

Research Article

Breast Cancer Awareness Among Females from Developing Nations: A Cross-Sectional Study in Iraq

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***Corresponding author:** Zainab Mohammed Salih, General Surgeon, University of Duhok College of Medicine, Duhok, Kurdistan Region, Iraq. Email: zainabmsalih@gmail.com**Received:** April 17, 2026**Accepted:** May 12, 2026**Published:** May 19, 2026**Abstract**

Background and objectives: Breast cancer is the most commonly diagnosed cancer among females globally, and many studies report low levels of knowledge or a gap between knowledge and practice in screening programs. The purpose of this study is to map women's level of knowledge of breast cancer screening to inform the development of future educational programs in developing nations.

Methodology: A cross-sectional interview based on a designed questionnaire aimed at women living in Duhok city. A total of 733 cases were enrolled; only 712 cases were enrolled in the study. The process of sampling was a convenient method based on university students, university lecturers, patients, and their relatives attending the general surgery consultation clinic. The questionnaire focused on sociodemographic and 7 questions on the key warning signs of breast cancer. Descriptive statistics alongside the One-way ANOVA, and Linear regression analysis were used for the analyses of the data.

Results: Educational level was significantly correlated with age groups, $P < 0.001$. The level of education and age groups showed significantly different mean scores for Breast Cancer Warning signs; $P = 0.002$, and < 0.001 , respectively. On the other hand, marital status ($P = 0.303$), Religion ($P = 0.100$), and Residency ($P = 0.087$) showed no impact on the assessed knowledge.

Conclusion: Women aged 30-50 years were more likely to identify the warning signs of breast cancer than older and younger age groups, and were mostly of low educational degrees, indicating no linkage of health education to educational degree in this community.

Keywords: Awareness; Breast cancer; Developing nation; Screening program.

Introduction

Breast Cancer represents the most commonly diagnosed cancer in females globally and the second most common cause of cancer death among women worldwide. The disease accounts for an annual incidence of 1/10 new cancer diagnoses. The disease commonly arises from the ductal epithelial cells, commonly known as ductal carcinoma, or from the breast lobules known as lobular carcinoma [1]. According to the Global Cancer Observatory by the World Health Organization (WHO), the estimated number of new cases worldwide, for both genders, is expected to increase from 2.30 to 3.36 million between 2022 and 2045. There will also be a significant increase in mortality, from 0.66 million to 1.06 million by 2045 [2]. The disease poses a significant burden locally, with 39.4 / 100,000 cases in Erbil City and 18.1/100,000 new diagnoses among females in Duhok City, marking one of the most prevalent cancers [3]. The main risk factors in the Kurdish society include nulliparity, early age at menarche, dietary patterns, and physical inactivity, which are environmental factors; nevertheless, genetics can also play a key role [4-6].

The disease is diagnosed through a triple assessment: clinically, from a detailed history and physical examination, and imaging, including sonographic breast assessment and mammography, combined with histopathological assessment using Fine Needle

Aspiration Cytology (FNAC) and/or biopsy [1,7]. Early diagnosis serves patient outcomes and improves survival [8-9], which is achieved through early detection and screening methods [8]. Screening Programs are aimed at the early detection of cancer during the asymptomatic period [9]. The program emphasizes several easy-to-apply approaches that contribute to the early detection of cancer. The program in many countries is population-based, especially in developed countries [10], nevertheless, in Iraq, several barriers are encountered with the screening program [11]. Literature divides the screening into patient-based screening programs focusing on patients' knowledge, attitude, and practice [12] and/or the application of self-breast examination [13], as well as healthcare workers based on a triple assessment [7]. The purpose of this study is to map women's level of knowledge on breast cancer screening to target the development of future educational programs in developing nations.

Methodology**Setting**

This cross-sectional study was conducted in Duhok city, Kurdistan Region of Iraq, over a five-month period from July 1, 2025, to December 1, 2025. Data were collected through structured

face-to-face interviews using a pre-designed questionnaire targeting adult women residing in Duhok. This article meets STROBE's recommendations regarding reporting cross-sectional observation studies [14] (Supplementary file 1).

