Submitted: 02 October, 2023 Accepted: 01 November, 2023 Published: 15 June, 2024 DOI:10.22514/ejgo.2024.001

ORIGINAL RESEARCH

European Journal of Gynaecological Oncology

Breast cancer screening outcomes and risk assessment among women of Abha city, Saudi Arabia

Hayfa A. AlHefdhi[1], Asma Saad Habbash[1], Safar Abadi Al-Saleem[1], Fatima Riaz[1], Syed Esam Mahmood[1,*], Amal A. AlHefdhi[2], Saad Abdullah Al Hatim[3], Abdullah Ali Alqahtani[3], Naif Shalan Alalyani[3], Saeed Abdullah Alahmari[3], Fahad Juwayid Alqahtani[3], Rawan Hassan Alshehri[3]

[1]Department of Family and Community Medicine, College of Medicine, King Khalid University, 62529 Abha, Saudi Arabia
[2]Family Medicine Specialist, Diabetic Centre, Ministry of Health, 62523 Abha, Saudi Arabia
[3]General Practitioner, Ministry of Health, 62523 Abha, Saudi Arabia

***Correspondence**
smahmood@kku.edu.sa
(Syed Esam Mahmood)

Abstract

Breast cancer is one of the most common cancers among women and the leadingcause of death related to cancers. This study focuses on the screening of breast cancer for earlydetection of breast cancer and identification of risk factors for the development of breast cancer. This cross-sectional study was conducted among the female participants who were registered for the breast cancer screening program conducted by King Khalid University, Abha under the supervision of Family and Community Medicine, Department of College of Medicine. Convenience sampling was done and a total of 331 patients were selected for the study. The collected data were coded and entered into an Excel software (Microsoft Office Excel 2010) database. Data was analyzed using Statistical Package for Social Sciences, version 16 (SPSS, Inc., Chicago, IL, USA). $p < 0.05$ was considered statistically significant. Out of 331 individuals only 3 (0.9%) were diagnosed with breast cancer. Three cases ofinvasive ductal carcinoma were identified among individuals with breast cancer. While 4 (1.2%) individuals had benign findings, such as fibroadenoma, ductal ectasia, sclerosing adenosis, andtissue fibrosis. Past surgical history, past radiotherapy/chemotherapy, and maternal problemsduring pregnancy were significantly associated with varying levels of breast cancer risk. Breastcomplaints show a significant association with breast cancer indicating the need for furtherinvestigation. Findings from physical examinations, mammography reports, breast ultrasound, biopsy referrals, biopsy results, and management plans all show significant relationships withbreast cancer risk. Our study findings indicate the need for health education for the prevention of breastcancer risk factors and the implementation of regular screening programs for the early detectionof the disease in the community.

Keywords

Breast cancer; Screening; Risk factors; Outcomes

1. Introduction

Breast cancer is one of the most common cancers among women and the leading cause of death related to cancers, whereas it is rare among men and accounts for less than 1% of cases of cancers among men [1]. All over the world incidence of breast cancer has risen greatly as well. Although it is one of the cancers that has been cured with great success. The data from 2010–2019 showed a 0.5% rise in breast cancer annually. In contrast mortality rates related to breast cancers declined at the slower rate of about 1.3% annually from 2011–2020, which was reported 1.9% annually from 2002–2011 [2]. Although breast cancer is considered to be a disease in developed countries almost half of the mortality occurred in less developed areas during 2020, survival however is less among women of low socioeconomic countries than the developed countries [3, 4]. There are certain risk factors causing breast cancer; breast cancer is a multifactorial disease [5, 6]. Factors included lifestyle including lack of physical activities, genetic factors, environment and age, the incidence of breast cancer increases with age and reaches to peak at the age of menopause [7, 8]. Whereas younger age of menarche increases the risk of breast cancer twofold [9, 10]. Risk of breast cancer decreases among multiparous women [7] whereas early maternal age of first pregnancy reduces the incidence of breast cancer. Lactation also plays a pivotal role in the prevention of breast cancer, the longer the duration of lactation more the protection it provides [10]. Oral contraceptive use is also one of the important risk factor leading to breast cancer, however risk of breast cancer development decrease 5–10 years after the discontinuation of hormonal contraceptives [11]. Literature suggested that hormonal replacement therapy is also associated

