



RESEARCH ARTICLE



Knowledge and awareness of breast cancer signs and symptoms among Jordanian women

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ABSTRACT

Background: Breast cancer (BC) remains the most common cancer among women worldwide. Early detection plays a vital role in reducing morbidity and mortality. This study aimed to assess Jordanian women's awareness of BC signs and symptoms to support timely recognition and intervention.

Research design and methods: A nationwide cross-sectional study was conducted involving 381 Jordanian women from the general community. Participants completed a self-administered questionnaire assessing their knowledge of BC signs and symptoms using a three-point Likert scale ("Yes," "Unsure," "No"). Demographic variables were analyzed for association with knowledge levels using Pearson's Chi-square or Fisher's Exact Test.

Results: 80.3% of participants demonstrated good awareness of BC signs and symptoms. Significant associations were found between knowledge levels and marital status ($p=0.000$), age ($p=0.033$), having children ($p=0.000$), number of children ($p=0.003$), education specialty ($p=0.000$), and working area ($p=0.005$).

Conclusions: Most participants demonstrated a strong awareness of BC signs and symptoms. However, educational interventions are needed to target knowledge gaps, particularly among unmarried women.

ARTICLE HISTORY

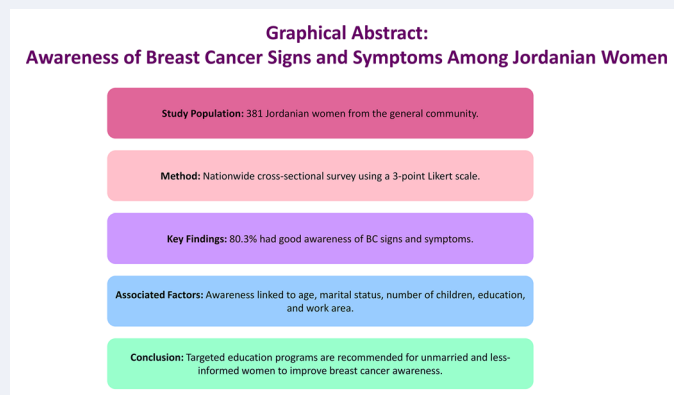
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KEYWORDS



Breast cancer; signs; symptoms; awareness; knowledge


GRAPHICAL ABSTRACT



ARTICLE HIGHLIGHTS

- Breast cancer (BC) is the most prevalent cancer among women worldwide, and early identification is essential for improved prognoses.
- This study evaluated the awareness and knowledge of BC signs and symptoms among 381 Jordanian women.
- To assess participants' comprehension of BC signs and symptoms, a standardized questionnaire on a three-point Likert scale was utilized.

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- The findings of this study are significant, indicating that 80.3% of women possessed a comprehensive awareness of BC signs and symptoms. This knowledge can be a powerful tool in the fight against BC.
- Knowledge levels were found to be substantially correlated with various demographics, including marital status, age, number and presence of children, educational attainment, and professional domain. This correlation piques curiosity and opens avenues for further research.
- The results underscore the pressing need for specialized educational initiatives. These initiatives have the potential to significantly enhance awareness among unmarried and less-informed women, inspiring hope for a future with reduced BC cases.

PLAIN LANGUAGE SUMMARY

Breast cancer is the predominant form of cancer in women. Recognizing the initial warning symptoms can enable women to pursue therapy earlier, thus enhancing their survival prospects. This study surveyed 381 women in Jordan regarding their awareness of breast cancer signs and symptoms. More than 80% of the women were capable of identifying the signs and symptoms of breast cancer. Our findings indicate that married women, those of advanced age, mothers, and individuals with greater educational attainment were more likely to possess substantial knowledge. This study suggests that although many women recognize the signs and symptoms of breast cancer, there remains a necessity to educate specific demographics, particularly unmarried women. Enhancing knowledge among all women is crucial for early disease detection and improved health outcomes.

1. Introduction

Worldwide, breast cancer (BC) has overtaken lung cancer as the most common cancer among females, accounting for 11.7% of cases, followed by colorectal cancer (10.0%), prostate cancer (7.3%), and stomach cancer (5.6%) [1]. Early detection and treatment are crucial for enhancing patient outcomes, but they require widespread public awareness of the disease, its risk factors, and the early warning signs. Although BC is the most commonly diagnosed cancer and the second leading cause of cancer-related death among women worldwide, its incidence and outcomes vary significantly between countries [2]. In developed countries, improved BC survival is linked to early detection, accessible diagnostics, and effective treatments [2]. Conversely, in less developed countries, BC is often diagnosed at advanced stages [2]. Despite the availability of screening tools in Jordan, participation is low. According to the Jordan Breast Cancer Program (JBCP), only 10,000 women took advantage of the free mammograms offered by the JBCP mobile unit in October 2023. Furthermore, 93.6% of Syrian refugee and Jordanian women aged 40 years and older reported never having a mammogram in their lives [3], highlighting the need for enhanced awareness and access to early detection methods.

BC is the third most significant cause of cancer-related mortality in Jordan, following lung and colorectal cancers [4]. Jordanian women often have limited knowledge about BC diagnosis, signs, symptoms, and management [4]. BC in Jordan is diagnosed at younger ages and in more advanced stages than in Western populations [4]. In Arab countries, the median age at BC diagnosis is approximately ten years younger than in Western nations, with the highest prevalence among women aged 40–50 [5]. In Jordan and other Arab countries, the average age at BC presentation is 45.4 years, emphasizing substantial regional differences in BC demographics and diagnosis patterns [6–10].

