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From Being Unaware to Be Informed: Evaluating Changes in Breast Cancer Awareness After Educational Program Intervention: A Quasi-Experimental Study

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ABSTRACT:

Background: Educational programs and awareness campaigns have recently been implemented in Saudi Arabia to enhance women's knowledge and awareness about breast cancer (BC) screening and diagnosis.

Aim: This study aims to assess the knowledge and attitudes of women regarding breast cancer screening before and after an educational lecture.

Methods: A quasi-experimental design was conducted by pre- and post-testing their knowledge through a structured written questionnaire, it was conducted on a randomly selected women aged 20 to 60 years at high schools in Alhasa- Saudi Arabia. An educational lecture was presented to them for one hour to raise their knowledge level about BC. All data was collected and then extracted to be analyzed with SPSS program version 27.0.

Results: From total 100 women as participants, most participants were aged 40–49 and highly educated, with limited prior awareness and moderate baseline knowledge. Recognition of breast cancer signs and risk factors varied, with strong awareness of hereditary risks but weaker understanding of lifestyle-related factors. Screening practices showed inconsistencies, particularly regarding mammography frequency and appropriate age. After the educational intervention, significant improvements were observed in overall knowledge, risk-factor awareness, confidence, and behavioral intentions. Statistical analysis confirmed highly significant gains across most domains, demonstrating the program's effectiveness ($p < 0.05$). Conclusion: Educational lectures and the awareness supporting programs can enhance the women's knowledge about BC screening and diagnosis in Saudi Arabia.

INTRODUCTION:

Breast cancer is the most common type of cancer in women, accounting for more than 10% of all new cases each year. It is also the second greatest cause of cancer-related death among women worldwide [1]. People know what the main risk factors are, and to minimize the number of cases, people need to take steps to prevent them. Invasive breast cancer is still the most common type of cancer in women around the world, making for roughly 11.7% of all new cases reported in 2020 [2]. In the US, women have around a 1 in 8 chance of getting the disease in their lifetime, while men have about a 1 in 1000 chance. The incidence of the disease rises progressively with age, going from around 1.5 per 100,000 in women aged 20 to 24 to more than 420 per 100,000 in women aged 75 to 79. Most cases (about 95%) are identified after age 40. The usual age upon diagnosis is roughly 61 years [3].

Early detection has a big effect on the outcome of diseases and public health in general. Mammography is still the main way to test for breast cancer, but adding digital breast tomosynthesis has made it easier to find the disease and cut down on unnecessary recalls. For women with an average risk, starting at age 40 [4], annual mammograms are the best way to lower the chance of death. Individuals at elevated risk or possessing dense breast tissue may benefit from adjunct imaging modalities—such as MRI [5], ultrasound, or molecular breast imaging—to facilitate the detection of malignancies not discernible on mammography [6].

There are several things that can increase a woman's risk of breast cancer, but being a woman is the most important one since women are exposed to estrogen more often over their lives, and breast tissue is especially sensitive to it. Men, who have significantly lower levels of estrogen, don't get the condition very often [7]. The risk goes up even more as you get older: it goes from around 1.5% at age 40 to 3% at age 50, and then it goes above 4% by age 70. Family history, race, drinking, smoking, and having a high body mass index are all risk factors [8].

Studies indicate that women's comprehension and perceptions of breast cancer significantly influence their readiness to pursue medical treatment [9]. A painless tumor is often the first thing that patients notice, although other symptoms may show up as well [10]. To get prompt medical care, you need to know about breast health and be able to spot warning symptoms. Women who know about the risk factors and early signs of the condition tend to get help sooner, which leads to better outcomes [11]. On the other hand, a lack of understanding often causes delays, makes the disease progress faster, and lowers the odds of survival [12].

Several educational programs and awareness campaigns have recently been implemented in Saudi Arabia to enhance women's knowledge and awareness—across all age groups—about the importance of early detection and appropriate breast cancer screening [13, 14].

Even though early detection is very important, there isn't much information about breast cancer awareness in many parts of Saudi Arabia, especially when it comes to risk factors and screening techniques [15, 16], therefore, this study aims to assess the knowledge and attitudes of women regarding breast cancer screening before and after an educational lecture. By evaluating changes in understanding and perceptions, we can better inform future educational efforts and enhance screening participation rates.

METHODS

Design

This research employed a quasi-experimental design with pre-test and post-testing to assess the effectiveness of an educational intervention that can change in knowledge and awareness levels.

Sampling and population

A random sampling method was employed to recruit participants from community centers, healthcare facilities, workplaces, and social groups within the specified location. The G power statistical program was used to give the final sample size with a margin error of 5% and confidence interval (CI 95%) of 100 women as participants.