Study population and sampling

A total of 733 women were initially approached. After excluding 21 participants due to incomplete responses, 712 women were included in the final analysis. The sample size was calculated using a population-based sample size calculator appropriate for Duhok city and was pre-approved by the institutional scientific committee. A convenience sampling technique was employed. Participants were recruited from university settings (students and lecturers) as well as from patients and accompanying relatives attending the general surgery consultation clinic. Although this method facilitated recruitment, it may limit generalizability.

Inclusion and exclusion criteria

The study participants were deemed eligible to participate in the study if they were 18 years and above, resided in Duhok city, and visited the clinic with complains other than breast diseases. Female participants who volunteered to give their informed consent were selected to participate in the study, while those who refused to participate in the study, had a previous diagnosis of breast cancer, and had incomplete information in their questionnaire forms were excluded from the study.

Data collection instrument

Data collection was carried out through the use of a structured and pre-designed questionnaire, which was reviewed and validated by the scientific committee (Supplementary File 2). Each interview was conducted for approximately 10 minutes. Before the commencement of the research, the participants were informed of the objectives of the research, and the questionnaire was administered. The questionnaire consisted of 18 questions, and they were grouped under two sections. These sections were as follows: Sociodemographic Characteristics, where questions were asked regarding age, residency, marital status, educational level, occupation, and religion. Awareness of Breast Cancer Warning Signs, where seven questions were asked regarding participants' awareness of key warning signs of breast cancer. Awareness score was obtained based on the identification of warning signs.

Validity assessment

The questionnaire was pre-tested by a group of experts in general surgery and public health to evaluate its content validity and cultural appropriateness. The tool was slightly modified for better clarity and comprehension.

Pilot testing

Before the actual study, a pilot study was conducted with 30 women from the target group. This was done to examine the clarity and understanding of the research instrument. The subjects who took part in the pilot study did not take part in the actual study. Some slight modifications were done to the research instrument to enhance clarity and understanding.

Variables and operational definitions

The primary outcome variable used in the study was the awareness of breast cancer warning signs. The awareness of the warning signs of breast cancer was measured by the use of seven questions regarding the clinical warning signs of breast cancer. For each of the questions, the correct answer was given a score of one (1), while the wrong answer and "don't know" were all given a score of zero (0). The awareness score for breast cancer warning signs was calculated by adding all the scores for the individual questions, giving a total range of 0-7. The major independent variables considered were age, level of education, marital status, religion, and residency. Age is considered to be within three categories, i.e., 18-30 years, 30-50 years, and above 50 years. Similarly, the level of education is considered to have seven categories, i.e., no formal education, primary, secondary, high, institute, college, and college graduate. For regression analysis, it is considered to be an ordinal variable based on increasing academic achievement. Similarly, marital status is considered to have categories such as single, married, divorced, and widowed. In addition, religion is considered to have categories such as Muslim, Christian, and Yezidi. Similarly, residency is considered to have categories such as urban and rural based on the residency of the patients.

Statistical analysis

The Statistical Package for the Social Sciences (SPSS), version 26, was used to analyze the data. Results are presented using descriptive statistics such as frequency, percent, mean, and standard deviation, among others. The differences in mean awareness scores among the sociodemographic groups were compared using a one-way ANOVA test. The results from the ANOVA test guided the use of the post hoc Tukey test to compare differences in mean awareness scores between two groups at a time, considering the presence of statistically significant differences. The association between awareness scores and other variables, such as age, was compared using the Pearson correlation test. The multivariable linear regression test was used to identify the independent association between awareness scores and potential predictor variables, considering the presence of potential confounders. The results from the regression test are presented using regression coefficients (B), 95% confidence intervals, and p-values. The p-value was considered significant at 0.05. The assumptions of normality and homoscedasticity were checked using a histogram and residual plots.

Ethical considerations

Ethical approval was granted by the scientific and ethical committees within the relevant institutions before the study began. The subjects were explained the study objectives and methods before the study began, and consent to participate was obtained. The subjects were assured that their responses will be kept confidential and anonymous, and the data collected will be processed in accordance with ethical guidelines for research. The subjects' participation in the study was voluntary, and they were made aware that they could withdraw from the study at any time without any consequences.

Results

Participant characteristics

A total of 712 women were included in the analysis. The majority

Table 1: Sociodemographic characteristics of the sample.