1.1. BC signs and symptoms

Although BC has specific signs and symptoms in its early stages, it is fortunate that it can often be detected and treated early. The most common signs are a lump in the breast or armpit accompanied by changes in skin texture, nipple alterations, pain, or unusual discharge [11,12]. Notably, skin dimpling resembling an orange peel and breast enlargement are significant signs, even in the absence of a palpable mass [12–14]. Although breast pain is frequently benign, ongoing or unexplained discomfort should prompt further medical evaluation [15]. Instances of BC diagnosis following breast pain are rare, affecting about 1% of women, but unexplained pain extending beyond hormonal cycles necessitates medical assessment [16,17].

Body image refers to the cognitive perception and subjective evaluation of one's physical appearance, encompassing thoughts, emotions, and behaviors related to body shape and size [18]. Physical concerns may

arise from various sources, including medical conditions, societal pressures, and personal experiences. For instance, individuals diagnosed with BC often experience significant changes in body image due to the physical and emotional consequences of both the disease and its treatment. These changes can lead to increased body dissatisfaction, psychological distress, and a reduced quality of life. Such challenges are not unique to BC; conditions like endometriosis and polycystic ovary syndrome can also cause physiological changes that negatively affect body image. Psychological interventions have shown effectiveness in addressing body image concerns [18]. Cognitive-behavioral therapy, self-compassion-based therapy, mindfulness-based interventions, and group psychoeducation have improved body appreciation and esteem and reduced body dissatisfaction. In particular, self-compassion and mindfulness-based therapies are effective in alleviating body image distress in clinical populations, such as breast cancer survivors, by fostering self-acceptance and enhancing self-esteem. Tailored therapeutic approaches that consider each individual's unique physical and emotional experiences are recommended to promote positive body image and overall psychological well-being [18].

BC signs are closely tied to body image disturbances, as the disease often involves visible physical changes that impact how individuals perceive and feel about their bodies [18]. Palpable lumps, swelling, or changes in breast shape and size can cause concern about appearance even before a formal diagnosis. Skin changes such as dimpling or redness, and nipple alterations like inversion or discharge, may trigger self-consciousness or anxiety [18]. Surgical interventions, such as mastectomy or lumpectomy, can result in partial or complete breast loss, profoundly influencing body image. Chemotherapy often causes hair loss, weight changes, and fatigue, contributing to feelings of unattractiveness or diminished femininity. Radiation and hormone therapies may lead to skin discoloration, scarring, or menopausal symptoms, further affecting physical self-perception [18]. The psychological burden of a cancer diagnosis, coupled with its physical effects, can lead to depression, anxiety, and body dissatisfaction. Many women experience a loss of identity or sexuality, especially when physical signs of illness are prominent or persistent [18].

Treating BC is a global health concern because of its high medical demands [19]. It is important to recognize that low survival rates are not inevitable. In Jordan, women's increased risk of preventable death is often linked to limited education and inadequate access to healthcare services. The timely identification and management of BC rely on adopting many approaches, such as the deployment of screening initiatives and the utilization of preventive measures [20]. The primary aim of the Breast Health Global Initiative (BHGI) is to develop efficacious strategies and offer evidence-based guidelines for the global prevention of BC [20]. The timely identification of BC plays a crucial role in mitigating the incidence and mortality rates associated with this condition [21].

The primary aim of this study is to assess the level of awareness among Jordanian women regarding the signs and symptoms of BC. Based on the literature indicating that BC awareness remains suboptimal in many populations and that improved awareness is critical for early detection and better outcomes, the primary hypothesis is that the general population of Jordanian women has a limited level of awareness regarding the signs and symptoms of BC. The secondary hypothesis is that higher levels of education, occupation in the health sector, and older age are associated with greater awareness of BC signs and symptoms among Jordanian women. This study's findings will identify specific knowledge gaps that can inform the development of targeted, evidence-based public health strategies to enhance BC awareness and early detection in Jordan. By explicitly stating these hypotheses, the study aims to provide a clear framework for analysis and interpretation, supporting the development of holistic strategies to improve public awareness and reduce the incidence and mortality associated with BC in Jordan.

2. Methods

2.1. Study design and data collection

A cross-sectional survey was conducted in Jordan from November 2022 to November 2023 using Google Forms to assess the level of awareness and knowledge among Jordanian women regarding BC, encompassing its signs and symptoms. The online survey was distributed via Facebook and WhatsApp. In addition, participants were recruited through social media platforms using the snowball sampling technique, where individuals who had already participated in the study recommended others. At the commencement of the survey, participants were requested to express their willingness to participate in the study. To mitigate the potential impact of self-report bias, participants were provided with specific

assurances regarding the voluntary nature of their involvement in the research and the assurance that their responses would remain anonymous and confidential. The initial section of the questionnaire provided a thorough exposition of the study's aims and approach while also highlighting the commitment to safeguarding participants' privacy regarding their answers. If the participant chooses to provide an affirmative response, they will be allowed to view the questionnaire. In contrast, opting for a negative response will disqualify them from the study. The survey contained no questions demonstrating partiality or prejudice against specific community sectors. Given that Arabic is the predominant language employed in Jordan, it was deemed appropriate to survey this native dialect. The poll consisted of a combination of closed-ended responses, including multiple-choice options such as "Yes," "No," or "Don't know," as well as checkboxes that allowed participants to select multiple options.

2.2. Sample size

According to the Raosoft online calculator (<http://www.raosoft.com/samplesize.html>), a minimum sample size of approximately 360 participants is advised. This sample size provides a 95% confidence interval and a 5% margin of error. The survey was distributed to a target population of 800 Jordanian women. However, to improve the study's applicability, 381 people were included.

2.3. Ethical consideration

The protocol of this study was approved by the Institutional Review Board (IRB) of the Hashemite University, Jordan (reference number: 20/9/2021/2022).