All women aged 20 to 60 years at high schools in Alhasa- Saudi Arabia and had previous knowledge about breast cancer in general with willingness to participate in this study were included, however women with a prior diagnosis of breast cancer and all healthcare professionals specialized in oncology or related fields were excluded.

Intervention

After setting up the intervention, a questionnaire was developed and adopted from Sim et al. (2009) study and adapted by the researcher [17]. This questionnaire was distributed before and after the educational program was carried out.

The educational program was developed and presented by trained educators or healthcare professionals to deliver the intervention.

It consists of a one-hour interactive session using multimedia presentations, brochures, and demonstrations, and supported with Educational brochures. It focused on the basics of breast cancer with understanding what breast cancer is and its prevalence, highlighting modifiable and non-modifiable risk factors, importance of early detection and screening methods like mammography and self-examinations and some prevention Strategies such as the lifestyle changes and preventive measures.

Data Collection Methods

After getting the ethical approval, a pilot study on 10% of the study participants was carried out to affirm the tool validity at first.

A pre-test questionnaire was done before the intervention; participants completed the questionnaire assessing their baseline knowledge and awareness of breast cancer. Then the educational program was conducted on the same respondents to then ask them to fill in the same questionnaire as post-test procedure.

Data Analysis

Using SPSS software program (version 27.0) to statistically analyze the obtained data. Descriptive analysis such as means, standard deviations were used to determine the levels of knowledge and awareness, paired t-test and ANOVA were used as inferential statistics to be found if there is a difference between pre- and post-test awareness and knowledge level about breast cancer. The results were considered significant at $p < 0.05$.

Ethical Considerations

An informed consent was obtained from all participants with detailed information about the study and sign a consent form. An additional ethical approval was obtained from King Faisal University with IRB no 2791.

RESULTS

Basic characteristics

In this study, a total of 100 women. The age distribution shows that the largest proportion of participants are between 40–49 years old (52%), followed by those in the 30–39 age group (40%), while only 8% fall in the 20–29 range. Most participants hold a college-level education (83%), while very small proportions have post-graduate (5%), secondary school (9%), or primary school (3%) education. A striking majority of the participants are unemployed (76%), with only 21% employed and 3% students. The majority of the participants are married (81%), whereas 10% are single and 9% categorized as other. (Table 1).

Table 1 Personal characteristics among the study participants (n=100)

Age (years)	Frequency (n)	Percentage (%)
20-29	8	8
30-39	40	40
40-49	52	52
Educational level		
College	83	83
Post-grad	5	5
Primary school	3	3
Secondary school	9	9
Occupational status		
Employed	21	21
Student	3	3
Unemployed	76	76
Marital status		
Married	81	81
Other	9	9
Single	10	10

Most respondents reported no family history (67%), while 25% indicated yes, and 8% were unsure. Regarding the previous diagnosis of BC among participants, only 6 reported a personal history before (Fig. 1&2).