Character		No.	Percentage (%)
Age	18-30	513	72.1
	30-50	168	23.6
	>50	31	4.3
Marital status	Single	446	62.6
	Married	259	36.4
	Divorced	3	0.4
	Widowed	4	0.6
Educational Level	No Education	35	4.9
	Primary School	49	6.9
	Secondary School	45	6.3
	High School	24	3.4
	Institute	5	0.7
	College	419	58.8
	College Graduate	135	18.9
Religion	Muslim	674	94.7
	Christian	15	2.1
	Yezidi	23	3.2
Residency	Urban	588	82.6
	Rural	124	17.4
Total		712	100.0

of participants were between 18 and 30 years old (72.1%), followed by 30-50 years (23.6%) and >50 years (4.3%). Most of them were single (62.6%), whereas 36.4% were married, and less than 1% were divorced and widowed. In relation to the level of education, 58.8% were college students, 18.9% were college graduates, whereas 4.9% had no formal education. Most of them were Muslims (94.7%), and 82.6% of them were from urban areas. More sociodemographic characteristics of participants are shown in Table 1.

Awareness of breast cancer risk factors

Awareness regarding breast cancer risk factors and associated misconceptions was found to vary among participants, as depicted in Table 2. Higher percentages of correct responses were found regarding cigarette smoking as a risk factor (74.3%), followed by breastfeeding as a protective factor (68.4%), and family history of breast cancer (62.0%). Moderate levels of awareness were found regarding obesity as a risk factor (54.6%), use of oral contraceptive pills/hormone replacement therapy (53.9%), and age as a risk factor (49.3%). However, less awareness was found regarding reproductive and hormonal factors, including late-onset menopause (30.6%), first childbirth at the age of 30 years or above (36.0%), and early onset of menstruation (34.1%). Misconceptions have also been found, especially regarding the possibility of breast cancer transmission from person to person, where only 7.7% of participants correctly disagreed with the statement.

Participants demonstrated varying levels of awareness regarding the warning signs of breast cancer (Table 3). The highest recognition was observed for the presence of a lump or thickening in the breast (60.3%), followed by a lump or thickening under the armpit (55.0%) and nipple discharge or bleeding (57.4%). Awareness was lower for other symptoms, including nipple pulling or retraction and skin redness, each identified by 42.6% of participants. Additionally, 48.1% recognized changes in the size or shape of the breast or nipple as a potential warning sign, while 44.4% identified pain as a possible indicator of breast cancer.

Table 2: Distribution of responses to breast cancer awareness questions.

Question	Yes n (%)	No n (%)	I don't know n (%)
Is breast cancer only seen in women?	320 (44.9%)	307 (43.1%)	85 (11.9%)
Can breast cancer be transmitted from one person to another?	55 (7.7%)	613 (86.1%)	44 (6.2%)
Do you think a family history of breast cancer is a risk factor?	441 (62.0%)	172 (24.2%)	98 (13.8%)
Do you think a personal history of breast cancer is a risk factor?	405 (57.0%)	198 (27.8%)	108 (15.2%)
Do you think cigarette smoking is a risk factor for breast cancer?	529 (74.3%)	137 (19.2%)	46 (6.5%)
Do you think breastfeeding can protect against breast cancer?	486 (68.4%)	146 (20.5%)	79 (11.1%)
Do you think older age is a risk factor for breast cancer?	350 (49.3%)	275 (38.7%)	85 (12.0%)
Do you think obesity is a risk factor for breast cancer?	389 (54.6%)	232 (32.6%)	91 (12.8%)
Do you think the use of oral contraceptive pills or hormone replacement therapy is a risk factor for breast cancer?	384 (53.9%)	185 (26.0%)	143 (20.1%)
Do you think late-onset menopause (after age 55 years) is a risk factor?	218 (30.6%)	367 (51.5%)	127 (17.8%)
Do you think having the first child after the age of 30 years is a risk factor?	256 (36.0%)	344 (48.4%)	111 (15.6%)
Do you think early onset of menstruation (before age 12 years) is a risk factor?	243 (34.1%)	364 (51.1%)	105 (14.7%)
Do you think engaging in less than 30 minutes of moderate physical activity five times per week is a risk factor?	417 (58.6%)	237 (33.3%)	58 (8.1%)