2.4. Development of the survey questionnaire

The questionnaires were designed to gather descriptive data on the participants' demographic characteristics and health history, including age, education level, marital status, and a history of BC. The replies provided by the participants in the survey were classified into the signs and symptoms of BC. This categorization centered explicitly on the participants' responses to the Likert scale items. Demographic characteristics encompass a range of variables, including but not limited to gender, age, nationality, place of residence, presence of children, and occupation. The health history includes the documentation of prior and ongoing breast-related issues, as well as the familial medical background. The subsequent component of the questionnaire evaluated the participants' understanding of signs and symptoms, including breast pain, alterations in nipple appearance, redness or swelling of the breasts, discharge from the nipple that is either bloody or milky, and asymmetry of the breasts. The process of selecting and developing the interconnected questions was carried out after a thorough assessment of the available scholarly literature.

2.5. Data analysis

All data were coded and entered into a customized database developed on IBM SPSS® V26.0 (IBM, New York, USA) for statistical analysis. Descriptive results were reported for participant characteristics (e.g., age, educational level, and area of residence) and for participant responses to the different questions in the questionnaire (i.e., responses to Likert items). Responses to items in the questionnaire were reported under signs and symptoms of BC. To evaluate participants' knowledge about signs, and symptoms of BC, respondents were asked to indicate their knowledge on a three-point Likert scale containing "Yes," "Don't know" and "No" on the scale, valued at 3 to 1 respectively. Items were reverse-scored where appropriate. Despite the limitations of binary responses, this approach aligns with prior validated methods (Breast CAM) in similar populations (The Breast CAM survey instrument was created in 2009 by Cancer Research UK, King's College London, and University College London, and it was validated with assistance from Breast Cancer Care and Breakthrough Breast Cancer).

According to the number of questions within each factor, the sum of all items gives a maximum score of 36 points for signs and symptoms of BC. The overall level of attitude was categorized using Bloom's cutoff point reference as "good knowledge" if the score was 80–100% (28.8–36 points for signs and

symptoms of BC factor), “neutral knowledge” if the score was 60–79% (21.6–28.7 points for signs and symptoms of BC factor) and “poor knowledge” if the score was less than 60% (21.6 points for signs and symptoms of BC factor). The Kolmogorov-Smirnov test was used to assess the normality of the distribution of the variables. To identify the association between participants’ demographics and their level of knowledge about the signs and symptoms of BC, Pearson Chi-square or Fischer’s Exact test, as appropriate, was used at $p < 0.05$.

3. Results

3.1. Participants’ socio-demographic characteristics

A total of 381 female participants completed the questionnaire and were subsequently included in the present study, yielding a response rate of 47.6%. Most participants, precisely 61.4%, fell within the 20–30 year age range. The predominance of participants under the age of 40 aligns with the study’s focus on enhancing BC awareness among younger demographics, as early education is crucial in establishing lifelong health behaviors and reducing future disease burden. According to the religious data, the majority, 99.5%, are Muslims, while the remaining 0.5% are identified as Christians. 28.6% of the female participants were found to be married, with three of these individuals not having any children. Among the cohort of married women who are parents, only 3.1% have five or more children. A minority of women, precisely 21.3%, were employed, which can be further categorized into non-governmental employment (10.8%), governmental employment (9.2%), and self-employment (1.3%). Among participants, 57.5% completed their undergraduate degrees in public or private universities, while only 6.3% pursued postgraduate studies. Approximately 70.6% of the female participants in the study reported a monthly income of less than \$1,000, as indicated in [Supplementary Table 1](#).

3.2. Participants’ health history characteristics

The vast majority of women who took part in the study reported no existing breast-related issues (91.6%) or a history of such concerns (85.5%). The study reported an equivalent percentage of 0.5% for women who had received a diagnosis of breast, colon, or lung cancer, as well as for women who had been diagnosed with other types of these cancers. In contrast, a subset of women who took part in the study, comprising around 23.6% of the sample, had received a medical diagnosis for other forms of cancer. A majority of women encountered the occurrence of cancer among their first or second-degree family members (12.1% in first-degree relatives and 26.8% in second-degree relatives) as well as among their friends (15.8%). A significant majority of women (82.2%) indicated that their families did not exhibit any instances of ovarian, breast, colon, lung, pancreatic, brain, or prostate cancers. According to [Table 1](#), a mere 10% of the female participants disclosed the occurrence of BC within their families before age 50.

3.3. Participants’ responses to statements in the questionnaire

[Table 2](#) displays the participants’ responses to statements classified into BC signs and symptoms. It is worth noting that an agreement exceeding 80% was observed regarding the signs and symptoms of BC, specifically bloody discharge from the nipple (84.8%), changes in the nipple (82.9%), and redness or swelling of the breast (80.6%). There was a negligible disparity observed between the proportions of respondents who concurred that pain might be regarded as an indicative signal for BC (74.8%) and those who held the opposing viewpoint (78.2%).

3.4. The level of participants’ knowledge about the signs and symptoms of BC

A higher mean score for each factor in the questionnaire indicates a good level of knowledge among women about the signs and symptoms of BC (31.6 ± 4.3). As shown in [Table 3](#) below, the vast majority (80.3%) of participants demonstrated a good knowledge of the signs and symptoms of BC. The percentage of participants who tended to be neutral regarding their knowledge of the signs and symptoms of BC was 16.5%. A small proportion of participants had poor knowledge of BC’s signs and symptoms (3.1%).

Table 1. Description of health history characteristics ($n=381$).