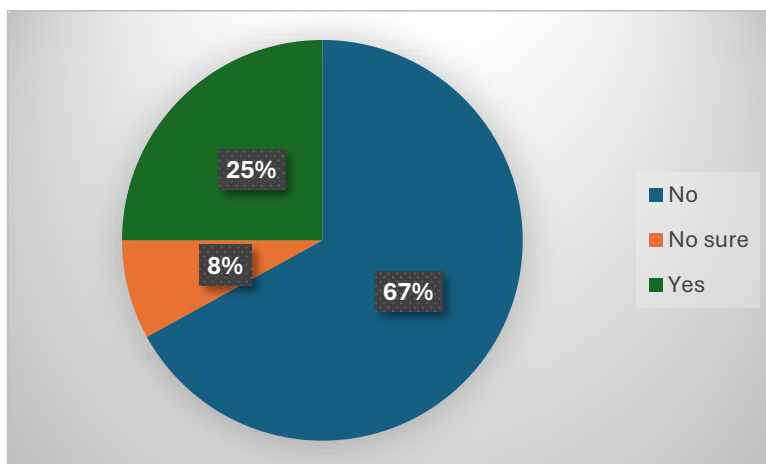


Figure 1 Family history detected among the participants

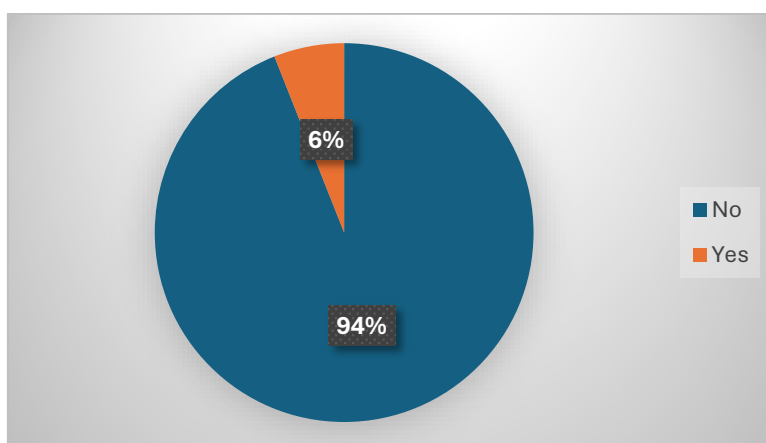


Figure 2 Personal Family history detected among the participants

General Awareness of Breast Cancer

Upon rating the current knowledge of the participants about BC, the degree of knowledge was 2.431 ± 0.6995 . Hearing about breast cancer before indicating an equal distribution between previous hearing and not (50% for each) (Fig. 3).

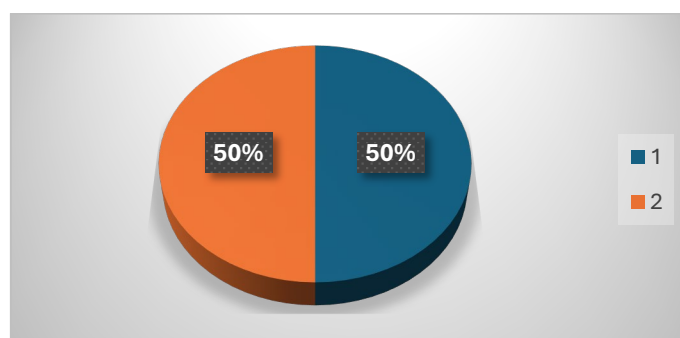


Figure 3 Hearing before about breast cancer

The data show that the most frequently recognized breast cancer sign is the combination of a lump in the breast or underarm, nipple discharge, skin dimpling or thickening, and redness or scaliness of the nipple (28%). A notable proportion (21%)

identified only a lump in the breast or underarm. Other combinations—such as a lump with nipple discharge (9%) or a lump with nipple discharge and redness/scaliness (11%). A small portion (4%) reported “Do not know”, showing gaps in awareness, and 3% reported having no symptoms (Table 2).

Table 2 The signs reported of breast cancer

	Frequency (n)	Percentage (%)
A lump in the breast or underarm	21	21
A lump in the breast or underarm, Nipple discharge	9	9
A lump in the breast or underarm, Nipple discharge, Redness or scaliness of the nipple	11	11
A lump in the breast or underarm, Nipple discharge, Skin dimpling or thickening, Redness or scaliness of the nipple	28	28
A lump in the breast or underarm, Nipple discharge, Skin dimpling or thickening, Redness or scaliness of the nipple	3	3
A lump in the breast or underarm, Redness or scaliness of the nipple	17	17
A lump in the breast or underarm, Skin dimpling or thickening, Redness or scaliness of the nipple	1	1
Do not know	4	4
Nipple discharge	3	3
No symptoms	3	3

Knowledge of Risk Factors

The most frequently recognized risk factor is family history combined with age over fifty (47%), considerable portion (31%) identified smoking as a risk factor. Obesity (8%), age over fifty alone (8%), and alcohol consumption (2%) were much less frequently selected. The presence of “Don’t know” (4%) responses (Table 3).

The preventive measures against breast cancer showed that most of participants (n=82) are believing in presence of preventive measures for breast cancer (Fig. 4).

The most commonly identified risk-reduction approach is the combination of regular exercise, maintaining a healthy weight, and breastfeeding (85%). Some participants selected individual or partial measures such as limiting alcohol intake (15%), breastfeeding alone (7%), or maintaining a healthy weight with breastfeeding (8%), however, 14% reported “Do not know” (Table 4).

Table 3 Risk factors for breast cancer

	Frequency (n)	Percentage (%)
Age over fifty	8	8
Alcohol consumption	2	2
Do not know	4	4
Family history, Age over fifty	47	47
Obesity	8	8
Smoking	31	31

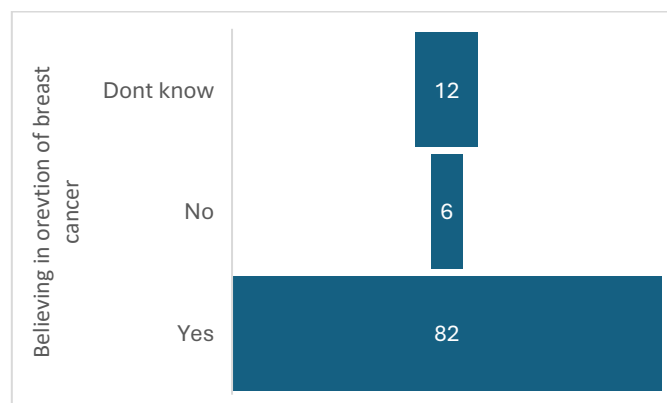


Figure 4 Believing in breast cancer preventive measures

Table 4 Risk factors reduction approaches

	Frequency (n)	Percentage (%)
Breastfeeding	7	7
Do not know	14	14
Limiting alcohol intake	15	15
Maintaining a healthy weight, Breastfeeding	8	8
Regular exercise, Maintaining a healthy weight, Breastfeeding	85	85