with increased breast cancer risk which is reduced after the discontinuation of therapy after 5 years [12]. *BReast CAncer 1* (*BRCA1*) and *BReast CAncer 2* (*BRCA2*) Genes are also associated with 40% of hereditary cancers *via* the autosomal dominant method [13]. Despite having negative *BRCA* Genes, those women who have a family history of breast cancer (2 or more cases <50 years or 3 or more cases at any age) are 11 times at risk of development of breast cancer [14]. Breast density also plays a role especially if increased after the use of estrogen and progesterone and a 3.4% risk of development of cancer occurs with every 1% increase in breast density [15]. Breast hyperplasia is also associated with an increased risk of breast cancer even in benign breast diseases [16]. higher socioeconomic status [9] Obesity, alcohol consumption [17], smoking [18], diet containing low polyunsaturated and saturated fatty acids [19], vitamin D deficiency [20], women who received radiation for cancer or received X-rays for screening of tuberculosis and follow up of pneumonia showed increased risk of breast cancer [21]. Since the prevalence of breast cancer is about 28.7% in Saudi Arabia which considered very high among other cancers. So measures should be taken vigilantly to reduce the burden of disease in the country [22]. Therefore, identification of these risk factors to reduce the mortality and morbidity associated with the development and implementation of screening programs should be done regularly. Screening would be done through mammogram and ultrasound after a thorough history and breast examination. Although screening can reduce the burden of breast cancer it has some drawbacks, especially over-diagnosis and high cost [23]. However, mammogram (MMG) is still considered the best screening tool for diagnosing breast cancer, if diagnosed early then chances for survival are higher for the patients [24]. Sensitivity of mammograms is about 90–95% where glandular tissue predominates whereas in high-density breast tissue sensitivity is reduced to 60–75% [25]. Mammogram screening decreases the mortality by 15–20%. Ultrasonography (USG) is another tool for screening; the sensitivity of USG is about 36% in detecting neoplastic lesions [26]. With the help of USG differentiation between cystic and solid lesions can be done, also utilized well for the evaluation of dense breast tissue where MMG has a limited role and for evaluation of preoperative and postoperative follow-up as well. Magnetic resonance imaging (MRI) also complements MMG by increasing the tendency to detect breast lesions but it is done by using contrast and it is quite expensive as well so the combination of MMG and MRI are not recommended together for screening, although sensitivity is about 88.1% for MRI [27]. Breast self-examination (BSE) can also be done but because of its low sensitivity of 12–14% and high index of false positive results, it is not recommended as a screening tool now [28, 29]. This study focuses on the screening of breast cancer by MMG and USG for early detection of breast cancer and identification of risk factors for the development of breast cancer.

2. Material and methods

2.1 Study area and population

This study was conducted at the King Khalid University Medical City at Abha. This cross-sectional study was conducted among the female participants who were registered free of cost for the breast cancer screening program conducted by King Khalid University under the supervision of Family and Community Medicine, Department of College of Medicine. There were two campaigns launched, each for one-week duration. The first campaign was held in the month of October 2021 while 2nd campaign was conducted in the month of October 2022. A total of 331 females were registered, during 1st campaign total of 111 females whereas during 2nd campaign total of 220 females were registered.

2.2 Inclusion and exclusion criteria

We recruited only those patients who agreed to participate in the study. We selected patients according to the following Criteria.

1. All women 40 years of age and more were included.
2. Women less than 40 years old with a strong family history and risk factors for breast cancer was included.
3. Any woman with signs and symptoms of breast cancer was included.

We excluded all pregnant women and those who did not agree to participate in the study. We also excluded women less than 40 years of age without any risk factors for breast cancer.

2.3 Sample size and sampling technique

Convenience sampling was done and all the patients who fulfilled inclusion criteria were recruited accordingly in the study. A total of 331 patients were selected for the study.

2.4 Questionnaire and data collection

The questionnaire consists of 41 items including a sociodemographic profile, risk factors for breast cancer, and a management plan. Variables included such age, nationality, marital status, history of smoking, body mass index, age of menarche, menstrual history, parity, age of first pregnancy, a maternal problem during pregnancy, history of abortions, history of breastfeeding, history of Polycystic ovaries, ovarian cyst, endometrial hyperplasia, use of hormonal contraceptive, type of hormones used, duration of contraceptive use, menopausal status, age of menopause, history of any breast problem at presentation, past medical surgical history of any co-morbid condition, history of COVID-19, history of radiotherapy and chemotherapy, family history of cancer, type of cancer, stage of cancer, history of any herbal use, physical examination findings for breast, mammogram report finding, breast ultrasound conducted, breast ultrasound findings, referral for biopsy, biopsy is done, biopsy report, management plan for breast cancer.