Variable	Responses	Percentage
Are you currently experiencing any breast-related problems?		
No	349	91.6
Yes	32	8.4
The current breast problem is:		
No current problem	334	87.7
More than one problem	19	5.0
Breast pain	11	2.9
Lump	7	1.8
Nipple discharge	3	0.8
Nipple changes	2	0.5
Breast warmth and itching	2	0.5
Others	3	0.8
Have you had a breast-related problem previously?		
No	327	85.8
Yes	54	14.2
The previous breast problem is:		
No previous problem	319	83.7
More than one problem	24	6.3
Breast pain	14	3.7
Lump	9	2.4
Nipple discharge	5	1.3
Breast warmth and itching	2	0.5
Nipple changes	1	0.3
Others	7	1.8
Have you ever been diagnosed with BC?		
No	379	99.5
Yes	2	0.5
If you have cancer other than BC, what is/are the cancer type/s:		
Colon	2	0.5
Lung	2	0.5
Another type of cancer	90	23.6
No cancer	285	74.8
More than one cancer	2	0.5
Have you, your family, or close friends had cancer?		
Close family members (first-degree relatives)	46	12.1
Other family members (second-degree relatives)	102	26.8
Close friends	22	5.8
Other friends	38	10.0
Do not know	145	38.1
More than one choice	28	7.3
Have you or any close family members been diagnosed with ovarian, breast, colon, lung, pancreatic, brain, or prostate cancers?		
Yes	16	4.2
No	313	82.2
Do not know	52	13.6
Have two or more family members been diagnosed with any of the following cancers: breast, ovarian, colon, lung, pancreatic, brain, or prostate cancer?		
Yes	50	13.1
No	288	75.6
Do not know	43	11.3
Have you or any close family member been diagnosed with BC at or before the age of 50?		
Yes	38	10.0
No	301	79.0
Do not know	42	11.0

Table 2. Participants' responses regarding the signs and symptoms of BC.

Statement	Yes		No		Don't know	
	Number	%	Number	%	Number	%
Signs and symptoms of BC						
Pain that is severe or persists and unrelated to the menstrual cycle is a warning sign.	263	69.0	47	12.3	71	18.6
A painful breast lump is a warning sign.	285	74.8	64	16.8	32	8.4
A painless breast lump is a warning sign.	298	78.2	35	9.2	48	12.6
Swollen axillary glands.	301	79.0	17	4.5	63	16.5
Skin thickening and orange peel texture to the skin.	268	70.3	27	7.1	86	22.6
Redness or swelling of the breast.	307	80.6	22	5.8	52	13.6
Bloody discharge from the nipple.	323	84.8	12	3.1	46	12.1
Ulceration over the breast.	300	78.7	21	5.5	60	15.7
Breast warmth and itching.	239	62.7	43	11.3	99	26.0
Nipple changes (inversion/retraction).	316	82.9	23	6.0	42	11.0
Asymmetry of breasts.	266	69.8	46	12.1	69	18.1
Milky discharge from the nipple.	184	48.3	96	25.2	101	26.5

Table 3. Participant's level of knowledge about the signs and symptoms of BC ($n=381$).

Factor	Level of knowledge	Score	N (%)
Signs and symptoms of BC	Good	28.8–36	306 (80.3)
	Neutral	21.6–28.7	63 (16.5)
	Poor	< 21.6	12 (3.1)

Minimum score =12; maximum score =36; mean score =31.6; SD =4.3.

The overall level of attitude was categorized using Bloom's cutoff point reference (Alzahrani et al. 2022; Chand, Mohammadnezhad, and Khan 2022 as "good knowledge" if the score was 80–100% (28.8–36 points for signs and symptoms of BC factor), "neutral knowledge" if the score was 60–79% (21.6–28.7 points for signs and symptoms of BC factor) and "poor knowledge" if the score was less than 60% (21.6 points for signs and symptoms of BC factor).

3.5. The sociodemographic determinants of participants' knowledge about the signs and symptoms of BC

Religion, level of education, and family income did not statistically influence any level of participants' knowledge about the signs and symptoms of BC ($p>0.05$). Table 4 summarizes the results of Pearson Chi-square or Fischer's Exact test as appropriate for the statistically significant associations between determinants and the level of participants' knowledge about the signs and symptoms of BC.

A statistically significant associations were observed between participants' level of knowledge about the signs and symptoms of BC and their marital status ($p=0.000$), their age ($p=0.033$), the presence of children ($p=0.000$), the number of children ($p=0.003$), their specialty ($p=0.000$) and their working area ($p=0.005$). Participants with good knowledge about the signs and symptoms of BC were more likely to be single, aged between 20 and 30 years, have no children, and be students studying pharmacy (Table 5).

Almost all participants' studied health history characteristics did not statistically influence any level of participants' knowledge about the signs and symptoms of BC ($p>0.05$). Table 5 summarizes the results of Pearson Chi-square or Fischer's Exact test as appropriate for the statistically significant associations between determinants and the level of participants' knowledge about the signs and symptoms of BC.

4. Discussion

The current study was conducted among a cohort of Jordanian women to assess their prevailing knowledge and awareness of BC's signs and symptoms. This is crucial in facilitating the timely identification of cases and reducing mortality rates associated with the disease. The high incidence of the disease can be attributed to several factors, including low education levels, common misconceptions, and delays in diagnosis [22].

BC awareness plays a vital role in promoting early detection and improving survival rates. Numerous international studies have shown that socio-demographic factors—such as education level, socioeconomic status, and geographic location—can significantly influence knowledge about the signs and symptoms of BC [22]. Research conducted in countries including Tanzania, Iraq, and others with highly educated populations has revealed notable disparities in awareness levels [23–26]. Consistent with these global findings, our study revealed that 80.3% of Jordanian women demonstrated a high level of awareness regarding BC signs and symptoms, with significant associations found between awareness levels, marital status, and educational background.