Correlation analysis

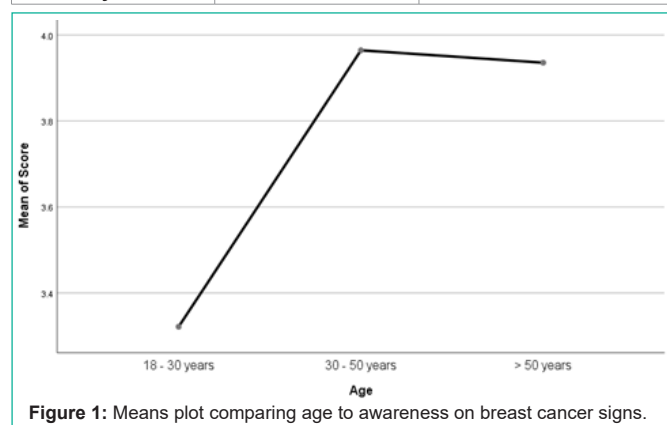
Comparing between groups within each sociodemographic character, the correlation was assessed. The level of education and age groups showed significantly different mean scores for Breast Cancer Warning signs; $P=0.002$, and <0.001 , respectively. On the other hand, marital status ($P=0.303$), Religion ($P=0.100$), and Residency ($P=0.087$) showed no impact on the assessed knowledge, as seen in Table 4. One-way ANOVA was used to assess the correlation of age to the detection of warning sign among the sample. Women at the age group of 30-50 years scored higher and statistically significant from the age group 18 – 30 years ($P=0.002$), while, no difference was noticed with women > 50 years ($P=0.997$). Comparing the younger generation 18-30 to

Table 3: Awareness of Breast Cancer Warning Signs Among Participants.

Question	Yes n (%)	No n (%)	I don't know n (%)
Do you think a lump or thickening in the breast could be a sign of breast cancer?	429 (60.3%)	213 (30.0%)	69 (9.7%)
Do you think a lump or thickening under the armpit could be a sign of breast cancer?	391 (55.0%)	231 (32.5%)	89 (12.5%)
Do you think nipple discharge or bleeding could be a sign of breast cancer?	408 (57.4%)	155 (21.8%)	148 (20.8%)
Do you think nipple pulling or retraction could be a sign of breast cancer?	303 (42.6%)	207 (29.1%)	201 (28.3%)
Do you think redness of the breast skin could be a sign of breast cancer?	303 (42.6%)	254 (35.7%)	154 (21.7%)
Do you think changes in the size or shape of the breast or nipple could be signs of breast cancer?	342 (48.1%)	248 (34.9%)	121 (17.0%)
Do you think pain in one of the breasts or armpits could be a sign of breast cancer?	316 (44.4%)	276 (38.8%)	119 (16.7%)

Table 4: One-way ANOVA assessment of Warning sign of breast cancer with sociodemographic character.

Character	Mean within groups	P Value between Groups
Age	4.507	0.002
Marital Status	4.572	0.303
Educational Level	4.247	< 0.001
Religion	4.560	0.100
Residency	4.564	0.087

**Figure 1:** Means plot comparing age to awareness on breast cancer signs.

older generation >50, the mean score difference was non-significant, $P=0.262$. The results are shown in Table 5 and Figure 1.

Pearson correlation analysis was performed to assess the association between sociodemographic variables and awareness scores. Age ($r=0.125$, $p<0.001$), marital status ($r=0.063$, $p=0.047$), religion ($r=0.070$, $p=0.030$), and residency ($r=0.064$, $p=0.044$) demonstrated weak but statistically significant positive correlations with awareness scores. In contrast, educational level showed a statistically significant negative correlation with awareness score ($r=-0.205$, $p<0.001$).

Educational level was also negatively correlated with age ($r=-0.418$, $p<0.001$), marital status ($r=-0.373$, $p<0.001$), religion

Table 5: One-way ANOVA assessing the age and knowledge of warning sign of breast cancer.

Age	No	Mean Score	P value		
			18-30 years	30-50 years	> 50 years
18-30 years	513	3.32		0.002	0.262
30-50 years	168	3.96	0.002		0.997
> 50 years	31	3.94	0.262	0.997	

Table 6: Pearson correlation and significance of different factors impacting the patients knowledge.

		Age	Marital Status	Educational Level	Religion	Residency
Pearson Correlation (r)	Score	0.125	0.063	-0.205	0.070	0.064
	Educational Level	-0.418	-0.373	1.000	-0.203	-0.151
Significance(P)	Score	< 0.001	0.047	< 0.001	0.030	0.044
	Educational Level	< 0.001	< 0.001		< 0.001	< 0.001
< 0.001						

($r=-0.203$, $p<0.001$), and residency ($r=-0.151$, $p<0.001$), indicating potential interrelationships among these sociodemographic factors (Table 6).