Awareness of Early Detection and Screening

The descriptive statistics indicate that participants demonstrated a strong understanding of the importance of early breast cancer detection, as shown by the very low mean score of 1.07, suggesting a high level of agreement among respondents. In contrast, the mean score for performing breast self-examination (BSE) was 1.67 (Fig. 5). Similarly, the item assessing whether participants had ever undergone a mammogram yielded a mean of 1.75. A majority of participants (69%) reported performing BSE annually, while 23% indicated that they perform it monthly. However, a small percentage (5%) reported they do not know how often they perform BSE, and 3% indicated they never perform it.

Regarding mammography frequency, the results show that 51% of participants undergo mammography annually. However, 26% reported not knowing how often they should receive mammograms, and 16% indicated they undergo screening every two years. A smaller proportion (7%) reported only having a mammogram when symptoms appear, suggesting reactive rather than preventive screening behavior.

The data on appropriate age for mammography reveal further insight into participants' knowledge. While 49% correctly identified the age range 30 to 40, and 39% recognized that mammography is recommended after age 40, a notable percentage remained uncertain. Specifically, 7% reported not knowing the appropriate age, and 5% incorrectly believed it should begin below age 30 (Table 5).

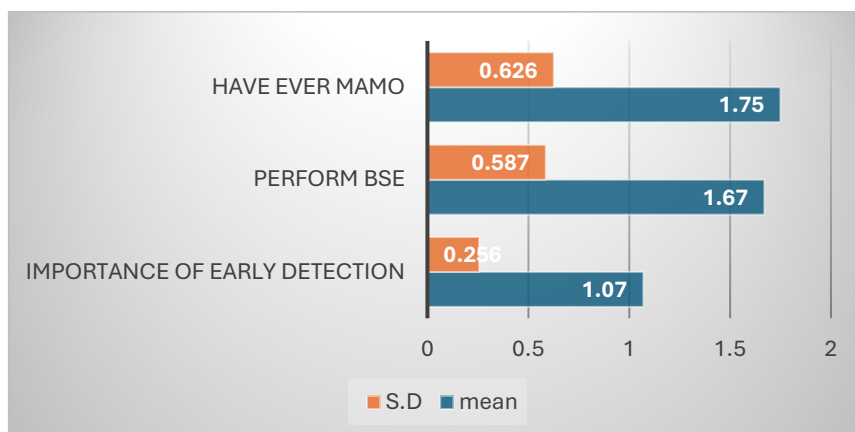


Figure 5 The awareness about detecting and screening breast cancer

Table 5 Assessment of breast self-examinations (BSE) and mammogram

		Frequency (n)	Percentage (%)
Ever Perform breast self-examinations (BSE)	Annually	69	69
	Don't know	5	5
	Monthly	23	23
	Never	3	3
How often Mammogram is performed	Annually	51	51
	Do not know	26	26
	Every two years	16	16
	When symptoms appear	7	7
Perfect Age for performing Mammogram	After forty	39	39
	Below thirty	5	5
	Do not know	7	7
	From thirty to forty	49	49

ANOVA findings presented offer crucial insights into how different demographic characteristics influence participants' awareness and screening-related behaviors. Among the age categories, statistically significant differences were observed across all three awareness items ($p = 0.008$), performance of breast self-examination (BSE) ($p = 0.005$), and perceived importance of early detection ($p = 0.02$).

Educational level demonstrated a significant effect only on whether participants had ever undergone mammography ($p = 0.03$). However, no significant differences were found for BSE performance ($p = 0.19$) or perceived importance of early detection ($p = 0.21$).

Occupation also showed significant associations with mammography uptake ($p = 0.008$) and BSE performance ($p = 0.04$), but not with perceived importance of early detection ($p = 0.41$).

Interestingly, family history did not significantly influence mammography use or BSE performance ($p = 0.71$ and 0.90 , respectively), but it strongly affected perceptions of early detection ($p = 0.001$).

The most striking finding arises from the personal history of breast cancer, which shows a highly significant association with mammography uptake ($p = 0.000$). However, personal history did not significantly influence BSE practices ($p = 0.41$) or perceptions of early detection ($p = 0.16$) (Table 6).