A team of 12 volunteer doctors and nurses recruited patients for mammogram screening. The team consisted of one radiologist who specialized in mammogram conduction and reporting, 2 family medicine consultants, 4 family medicine residents, and 5 nursing staff members. Publicity was done through messages on mobile phones, brochure distribution and

announcements over the university social media platform so that messages for free consultations and mammograms could be conveyed to the addressed population. University social media platform was the most effective method for enrolling patients. Those participants who were interested in breast cancer screening were enrolled and registered for appointments. On the day of the appointment, a thorough history and physical examination were conducted by the team of volunteer doctors. The high-risk patients were further recruited for mammograms and breast ultrasounds if indicated. Mammograms and ultrasound were conducted and reported by radiologists specialized in mammograms. Patients who had some findings on mammograms and ultrasound were referred to breast surgeons at Aseer Central Hospital for biopsy. Biopsy reports were collected from the pathology laboratory of Aseer Central Hospital. Patients were informed about their report and psychological support was provided to the patients who had breast cancer and further plan of management was discussed in conjoint support of breast surgeons and oncologists.

2.5 Statistical analysis

The collected data were coded and entered into a Microsoft Excel (2010, Microsoft Corp, Redmond, WA, USA). Data was analyzed using Statistical Package for Social Sciences, version 16 (SPSS, Inc., Chicago, IL, USA). The qualitative results are presented in descriptive statistics such as pie and bar diagrams and compared using Fisher's exact test for characteristics of participants like Sociodemographic, gynecological and obstetric risk factors, *etc.* with dependent variables such as breast cancer of study subjects. Baseline characteristics cases were compared using chi-square for categorical variables. $p < 0.05$ were considered statistically significant. Logistic regression analysis to determine the associations of characteristics of participants with breast cancer.

3. Results

Table 1 and Fig. 1 provide the outcomes of the study in terms of the frequency and percentage 237 of individuals with and without breast cancer. In this study, 3 individuals were diagnosed with 238 breast cancer. This represents 0.9% of the total study population. The majority of individuals in 239 the study, 328 in total, did not have breast cancer. This accounts for 99.1% of the study population. 240 the total number of study subjects included in the analysis is 331 individuals. Study outcomes, 241 specifically the number and percentage of individuals with and without breast cancer. In this 242 dataset, the majority of participants did not have breast cancer, with only a small percentage 243 diagnosed with the condition.

TABLE 1. Breast cancer screening outcome.

Breast Cancer	Frequency	Percent
Yes	3	0.9
No	328	99.1
Total	331	100.0

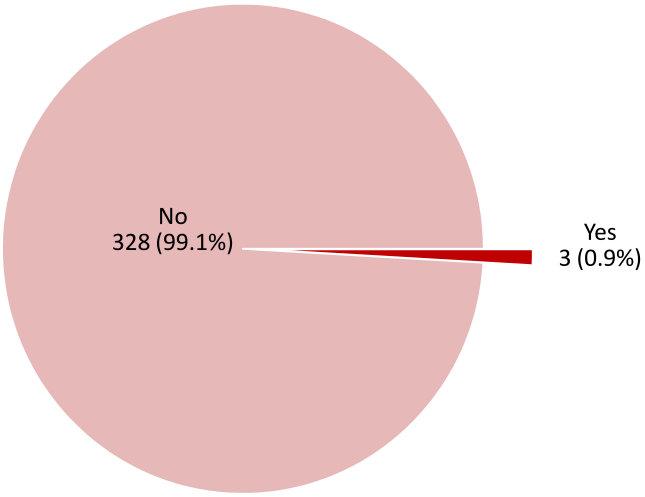

FIGURE 1. Study participants with and without breast cancer.

