breast cancer among women may have also increased their fears. However, unfortunately, this increase in fear did not necessarily translate into the adoption of regular BSE habits. Fear may have both adaptive and maladaptive effects on health behaviors. While excessive fear can lead to avoidance, denial, and reluctance to participate in screening practices, moderate levels of fear may increase perceived susceptibility and motivate women to engage in preventive health behaviors, including breast cancer screening and self-monitoring. Therefore, the increase in fear observed after the educational intervention should not necessarily be interpreted as a negative outcome. Rather, it may reflect increased awareness and recognition of breast cancer risk.

In studies aiming to increase women's knowledge, awareness, and practical skills related to breast cancer and BSE, it has been observed that various interventions, such as brochures, PowerPoint presentations, face-to-face education sessions, peer education, videos, smartphone applications, and breast examination models, effectively enhanced knowledge, awareness, and practical skills.[19,20] Despite the presence of research evaluating the effectiveness of BSE training, few studies have utilized skill assessment forms specifically designed for BSE training. Ibrahim et al.[21] found significant differences between pretest and posttest results concerning Iraqi women's knowledge of BSE steps. In a study by Akarsu and Andsoy,[11] it was noted that the rates of correctly identifying BSE steps increased 1 and 3 months after the training. In our study, the posttraining total BSE skill score of the intervention group was significantly higher than that of the control group. The increase in posttraining total BSE skill score in the control group may be attributed to increased awareness. Women in the intervention group also found more masses on the breast examination model after training. The increase in the number of lumps detected in both groups may be partially explained by a testing effect or increased familiarity with the breast examination model and assessment procedure. Because no significant between-group difference was observed, this improvement cannot be attributed solely to the educational intervention.

### Strengths and limitations

One of the strengths of our study is the evaluation of women's proficiency in performing BSE effectively (ie, correctly performing BSE and detecting masses in the breast). Additionally, the use of a pretest/posttest experimental design with repeated measurements in both the intervention and the control groups is another strong aspect of the research. However, this study has certain limitations. The sample group was selected

from a single region, which means that the findings may not be generalizable to all women.

Moreover, a limitation of this study is that mammography history was obtained through verbal self-report rather than verified through medical records or imaging reports. Furthermore, the 1-month follow-up period limited the evaluation of long-term behavioral change and sustained breast cancer screening practices. In addition, participants in this study demonstrated relatively high levels of breast health awareness and previous BSE practice. Therefore, the findings may not be fully generalizable to women with lower awareness levels or less engagement in preventive health behaviors.

## CONCLUSION

Evaluation of the study data indicated that while women were knowledgeable about breast cancer and BSE for early detection and prevention, a greater proportion demonstrated improved BSE skills following the training. An increase in fear scores related to breast cancer was noted after the education on breast cancer and BSE. Practicing mass detection on the breast examination model contributed to the development of women's breast examination skills. Training on breast cancer and BSE skills may be beneficial in combating breast cancer, which is a significant public health issue. The use of a breast examination model and visual presentations may be more effective in retaining information. Considering the benefits of BSE, government policies aimed at promoting health should adopt educational and incentive policies to make it a cultural habit. Strategies should be developed to address factors influencing the habit of performing BSE. Additionally, conducting high-quality randomized controlled trials on large populations across different cultures or with high cross-cultural representations over the long term is recommended to achieve high-level evidence. Based on the findings of this study, breast cancer awareness may increase, and BSE skills may improve with breast cancer and BSE training given to women.

## ETHICAL CONSIDERATIONS

The study was conducted in accordance with the principles of the Declaration of Helsinki and was approved by the Sakarya University Medical Non-Interventional Ethics Committee (December 28, 2023; No. E-71522473-050.01.04-318462-374). Written informed consent was obtained from all individual participants included in the study.

## DATA AVAILABILITY

The datasets generated and analyzed during the current study are not publicly available because they contain information that could compromise participant privacy but are available from the corresponding author on reasonable request and with approval of the institutional ethics committee.

## CONFLICT OF INTERESTS

The authors declare that they have no conflict of interest with any institution, organization, or person related to this study.

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## AI DISCLOSURE

No AI or AI-assisted technologies were used.

## AUTHOR CONTRIBUTION

MS: study design, data collection, data analysis, study supervision, manuscript writing, and critical revisions for important intellectual content; BY: study design, data analysis, and manuscript writing; YHB: study design, data analysis, study supervision, and critical revisions for important intellectual content.

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