Table 6 ANOVA for measuring participants' awareness in relation to some categorical characteristics

Character	Awareness item	Awareness level	F value	p-value
Age	Have you ever made mammogram	1.65 ± 0.7	32.4	0.008
	Performing BSE	1.52 ± 0.1	21.6	0.005
	Importance of early detection of BC	0.96 ± 0.21	31.4	0.02
Educational level	Have you ever made mammogram	1.47 ± 0.13	21.7	0.03
	Performing BSE	1.54 ± 0.41	17.8	0.19
	Importance of early detection of BC	1 ± 0.4	19.24	0.21
Occupation	Have you ever made a mammogram	1.42 ± 0.6	24.5	0.008
	Performing BSE	1.37 ± 0.11	31.4	0.04
	Importance of early detection of BC	0.94 ± 0.25	21.8	0.41
Family history	Have you ever made a mammogram	$1.61 \pm .6$	15.6	0.71
	Performing BSE	1.47 ± 0.7	17.7	0.9
	Importance of early detection of BC	0.87 ± 0.09	19.4	0.001
Personal history	Have you ever made a mammogram	1.47 ± 0.4	16.7	0.000
	Performing BSE	1.14 ± 0.8	22.7	0.41
	Importance of early detection of BC	1.01 ± 0.07	31.9	0.16

Attitudes and Beliefs About Breast Cancer

The change in knowledge about breast cancer examined attitudes toward breast cancer, further highlights important aspects of participants' perceptions. Levels of concern about breast cancer showed a mean score of 2.08, indicating a moderate degree of worry or perceived susceptibility among participants. Beliefs regarding the curability of breast cancer scored lower, with a mean of 1.08 (Table 5), additionally, attitudes concerning the importance of acting upon discovering a lump—reflected by a mean score of 1.36 (Fig. 6).

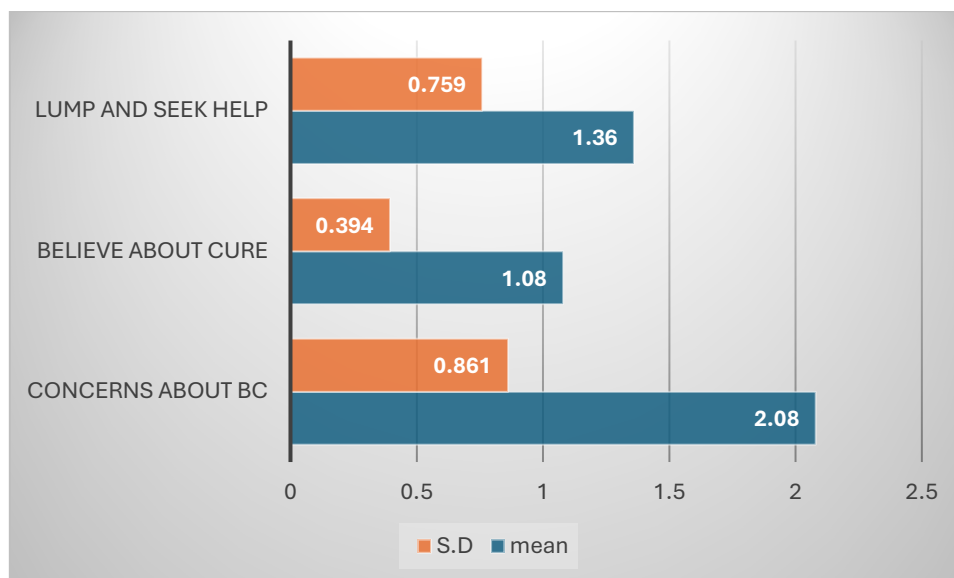


Figure 6 Attitude levels about breast cancer

Knowledge Change Assessment

The results reflect a comprehensive assessment of the participants' changes in knowledge and behavioral intentions following the educational program. Overall, the findings. The highest mean score was reported for the "Rate of usefulness," with a mean value of 3.79.

A noticeable improvement was also observed in the participants' educational gain, reflected by a mean score of 3.00, indicating that the program substantially contributed to enhancing their knowledge base. Measures related to confidence and empowerment showed moderate positive outcomes. For instance, participants' confidence in performing breast self-examination (BSE) had a mean of 1.44, while feelings of empowerment scored 1.49. Behavioral intentions also improved following the educational program. Participants reported greater willingness to share information with friends (mean = 1.28) and to schedule a medical appointment if needed (mean = 1.44) (Table 6).