Our findings align with studies conducted among women in Mwanza, Tanzania, and in Iraq, where approximately 50% of participants demonstrated low levels of awareness despite being part of educated populations [24]. Additional research involving younger women and university students in various countries aimed to determine whether higher education correlates with greater awareness; however, the results were generally disappointing, with limited knowledge still evident [25–27]. Interestingly, our study identified a significant association between marital status and awareness in the Jordanian context. Unmarried women appeared more inclined to understand the underlying causes of breast-related concerns, which contrasts with findings from other studies [28,29].

Early detection is widely recognized as a crucial factor in improving BC survival rates. International studies from countries such as Pakistan and Singapore have demonstrated a strong association between awareness and early diagnosis [30,31]. Our findings are consistent with this global trend, with 94% of Jordanian participants recognizing the importance of early detection. A distinctive observation in the Jordanian context, however, was that a significant portion of participants were aware of the potential link between exposure to

Table 4. Participants' socio-demographic characteristics that are associated with the participant's level of knowledge about the signs and symptoms of BC ($n=381$).

Factor	Variable	Category	Level of knowledge			p-value
			Good	Neutral	Poor	
Signs and symptoms of BC	Age	Less than 20	46 (15)	11 (17.5)	1 (8.3)	0.033
		20–30	200 (65.4)	28 (44.4)	6 (50)	
		31–40	35 (11.4)	13 (24.4)	3 (25)	
		41–50	18 (5.9)	4 (6.3)	1 (8.3)	
		51–60	7 (2.3)	4 (6.3)	1 (8.3)	
	Religion	Islam	304 (99.3)	63 (100)	12 (100)	0.782
		Christianity	2 (0.7)	0 (0)	0 (0)	
	Place of residence	North of Jordan	99 (32.4)	29 (46)	8 (66.7)	0.078
		Middle and West of Jordan	165 (53.9)	24 (38.1)	4 (33.3)	
		East of Jordan	19 (6.2)	4 (6.3)	0 (0)	
		South of Jordan	23 (7.5)	6 (9.5)	0 (0)	
	Marital status	Single	230 (75.2)	35 (55.6)	4 (33.3)	0.000
		Married	73 (23.9)	28 (44.4)	8 (66.7)	
		Divorced	3 (1)	0 (0)	0 (0)	
	Presence of children	Yes	73 (23.9)	25 (39.7)	8 (66.7)	0.000
		No	233 (76.1)	38 (60.3)	4 (33.3)	
	Number of children	None	233 (76.1)	38 (60.3)	4 (33.3)	0.003
		1–2	31 (10.1)	11 (17.5)	2 (16.7)	
		3–4	33 (10.8)	11 (17.5)	6 (50)	
		5–6	7 (2.3)	3 (4.8)	0 (0)	
		More than 6	2 (0.7)	0 (0)	0 (0)	
	Level of education	The primary school completed	1 (0.3)	0 (0)	0 (0)	0.302
		High school (Tawjihi), the secondary school completed	94 (30.7)	18 (28.6)	2 (16.7)	
		Diploma degree	8 (2.6)	2 (3.2)	2 (16.7)	
		Community college	7 (2.3)	3 (4.8)	1 (8.3)	
		Undergraduate degree, the public or private university completed	177 (57.8)	35 (55.6)	7 (58.3)	
		Postgraduate degree, master's, or Doctor of Philosophy degree completed	19 (6.2)	5 (7.9)	0 (0)	
		Medical field, Pharmacy	212 (69.3)	32 (50.8)	3 (25)	
		Medical field, medicine	22 (7.2)	4 (6.3)	0 (0)	
		Other Medical fields	17 (5.6)	3 (4.8)	0 (0)	
		Engineering field	10 (3.3)	6 (9.5)	1 (8.3)	
	Specialty	Literary field and human sciences	15 (4.9)	8 (12.7)	3 (25)	0.000
		The electronic field, technology sciences, and economics	6 (2)	4 (6.3)	1 (8.3)	
		Others	24 (7.8)	6 (9.5)	4 (33.3)	

(Continued)

Table 4. Continued.

Factor	Variable	Category	Level of knowledge			p-value
			Good	Neutral	Poor	
Description of main work		Government employee	27 (8.8)	6 (9.5)	2 (16.7)	0.005
		Non-government employee	35 (11.4)	4 (6.3)	2 (16.7)	
		Self-employed	1 (8.3)	3 (4.8)	1 (0.3)	
		Student	200 (65.4)	33 (52.4)	3 (25)	
		Homemaker	25 (8.2)	13 (20.6)	3 (25)	
		Retired	1 (0.3)	1 (1.6)	0 (0)	
		Unemployed, able to work	15 (4.9)	3 (4.8)	1 (8.3)	
		Unemployed, unable to work	2 (0.7)	0 (0)	0 (0)	
Family income		less than 500 JD/ month	85 (27.8)	20 (31.7)	3 (25)	0.916
		500–999 JD/ month	132 (43.1)	24 (38.1)	5 (41.7)	
		1000–1499 JD/ month	50 (16.3)	9 (14.3)	1 (8.3)	
		1500–1599 JD/ month	19 (6.2)	5 (7.9)	1 (8.3)	
		More than 2000 JD/ month	20 (6.5)	5 (7.9)	2 (16.7)	

BC, breast cancer.

radiation during early life and the development of BC [32,33]. This heightened awareness may be attributed to local public health initiatives or personal experiences that have emphasized environmental risk factors. Nevertheless, it is worth noting that the female participants in our study demonstrate an understanding of the potential benefits of early radiation exposure in the development of BC ($p < 0.05$). This observation aligns with previous research findings that indicate a positive association between radiation exposure during early life stages and an increased incidence of BC [32,33].