Table 2 indicates that among the study subjects, there were 3 cases of breast cancer out of 298 Saudi nationals, while there were no cases among the 33 non-Saudi nationals. The *p*-value of 1.000 suggests that there is no significant association between nationality and breast cancer risk in this study, indicating that the nationality of the subjects does not influence their likelihood of developing breast cancer. Among married individuals, 3 cases of breast cancer were observed out of 247, while there were no cases among divorced or single individuals. It is not significantly associated with breast cancer risk in this study. The study categorized individuals into different age groups ($\leq$40, 40–60 and $>$60). The data show that age does not significantly influence breast cancer risk. Body Mass Index (BMI) is not significantly associated with breast cancer risk. Chronic disease and mastitis/breast abscess did not show a significant association with breast cancer. Those with no past medical history also did not exhibit a significant risk. The presence or absence of past surgeries did not show significantly influences breast cancer risk. Individuals with more than one surgery had a higher risk while those with no history of surgery had a lower risk. The number of children an individual has, and an abortion history does not significantly affect breast cancer risk. The presence of maternal problems during pregnancy, such as gestational diabetes (GDM), preeclampsia or gestational hypertension, is not significantly associated with breast cancer risk. This analysis suggests that among the study subjects, factors such as nationality, marital status, age, BMI, past medical history, parity and abortion history do not appear to be significant predictors of breast cancer risk. However, past surgical history, past radiotherapy/chemotherapy and maternal problems during pregnancy are associated with varying levels of breast cancer risk.

Table 3 presents an analysis of the association between various gynecological history factors and the occurrence of breast cancer among study subjects. The data show that among those with menstrual irregularity, there were 3 cases of breast cancer out of 275 individuals. In contrast, among those without menstrual irregularity, there were no breast cancer cases among 56 individuals. The presence or absence of menstrual

TABLE 2. Demographic, gynecological and obstetric risk factors of breast cancer among study participants.

Variables	Category	Breast Cancer		Total	*p* value
		Yes	No		
Nationality					
	Saudi	3	295	298	1.000
	Non-Saudi	0	33	33	
Marital Status					
	Married	3	244	247	
	Divorced	0	33	33	0.573
	Single	0	51	51	
Age (yr)					
	≤40	0	34	34	
	40–60	3	269	272	0.966
	>60	0	25	25	
BMI					
	Underweight <18.5	0	2	2	
	Normal (18.5–24.9)	0	63	63	1.000
	Overweight (25–29.9)	2	108	110	
	Obese class I (≥30)	1	155	156	
Smoking					
	Current	0	5	5	
	Past	0	2	2	0.998
	Never	3	321	324	
Past Medical history					
	Chronic disease	0	150	150	
	Mastitis/Breast abscess	1	8	9	1.000
	No past medical history	2	160	162	
Past Surgical history					
	Other surgeries	0	135	135	
	More than one surgery (bariatric surgery, cholecystectomy, C-section, and tonsillectomy)	3	90	93	0.555
	No history of surgery	0	103	103	
Past Radiotherapy					
	No history of radiotherapy	3	328	331	-
Past chemotherapy					
	No history of chemotherapy	3	328	331	-
Parity					
	Less than 2	0	15	15	
	2 to 4	3	106	109	
	More than 4	0	172	172	1.000
	Unknown	0	5	5	
	No (nullipara)	0	30	30	
Abortion					
	01 to 03	3	118	121	
	More than 3	0	15	15	0.068
	No abortion	0	195	195	
Maternal Problems During Pregnancy (GDM, preeclampsia, gestational HTN)					
	Yes	0	39	39	1.000
	No	3	289	292	

BMI: Body Mass Index; GDM: Gestational Diabetes Mellitus; HTN: Hypertension.

TABLE 3. Gynecological and other risk factors and their association with breast cancer among study participants.

Gynecological risk factors	Breast Cancer		Total	*p*-value
	Yes	No		
Menstrual irregularity				
Yes	3	272	275	1.000
No	0	56	56	
History of PCOS				
Yes	0	46	46	1.000
No	3	282	285	
History of Fibroid				
Yes	0	19	19	1.000
No	3	309	312	
Hyperplasia				
Yes	0	10	10	1.000
No	3	318	321	
Ovarian cyst				
Yes	0	9	9	1.000
No	3	319	322	
Age of menarche				
Less than 11	0	26	26	
11 to 14	1	254	255	1.000
More than 14	2	48	50	
Age of menopause				
No menopause yet	3	238	241	
<45	0	12	12	0.565
45 to 50	0	35	35	
51 to 55	0	43	43	
Age of First pregnancy				
<30	3	258	261	
30 to 35	0	30	30	1.000
≥36	0	7	7	
Never pregnant	0	33	33	
Contraceptive use				
Current	0	15	15	
Current and past	0	1	1	0.270
Past	3	175	178	
Never	0	137	137	
Contraceptive type				
Combined estrogen and progesterone pills	2	130	132	
Progesterone (IUD/Inject/Implant)	1	21	22	0.270
Both (pills and injectables)	0	40	40	
Never	0	137	137	
Contraceptive duration				
Less than 5 yr	3	109	112	
More than 5 yr	0	82	82	0.270
Never	0	137	137	

TABLE 3. Continued.