Table 7 The Knowledge Change Assessment

	Mean	S.D
Improve Educational	3.00	1.172
Confident in BSE	1.44	.891
Share with friends	1.28	.533
Schedule an appointment	1.44	.820
Feel empowered	1.49	1.020
Rate of usefulness	3.79	.481

One sample T-test assessment to measure the change in knowledge after the educational program

The results of the one-sample t-test revealed a significant improvement in participants' knowledge following the educational program. The overall knowledge score increased markedly, with a mean of 3.79 and a highly significant p-value ($p = 0.000$). The confidence interval for the mean difference (1.26–1.62). Knowledge related specifically to breast cancer risk factors also showed a substantial rise. The results demonstrated a very large mean difference of 3.00, supported by a narrow confidence interval (2.77–3.23) and an extremely high t-value ($t(99)=16.157$) (Table 8).

When knowledge scores were examined in relation to demographic and background variables, several noteworthy patterns emerged. Age did not show a meaningful effect on knowledge improvement, as both pre- and post-test scores were statistically similar across age groups (Table 9).

Table 8 A measurement of the change in the knowledge after the educational program

	Mean	S.D	Std. Error Mean	t	df	Sig. (2-tailed)	Mean Difference	95% Interval Difference	Confidence of the
								Upper	Lower
Knowledge Change Assessment	3.79	0.481	0.089	16.157	99	0	1.44	1.26	1.62
Knowledge about risk factors	1.49	1.02	0.117	25.596	99	0	3	2.77	3.23
Change in knowledge after test	1.28	0.533	0.053	24	99	0	1.28	1.17	1.39

Table 9 Chi-square for measurement the knowledge of the participants in relation to some categorical characteristics

Character	Pre-test (mean $\pm$ S.D)	After-test (mean $\pm$ S.D)	p-value
Age	2.14 $\pm$ 0.1	2.4 $\pm$ 0.41	0.638
Educational level	3.41 $\pm$ 0.02	1.71 $\pm$ 0.1	0.002
Occupation	3.1 $\pm$ 0.41	3.14 $\pm$ 0.21	0.957
Family history	2.78 $\pm$ 0.3	1.24 $\pm$ 0.01	0.00
Personal history	2.41 $\pm$ 0.41	2.45 $\pm$ 0.12	0.66
Hearing about BC before	4.41 $\pm$ 0.9	1.17 $\pm$ 0.01	0.002

DISCUSSION

Educational programs and awareness campaigns have recently been implemented in Saudi Arabia to enhance women's knowledge and awareness about breast cancer screening and diagnosis. Therefore, this study aims to assess the knowledge and attitudes of women regarding breast cancer screening before and after an educational lecture. This study provides a comprehensive assessment of women's knowledge, attitudes, and screening practices related to breast cancer before and after participating in an educational lecture.

In this study, a total of 100 women gave a consent to participate in this quasi-experimental study. The age distribution shows that the largest proportion of participants are between 40–49 years old (52%). This indicates that the sample is predominantly middle-aged, with very few young adults represented that may give a good background for breast cancer field as it mainly focuses on middle aged and women [18].

Such a distribution may influence the study's outcomes, especially if age is related to attitudes, behaviors, or health factors being assessed. The dominance of the 40–49 category suggests that the sample may reflect experiences or viewpoints more common in this age bracket rather than a younger demographic [19].

Most participants hold a college-level education (83%), while very small proportions have post-graduate (5%). This high percentage at the college level suggests that the sample is highly educated, which may affect their awareness, decision-making, and overall responses in the study. The limited representation of lower-education groups means the results may not generalize well to populations with basic or moderate educational backgrounds [2, 20, 21].

A striking majority of the participants are unemployed (76%), and this could strongly influence variables such as stress, income, lifestyle, or health-related outcomes, depending on the study context. The majority of the participants are married (81%), which may affect social support systems, daily responsibilities, stress levels, and lifestyle patterns. The small percentage of singles may limit comparative analysis across different marital groups.

Most respondents reported no family history (67%). This distribution suggests that the participants may have a familial predisposition relevant to the condition or topic being studied. Previous studies by Maouchi et al. (2023), Asmare et al. (2022), and Sarker et al. (2022), reported that the family history is one of the contributors to BC awareness, knowledge, and practices from women [12, 22, 23].

Regarding the general awareness of BC, upon rating the current knowledge of the participants about BC, the degree of knowledge was 2.431 ± 0.6995 . This moderate level of assessing knowledge by themselves may indicate the need for performing any external approach to raise their knowledge level about breast cancer. Hearing about breast cancer before indicating an equal distribution between previous hearing and not (50% for each), it is in alignment with Assfa Mossa (2022), who reported that over 80% were unfamiliar [24].