The findings of this study demonstrate that a significant proportion of participants, precisely 84.8%, demonstrated knowledge of the association between red nipple discharge and BC. However, a significant percentage of participants, precisely 48.3%, demonstrated knowledge of the potential correlation between milky nipple discharge and BC. According to past studies, the occurrence of either bloody or milky discharge from the nipple can potentially indicate the presence of BC, particularly if the leaking is limited to one breast [34–36]. It is important to note that BC is typically not the major reason for nipple discharge [36]. Based on the findings of multiple clinical trials, a cohort of 370 individuals presented with diverse forms of discharge, such as watery, serous, serosanguinous, or hemorrhagic [34]. Among this group, a proportion of 13.5% received a diagnosis of BC [37]. Furthermore, a prevalence rate of 50.3% was observed for intraductal papillomas, fibrocystic disease was identified in 31.1%, and 5.5% of the patients exhibited advanced duct ectasia [37].

This study revealed that a significant majority of participants (82.9%) recognized nipple changes, such as inversion or retraction, as potential symptoms of BC. While nipple retraction is indeed considered a possible sign of BC, it is essential to note that it can also result from benign conditions, underscoring the need for clinical evaluation of any noticeable breast changes [38,39], it can also result from factors like physical touch, breastfeeding, or environmental conditions such as exposure to cool temperatures [40–42]. Additionally, our findings demonstrated a high level of awareness among participants regarding various BC symptoms: 70% identified severe breast pain unrelated to the menstrual cycle, 75% recognized painful lumps, and 79% were aware that painless lumps could be a sign of BC. However, previous studies have shown that breast pain is present in only about 6% of BC cases and is not always a reliable indicator of malignancy. This highlights the importance of distinguishing between common breast symptoms and those that warrant further clinical evaluation [43]. Factors such as the menstrual cycle or benign conditions like mastitis can also contribute to breast pain [44]. Therefore, it is essential to evaluate cases of severe or persistent breast pain to rule out cancer or identify other benign conditions.

Table 5. Participants' health history characteristics that are associated with the participant's level of knowledge about the signs and symptoms of BC ($n=381$).

Factor	Variable	Category	Level of knowledge			p-value
			Good	Neutral	Poor	
Signs and symptoms of BC	Are you currently experiencing any breast-related problems?	Yes	28 (9.2)	4 (6.3)	0 (0)	0.434
		No	278 (90.8)	59 (93.7)	12 (90.8)	
	The current breast problem is:	No current problem	270 (0)	52 (0)	12 (0)	0.909
		More than one problem	13 (4.2)	6 (9.5)	0 (0)	
		Breast pain	9 (2.9)	2 (3.2)	0 (0)	
		Lump	5 (1.6)	2 (3.2)	0 (0)	
		Nipple discharge	3 (1)	0 (0)	0 (0)	
		Nipple changes	2 (0.7)	0 (0)	0 (0)	
		Breast warmth and itching	2 (0.7)	0 (0)	0 (0)	
		Others	2 (0.7)	1 (1.6)	0 (0)	
	Have you had a breast-related problem previously?	Yes	42 (13.7)	12 (19)	0 (0)	0.196
		No	264 (86.3)	51 (81)	12 (100)	
	The previous breast problem is:	No previous problem	258 (84.3)	49 (77.8)	12 (100)	0.972
		More than one problem	19 (6.2)	5 (7.9)	0 (0)	
		Breast pain	11 (3.6)	3 (4.8)	0 (0)	
		Lump	7 (2.3)	2 (3.2)	0 (0)	
		Nipple discharge	4 (1.3)	1 (1.6)	0 (0)	
		Breast warmth and itching	1 (0.3)	1 (1.6)	0 (0)	
		Nipple changes	1 (0.3)	0 (0)	0 (0)	
		Others	5 (1.6)	2 (3.2)	0 (0)	
	Have you ever been diagnosed with BC?	Yes	1 (0.3)	1 (1.6)	0 (100)	0.473
		No	305 (99.7)	62 (98.4)	12 (100)	
	If you have cancer, what is/are the cancer type/s:	Colon	1 (0.3)	1 (1.6)	0 (0)	0.564
		Lung	1 (0.3)	1 (1.6)	0 (0)	
		Another type of cancer	68 (22.2)	17 (27)	5 (41.7)	
		More than one cancer type	2 (0.7)	0 (0)	0 (0)	
		No cancer	234 (76.5)	44 (69.8)	7 (58.3)	
	Have you, your family, or close friends had cancer?	Close family members (first-degree relatives)	41 (13.4)	3 (4.8)	2 (16.7)	0.453
		Other family members (second-degree relatives)	85 (27.8)	16 (25.4)	1 (8.3)	
		Close friends	18 (5.9)	3 (4.8)	1 (8.3)	
		Other friends	29 (9.5)	8 (12.7)	1 (8.3)	
		Do not know	109 (35.6)	29 (46)	7 (58.3)	
		More than one choice	24 (7.8)	4 (6.3)	0 (0)	

(Continued)

Table 5. Continued.

Factor	Variable	Category	Level of knowledge			p-value
			Good	Neutral	Poor	
	Have you or any close family members been diagnosed with ovarian, breast, colon, lung, pancreatic, brain, or prostate cancers?	Yes	16 (5.2)	0 (0)	0 (0)	0.213
		No	248 (81)	56 (88.9)	9 (75)	
		Do not know	42 (13.7)	7 (11.3)	3 (25)	
	Have two or more family members been diagnosed with any of the following cancers: breast, ovarian, colon, lung, pancreatic, brain, or prostate cancer?	Yes	42 (13.7)	7 (11.1)	1 (8.3)	0.931
		No	230 (75.2)	49 (77.8)	9 (75)	
		Do not know	34 (11.1)	7 (11.1)	2 (16.7)	
	Have you or any close family member been diagnosed with BC at or before the age of 50?	Yes	29 (9.5)	8 (12.7)	1 (8.3)	0.480
		No	243 (79.4)	50 (79.4)	8 (66.7)	
		Do not know	34 (11.1)	5 (7.9)	3 (25)	

BC, breast cancer.