Furthermore, chi-square analysis demonstrated a statistically significant association between age group and educational level ($p<0.001$). Women aged 30–50 years were more frequently represented in lower educational categories (high school or below), whereas women aged 18–30 years were predominantly enrolled in higher educational levels (Table 7).

Table 7: Chi-square assessing the relationship between educational level and age.

	18 – 30 years	30 – 50 years	> 50 years	Total
No Education	3	23	9	35
	8.6%	65.7%	25.7%	100.0%
Primary School	10	31	8	49
	20.4%	63.3%	16.3%	100.0%
Secondary School	25	16	4	45
	55.6%	35.6%	8.9%	100.0%
High School	15	8	1	24
	62.5%	33.3%	4.2%	100.0%
Institute	5	0	0	5
	100.0%	0.0%	0.0%	100.0%
College	384	31	4	419
	91.6%	7.4%	1.0%	100.0%
College Graduate	71	59	5	135
	52.6%	43.7%	3.7%	100.0%
P value < 0.001				

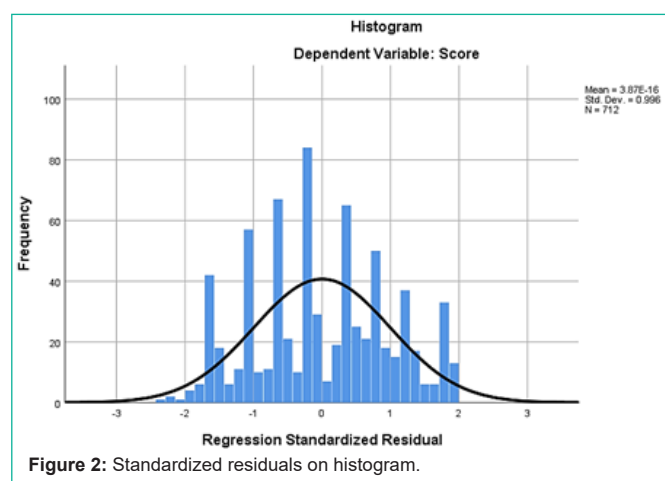
Multivariable linear regression analysis

After controlling for sociodemographic factors, multivariable linear regression analysis was used to find independent predictors of awareness ratings. Educational level was the only factor significantly associated with awareness of breast cancer warning signs. Higher educational attainment was independently associated with lower awareness scores ($B=-0.231$, 95% CI: -0.336 to -0.127 , $p<0.001$). Age ($B=0.285$, 95% CI: -0.066 to 0.636 , $p=0.111$), marital status ($B=-0.206$, 95% CI: -0.565 to 0.153 , $p=0.261$), religion ($B=0.148$, 95% CI: -0.276 to 0.572 , $p=0.494$), and residency ($B=0.171$, 95% CI: -0.248 to 0.590 , $p=0.424$) were not independently associated with awareness scores (Table 8).

Assessment of model assumptions demonstrated approximate normal distribution of residuals, with standardized residuals scattered around zero and no evidence of extreme outliers, indicating that the

Table 8: Linear Regression analysis and the change of the score.

Character	B	95% C.I.	Std. Error	P Value
Age	0.285	-0.066 – 0.636	0.179	0.111
Marital Status	-0.206	-0.565 – 0.153	0.183	0.261
Educational Level	-0.231	-0.336 – 0.127	0.053	<0.001
Religion	0.148	-0.276 – 0.572	0.216	0.494
Residency	0.171	-0.248 – 0.590	0.213	0.424



assumptions of linear regression were adequately satisfied (Figure 2).

Discussion

The present study assessed the knowledge of warning signs of breast cancer in a developing region. Similar to previous studies, knowledge of breast cancer symptoms in developing countries is still poor [15,16]. In this study, it was found that women aged between 30 and 50 years were more knowledgeable than younger women aged between 18 and 30 years. However, knowledge of warning signs was similar between younger and older women (>50 years). This is similar to findings of previous studies that found that women aged ≥ 35 years are likely to be knowledgeable about breast cancer symptoms [17,18]. This could be attributed to increased perceived risk and utilization of healthcare services [19]. However, as found in previous studies, even though knowledge of warning signs of breast cancer is relatively higher in this study, it is still a long way from translating into behavior because breast cancer is still considered an “older woman’s disease” [20-22].