The ANOVA findings gave crucial insights into how different demographic characteristics influence participants' awareness and screening-related behaviors. Overall, the results show that awareness levels vary significantly across certain demographic groups, particularly age, educational background, occupation, and personal history of breast cancer, whereas other factors such as family history, demonstrate selective influence [14, 21, 25].

The data show that the most frequently recognized breast cancer sign is the combination of a lump in the breast or underarm, nipple discharge, skin dimpling or thickening, and redness or scaliness of the nipple (28%), indicating that many participants recognize multiple warning signs rather than only one, it is in agreement with AlMutawah et al. (2025), who found that the participants with a family history of breast cancer showed significantly higher awareness of breast cancer signs and risk factors ($p < 0.001$). A breast lump or thickening was the most recognized symptom (72%), while fear of pain or discomfort was the most common barrier to screening (57.8%) [26].

A small portion (4%) which may reflect low knowledge or misunderstanding of the question. Overall, it has been suggested that there is moderate awareness, but with significant variability, highlighting a need for more focused education on the full spectrum of breast cancer signs.

Regarding the knowledge of women about BC risk factors, it has been noted that the most frequently recognized risk factor is family history combined with age over fifty (47%), (31%) identified smoking as a risk factor, obesity (8%), and alcohol consumption (2%) were much less frequently selected, indicating limited awareness of lifestyle-related risks. It showed a strong understanding that genetic predisposition and increasing age and smoking are major contributors to breast cancer risk. It is consistent with Rainey et al. (2022) study, who reported that self-perceived breast cancer risk was associated with greater uptake of supplemental screening, BSE, risk-reducing medications, and preventive lifestyle behaviors. Additional predictors included having a first-degree relative with breast cancer, older age, and higher BMI [27].

The preventive measures against breast cancer showed that most of participants ($n=82$) are believing in presence of preventive measures for breast cancer, this high knowledge degree is agreeing with Chlebowski et al. (2021) study, who reported that the prevention of breast cancer is mandatory to reduce risk of BC incidence and exacerbation [25].

And this suggests that while many respondents may recognize the importance of prevention, their specific understanding of effective measures may be inconsistent. It supports the idea that health education programs emphasizing practical preventive behaviors could significantly strengthen preventive awareness.

The most commonly identified risk-reduction approach is the combination of regular exercise, maintaining a healthy weight, and breastfeeding (85%). The distribution overall suggests that while many participants understand key preventive methods, there is still a need to reinforce comprehensive prevention messaging, especially for those unfamiliar with these practices. Different studies ([28]; [29]; [30]) reported that breastfeeding and exercise are the main preventive ways used to reduce risk of BC.

The awareness of early detection and screening of BC indicated that participants demonstrated a strong understanding of the importance of early breast cancer detection, as shown by the very low mean score of 1.07, suggesting a high level of agreement among respondents. In contrast, the mean score for performing breast self-examination (BSE) was 1.67, reflecting moderate engagement in this practice. Similarly, the item assessing whether participants had ever undergone a mammogram yielded a mean of 1.75, indicating that while some women have participated in screening, others may lack regular engagement in mammography practices, it is in alignment with Racine et al. (2022) study, who breast self-examination (BSE) and mammogram reflecting the most effective women attitudes in BC [31].

The frequency data on BSE practices further illustrate these patterns. A majority of participants (69%) reported performing BSE annually. These findings reflect both positive practices among most participants and a small but important subset who may need additional education or reinforcement regarding BSE frequency and technique.

Regarding mammography frequency, the results show that 51% of participants undergo mammography annually, demonstrating strong adherence to screening recommendations and it agrees with Rania Mohammed et al. (2021) study, who showed that the annually performing mammogram is a mandatory screening procedures for women to control BC and its prognosis [32].

The data on appropriate age for mammography reveal further insight into participants' knowledge. While 49% correctly identified the age range 30 to 40 years old. These findings suggest that although many participants possess accurate knowledge about screening guidelines, a considerable minority remains unclear about when mammography should begin.

Altogether, the results indicate that participants generally recognize the importance of early detection and demonstrate moderate to strong engagement in BSE and mammography practices. However, the presence of uncertainty and inconsistent screening behaviors among a subset of respondents underscores the ongoing need for targeted awareness interventions that reinforce the correct timing, frequency, and purpose of breast cancer screening methods.

Attitudes and beliefs about BC showed that the levels of concern about breast cancer showed a mean score of 2.08, indicating a moderate degree of worry or perceived susceptibility among participants. Beliefs regarding the curability of breast cancer scored lower, with a mean of 1.08, suggesting that most participants hold a generally positive outlook regarding recovery when breast cancer is detected early. Additionally, attitudes concerning the importance of acting upon discovering a lump—reflected by a mean score of 1.36—indicate that participants largely understand the necessity of seeking medical help promptly, it is in agreement with Adib-Rad et al. (2025) study, who affirmed the belief that the BC recovery can be enhanced by positive women's attitudes [33].