A discernible orange hue on the mammary glands can be attributed to the emergence of fluid accumulation, potentially indicating the presence of edema [45]. Furthermore, the medical condition known as peau d'orange is characterized by the formation of small indentations on the subcutaneous layer of the skin, resulting in a texture resembling that of an orange [45,46]. In addition to BC [47], this symptom can be ascribed to other conditions, including pregnancy, lactation, menstrual cycles, dermatological problems, mastitis, and the use of antihypertensive medications [45,48]. Nevertheless, approximately 70% of the study participants showed awareness of the correlation between the symptoms of orange-colored skin and the potential existence of BC. The malignancy is commonly identified as inflammatory BC when the characteristic peau d'orange texture is absent [14]. Based on empirical research, the prevalence of inflammatory BC constitutes approximately 1–5% of the total occurrences of BC [14]. Potential additional signs of inflammatory BC include breast warmth and itching [14]. It is imperative to acknowledge that the existence of these symptoms does not automatically establish the presence of cancer. Nevertheless, it is recommended to pursue a medical evaluation to guarantee a thorough assessment and accurate diagnosis. However, approximately 63% of the population in the study exhibits awareness regarding breast warmth and itching, which are prominent signs of BC.

To address these gaps, our findings underscore the urgent need for localized BC awareness programs in Jordan. Unlike countries with well-established national screening initiatives, Jordan faces distinct challenges, including limited access to healthcare, cultural stigmas, and disparities in health literacy. These barriers highlight the importance of integrating BC education into school curricula, university programs, and community outreach initiatives to improve early detection rates. Additionally, public health campaigns should be regularly updated to ensure that Jordanian women can recognize key warning signs and feel empowered to seek medical attention when necessary.

Socio-demographic factors play a critical role in shaping BC knowledge and outcomes. Individuals from lower socioeconomic backgrounds often have reduced access to healthcare and educational resources, which can lead to limited awareness and delayed diagnoses. For example, a study reported that women living in poverty-stricken areas are more likely to develop aggressive forms of BC, requiring more intensive treatment and resulting in higher mortality rates [49]. Geographic disparities also contribute to diagnostic delays; women in rural areas are more frequently diagnosed at advanced stages compared to their urban counterparts, likely due to reduced access to screening services [50]. Racial and ethnic disparities further compound these challenges. In the United States, for instance, Black women are often less informed about their tumor

characteristics, which can negatively impact treatment decisions and outcomes [51]. Addressing these socio-demographic disparities is crucial for enhancing BC awareness, promoting early detection, and achieving equitable treatment outcomes across all communities.

Variations in knowledge across different socio-demographic groups can be attributed mainly to differences in socioeconomic status, educational level, cultural beliefs, and access to health information [52]. For instance, Heshmat et al. found that nutritional knowledge among Iranian households varied significantly by socioeconomic status, influencing health behaviors such as dietary intake of fruits and vegetables [53]. Similarly, a study (53) highlighted that different demographic groups exhibit variations in their knowledge of diabetes management, which can be influenced by socioeconomic status, gender, and age [54]. Moreover, Gelaw highlighted the correlation between low socioeconomic status in Ethiopia and limited knowledge about tuberculosis, where socioeconomic conditions influenced access to education and healthcare resources [55]. This trend is echoed in the work of Almuhanha et al., which found that socio-economic status significantly impacted knowledge about health issues, including infectious diseases [56].

Education level further amplifies existing disparities, as it is a key determinant of health knowledge and behavior. Individuals with higher educational attainment performed significantly better on nutrition-related knowledge assessments, demonstrating a strong link between education and health literacy [57]. These findings align with broader research indicating that education serves as a mediator for improved health outcomes and greater awareness of nutritional and preventive health practices [58]. In the context of child health, it was found that parental nutritional knowledge significantly influenced the dietary choices made for their children, highlighting the intergenerational impact of education on health behaviors [59]. Collectively, these factors shape health literacy, influence lifestyle decisions, and affect individuals' capacity to recognize early symptoms and participate in preventive care.

Cultural influences and access to information also play critical roles in shaping knowledge. In communities with restricted access to modern education and healthcare resources, as shown by Basu et al. in rural India, levels of awareness about health issues like diarrhea management were notably lower [60]. Access to information is further complicated by geographical disparities, as highlighted by Chirwa's research on HIV knowledge, which found that rural populations often possess a lower comprehensive understanding compared to their urban counterparts due to limited exposure to health education [61].

In addition to the collective effects of socio-economic, educational, and cultural factors, the impact of demographic characteristics, such as age and ethnicity, also contributes to knowledge variations. Alves et al. noted that traditional knowledge regarding medicinal plants showed significant disparities influenced by factors like age, gender, and ethnicity in indigenous populations, stressing that local practices can profoundly affect knowledge distribution [62]. Wardle's exploration of attitudes toward healthy lifestyles suggests that cognitive determinants of behavior, which vary socioeconomically, significantly shape individual health comprehension and practices [63].