According to the study’s findings, participants’ knowledge of the warning signals and risk factors linked to breast cancer varied somewhat. The knowledge of the lifestyle and hereditary factors associated with breast cancer has been found to be relatively higher than the knowledge of the reproductive and hormonal factors associated with the risk of breast cancer. This may be attributed to the fact that the general public may be more aware of the issues that are discussed and publicized to a greater extent, whereas the hormonal factors may not be so clearly understood by the general public. Misconceptions have also been noted, especially with regard to the heritability of breast cancer, which may be attributed to the general public’s lack of knowledge with regard to cancer in general. A similar trend was noticed with respect to awareness about the warning signs. More awareness was reported with respect to the most common signs, i.e., the presence of a breast lump or thickening. However, awareness with respect to other important and relevant signs, such as nipple changes, changes in the shape of the breast, changes in the skin of the breast, or axillary symptoms, was not as consistent. It can thus be inferred that awareness programs may have effectively communicated to people the most classic sign, i.e., the presence of a breast lump or thickening, while there is a lack of awareness with respect to the other important and relevant signs of breast cancer. More awareness among

people about all the important and relevant signs of breast cancer can help in the early detection, which is an important aspect of its diagnosis in communities with limited screening facilities. The findings of the present study are consistent with those reported in a previous study conducted among Iranian women, which also demonstrated variable awareness of breast cancer risk factors and warning signs [23]. In that study, participants showed relatively better recognition of commonly discussed risk factors such as family history and smoking, whereas awareness of hormonal and reproductive factors, including early menarche and late menopause, was considerably lower. Similarly, women are more likely to perceive palpable breast lumps as an important warning sign of cancer, whereas other signs such as nipple discharge and skin changes are less frequently perceived as such. These similarities suggest that public awareness campaigns in this region are likely emphasizing easily recognizable signs and lifestyle factors, whereas complex biological risk factors are still not well understood by the general public.

Although higher educational status has always been recognized as a significant predictor of enhanced recognition of warning signs of breast cancer in different settings, including Jordan and Kuwait [18,24,25], our results revealed a reverse relationship between educational status and women’s knowledge of warning signs of breast cancer. The results of this study revealed that women with higher educational status had lower knowledge compared to women with lower educational status. This could be attributed to different levels of exposure to breast cancer awareness campaigns in developing countries, especially in women with lower educational status [26]. In addition, academic education does not always reflect health literacy, and the level of organized education in health issues is still relatively low in the community, even in highly educated women. It is also important to note that the level of education was found to have negative correlations with age and marital status, suggesting possible links between these factors. Thus, in our sample, women with high education tend to be younger and unmarried, which may translate into fewer gynecological visits, fewer births, and therefore fewer breast health counseling sessions. Residency, marital status, religion, and age had weak positive correlations with awareness scores, suggesting these factors had little independent influence compared to education level.

Clinical implications

The findings of this study highlight the significance of creating organized initiatives to raise awareness of breast cancer among women of all educational backgrounds. Education does not always equate to health literacy, as evidenced by the inverse relationship between education and breast cancer awareness. Primary health care counseling, regular breast awareness education during gynecological check-ups, and regular breast cancer screening awareness education are some of the ways of improving breast cancer awareness.

Limitations

The use of a convenience sampling technique may also limit the results’ generalizability to the larger population of women in the Duhok region. Second, the sample was mostly comprised of young and urban women, which may result in selection biases. Third, awareness was also measured using self-reported data, which may result in recall biases and social desirability biases. Fourth, the

study design does not allow for any cause-effect inferences and does not enable the establishment of any temporal relationship between sociodemographic factors and awareness levels.

Conclusion

Women aged 30–50 years demonstrated higher recognition of warning signs compared to other age groups. An inverse association between educational level and awareness score was observed in this sample. The findings of this study indicate that formal education may not necessarily imply that women are sufficiently aware of breast health issues. It is crucial to remember that in order to investigate the factors influencing breast cancer awareness and the connection between knowledge and health literacy in this context, longitudinal research and community-based studies employing a representative sampling method should be conducted.

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