The results of knowledge change assessment was presented to reflect a comprehensive assessment of the participants' changes in knowledge and behavioral intentions following the educational program. Overall, the findings indicate a strong positive shift in awareness, confidence, and perceived usefulness of the intervention. The highest mean score was reported for the "Rate of usefulness," with a mean value of 3.79, suggesting that most participants found the educational program highly beneficial in enhancing their understanding of breast cancer and related practices and it has been suggested that education not only influenced knowledge but also encouraged proactive and health-promoting behaviors, reflecting a positive shift toward early detection practices. This high rating reinforces the effectiveness and relevance of the program's content; previous studies were

conducted too to affirm the importance of educational programs to enhance women knowledge about BC and its different diagnosis and preventive measures [34].

The measurement of the change in the knowledge after the educational program revealed a significant improvement in participants' knowledge following the educational program. The overall knowledge score increased markedly, with a mean of 3.79 and a highly significant p-value ($p = 0.000$), indicating that the program had a strong and measurable impact. The confidence interval for the mean difference (1.26–1.62) further confirms that the improvement is both reliable and consistent across participants, it is in agreement with Sado et al. (2021), who shed the light on the importance of educational programs in enhancing the breast cancer awareness and knowledge among women from different ages and educational level [35].

When knowledge scores were examined in relation to demographic and background variables, several noteworthy patterns emerged. Age did not show a meaningful effect on knowledge improvement, as both pre- and post-test scores were statistically similar across age groups. This suggests that the educational program was equally effective regardless of participants' ages. In contrast, educational level showed a significant relationship with knowledge change, indicating that participants with different education backgrounds benefitted at varying levels from the program.

Occupation did not appear to influence knowledge outcomes, as employed, unemployed, and student participants showed comparable gains, may be because their reported job has no impact or correlations to the breast cancer and any chronic diseases.

Family history of breast cancer, however, showed a strong and significant association with knowledge improvement. Participants with a family history displayed greater increases in awareness, likely due to personal relevance and heightened sensitivity to breast cancer information [13, 14, 19].

Although personal history of breast cancer did not significantly affect knowledge change, implying that individuals with past personal experiences, but participants who had previously heard about breast cancer exhibited significantly larger improvements. This suggests that prior exposure or general awareness created a stronger foundation for absorbing new information during the educational sessions from hearing about BC, and they may hear about BC in different advertisements of social media platforms.

Overall, the results demonstrate that structured educational programs play a vital role in improving women's awareness, shaping attitudes, and promoting proactive health behaviors. The study highlights the ongoing need for consistent, accessible, and community-based breast health education to sustain and expand these positive outcomes.

This study highlighted noticeable gaps in understanding modifiable risk factors such as weight control, exercise, smoking, and alcohol consumption. Therefore, future educational efforts should place greater emphasis on lifestyle-related prevention strategies, ensuring that women not only recognize these factors but also understand how to incorporate healthier habits into their daily routines. This study also points to the value of engaging social networks and family members in awareness initiatives.

CONCLUSION

The findings reveal that although the sample consisted largely of middle-aged, highly educated, and mostly unemployed women, significant variations existed in their initial awareness and understanding of breast cancer. Before the intervention, participants demonstrated moderate awareness of breast cancer symptoms, with many recognizing common signs such as breast lumps but showing limited knowledge of other important indicators. Awareness of risk factors was similarly uneven: while hereditary and age-related risks were commonly identified, understanding of modifiable lifestyle factors—such as weight control, alcohol intake, and physical activity—was relatively low.

The educational intervention implemented in this study had a substantial positive impact. Participants reported meaningful increases in knowledge, greater confidence in performing breast self-examination, and stronger intentions to seek medical help or share information with others. Statistical analysis confirmed highly significant improvements across multiple knowledge domains, including overall understanding of breast cancer, recognition of risk factors, and clarity regarding screening practices. Importantly, the program was effective across all age groups, though greater gains were observed among women with higher education, those who had a family history of breast cancer, or those who had previously heard about the disease.

RECOMMENDATIONS

Based on the findings of this study, several important recommendations can be made to strengthen breast cancer awareness and improve screening behaviors among women. It is essential to expand the reach of educational programs, as the intervention clearly demonstrated its effectiveness in increasing knowledge and shaping positive health behaviors. These programs should be offered more frequently and in a wider range of community settings to ensure that women from diverse educational and socioeconomic backgrounds have equal access to accurate and practical information. Also, greater attention should be given to women with a family history of breast cancer, as these individuals demonstrated heightened responsiveness to educational materials.

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