5. Strengths and limitations

The study's strengths include its nationwide scope with 381 participants from across Jordan, providing diverse and generalizable insights into Jordanian women's knowledge of BC. It focuses on an understudied population and employs a robust methodology with validated scoring systems. The study also considers sociodemographic factors, offering insights for targeted educational interventions. However, one notable limitation of this study is the potential for non-response bias, which may have influenced the results. Although a reasonable sample size was obtained, individuals who chose not to participate might differ in meaningful ways from those who did. This could impact the representativeness of the findings and limit the generalizability of the results to the broader population of Jordanian women. Future studies should aim to improve response rates and consider strategies to assess and mitigate the effects of non-response bias. Another limitation of the study is the religious homogeneity of the sample, with 99.5% of participants identifying as Muslim. While this reflects Jordan's demographic reality, it limits the applicability of the findings to non-Muslim or more culturally diverse populations. Religious and cultural beliefs can influence health behaviors and perceptions of diseases like breast cancer. Therefore, future research should include participants from different faiths and cultural backgrounds to better understand these nuances and enhance the generalizability of the results.

Another limitation of this study is the method of participant recruitment, which was conducted primarily through social media platforms. While this approach allowed for wide and efficient dissemination of the survey, it may have introduced sampling bias. Specifically, it is likely that the sample was skewed toward younger, more tech-savvy, and more educated women who are more active on digital platforms. As a result, the findings may not fully represent the awareness levels of less-connected or older populations, potentially affecting the generalizability of the results. Additionally, the study's cross-sectional design restricts the ability to infer causality.

6. Conclusion

This study highlights significant gaps in awareness of BC signs and symptoms among women in Jordan, underscoring an urgent need for targeted, evidence-based strategies to enhance early detection and improve patient outcomes. Despite the increasing global focus on BC awareness, a considerable number of participants in this study showed limited recognition of early warning signs. This issue is particularly alarming in light of the country's high incidence and mortality rates associated with BC. These knowledge gaps may contribute to delayed health-seeking behavior, which can, in turn, lead to diagnoses at more advanced stages, reduced treatment effectiveness, and lower survival rates.

Multiple socio-demographic factors appear to shape these disparities in awareness. Variables such as educational attainment, socioeconomic status, and geographic location (urban vs. rural residence) emerged as significant determinants of participants' understanding of BC. Women with lower education levels or those residing in less developed or underserved areas were less likely to identify key symptoms, reinforcing the need for a broad, multi-level public health approach that addresses both knowledge deficits and the structural barriers that prevent timely access to care. These disparities are further exacerbated by limited transportation options, long waiting times, and financial constraints that prevent many women from accessing screening services even when they are aware of them.

To improve awareness and promote early detection, national health authorities must implement inclusive, culturally sensitive educational campaigns tailored to high-risk and underserved populations. Special attention should be given to married women and individuals outside the healthcare sector, as these groups were observed to have lower levels of knowledge in this study. In Jordan, cultural stigma surrounding BC continues to present a major barrier to open dialogue. Many women refer to the disease euphemistically as "that alternative illness," reflecting discomfort or fear that inhibits discussion, information-sharing, and proactive screening behaviors. Overcoming these deeply rooted social taboos requires a culturally nuanced communication strategy that normalizes conversations about BC and empowers women to seek information and medical assistance without fear of judgment.

Incorporating BC education into primary healthcare services, regular medical checkups, and grassroots community outreach initiatives can help bridge the knowledge gap and build trust between healthcare providers and the public. Moreover, leveraging digital tools—such as electronic media, social networking platforms, and mobile health applications—presents a practical and scalable way to engage younger audiences and populations in rural or remote regions who may otherwise lack access to formal health education channels. Collaborations with local influencers and community health workers can amplify these efforts and ensure that messages are delivered in ways that resonate with the target audience.

Additionally, the development and distribution of culturally and linguistically appropriate materials—such as brochures, videos, and infographics in Arabic and other locally spoken languages—can support better understanding among diverse audiences. Hosting interactive community workshops, especially in collaboration with local leaders or women's organizations, can further reinforce key messages and address common misconceptions. Multisectoral collaboration involving healthcare professionals, non-governmental organizations, community-based leaders, and national policymakers is essential to amplify the reach and impact of awareness campaigns.

Looking ahead, future research should prioritize evaluating the effectiveness of these targeted interventions. Longitudinal studies or follow-up assessments conducted 6 to 12 months after the implementation of educational programs can provide valuable insights into their influence on knowledge, attitudes, and screening behaviors. Such evaluation will inform iterative improvements and guide evidence-based policy development. Additional research is also needed to understand the psychological, emotional, and cultural barriers that prevent women from acting on their awareness, as addressing these internal factors is equally critical to ensuring that knowledge translates into action.

Ultimately, by implementing these strategies, the findings of this study can contribute to shaping more robust public health initiatives and policy frameworks. These efforts are essential to reducing the burden of breast cancer in Jordan, improving early detection rates, and, most importantly, saving lives.

Authors' contributions

A.Z.A. led and conceptualized the article, designed and performed the research article, and drafted and proofread the article critically. T.A. helped analyze the data, write the results section, and revise the article critically. G.B.H., A.O.R., and S.M. helped write the discussion section and revise the article critically. K.A. helped write the conclusion and limitations section and revise the manuscript critically. F.S.A. and T.A. assisted in writing the introduction section and reviewing the manuscript. All authors approved the final version of the manuscript.

Ethics/Institutional Review Board statement

The protocol of this study was approved by the Institutional Review Board (IRB) of the Hashemite University, Jordan (reference number: 20/9/2021/2022).

Informed consent statement

At the commencement of the survey, respondents were requested to provide their agreement on an informed permission/consent document, demonstrating their willingness to participate in the research.

Disclosure statement

No potential conflict of interest was reported by the author(s).

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Data availability statement

Data is available upon request.

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