Gynecological risk factors	Breast Cancer		Total	*p*-value
	Yes	No		
Family history of cancer				
Yes	0	160	160	0.248
No	3	168	171	
Type of family history of cancers				
Breast	0	31	31	
Colon	0	11	11	
Lung	0	3	3	
Other	0	65	65	0.248
Endometrial	0	8	8	
Ovary	0	0	0	
No	3	168	171	
More than one	0	42	42	
Previous breast imaging				
US done	0	28	28	
Mammography done	0	80	80	0.275
Never	3	194	197	
Both (US, Mammography)	0	26	26	
Breast complaint(s)				
No	1	263	264	
Mass	2	12	14	
Discharge	0	8	8	
Noncyclic mastalgia (pain)	0	32	32	0.112
Skin Change	0	2	2	
Palpable axillary LN	0	4	4	
Pruritus/itching	0	1	1	
More than one complaint	0	6	6	
Breastfeeding				
No	2	62	64	0.096
Yes	1	266	267	

PCOS: Polycystic Ovarian Syndrome; IUD: Intra Uterine Device; LN: Lymph node.

irregularity does not appear to be significantly associated with breast cancer risk. History of Polycystic Ovarian Syndrome (PCOS), there were no cases of breast cancer among 46 individuals. Conversely, among those without a history of PCOS, there were 3 breast cancer cases among 285 individuals. Whether individuals had a history of PCOS or not does not seem to significantly influence breast cancer risk, with a *p*-value of 1.000. Similarly, a history of fibroids does not show a significant association with breast cancer risk (*p*-value of 1.000). The presence or absence of endometrial hyperplasia and having or not having ovarian cysts are not significantly linked to breast cancer risk. Among those with ovarian cysts, there were no cases of breast cancer among 9 individuals. Equally, among those without ovarian cysts, there were 3 breast cancer cases among 322 individuals. The age at which menarche and the age of menopause occurred does not seem to be significantly associated with breast cancer risk. The age at which individuals had their first pregnancy, current or past use of contraceptives the type of contraceptives, and the duration of contraceptive use (less than 5 years or more than 5 years) does not appear to significantly influence breast cancer risk. The presence or absence of a family history of cancer, a specific type of family history of cancer, individuals who had previous breast imaging (ultrasound, mammography or both), presence or absence of breastfeeding and smoking, in general, does not seem to significantly affect breast cancer risk (*p*-value of 0.275). However, some factors like breast complaints show a significant association, indicating the need for further investigation.

Table 4 provides a detailed analysis of the association between various investigation and examination factors and the occurrence of breast cancer among study subjects. Notably, all

TABLE 4. Association of physical examination, clinical investigation, and management of breast cancer among study participants.

Variables	Breast Cancer		Total	*p*-Value
	Yes	No		
Physical examination				
Unremarkable	1	279	280	
Mass	2	14	16	
Palpable axillary LN	0	1	1	
Mastitis	0	0	0	
Discharge	0	1	1	0.063
Skin Change	0	3	3	
Asymmetric	0	5	5	
Skin retraction	0	3	3	
Inverted nipples	0	17	17	
More than one	0	5	5	
Mammography Report (BIRADs)				
0/incomplete, need US or additional study (MRI)	1	22	23	
1/negative, for annual screening follow up (Normal)	0	260	260	
2/benign findings, for annual screening follow up	0	25	25	0.194
3/probably benign for short interval follow-up	0	1	1	
4/5 suspect malignancy	2	2	4	
Mammography is not indicated (till age <40 yr)	0	18	18	
Breast US				
Yes	3	48	51	0.003
No/Not indicated	0	280	280	
Breast US results				
No abnormal findings	0	22	22	
Benign cyst for follow- up	0	2	2	
Benign fibrocystic changes	0	7	7	0.004
Benign mass for US follow-up	0	12	12	
Suspicious mass/findings for biopsy	3	5	8	
Not indicated	0	280	280	
Referral for biopsy				
Yes	3	7	10	0.0001
No	0	321	321	
Biopsy result findings				
Invasive ductal Carcinoma, hormonal positive, HER2-negative	3	0	3	
Sclerosing adenosis (pre-cancerous lesion)	0	1	1	
Fibroadenoma (benign)	0	1	1	0.028
Ductal ectasia without intraductal component (benign)	0	1	1	
Tissue fibrosis (benign)	0	1	1	
Management plan				
Not indicated	0	328	328	0.0001
Excisional biopsy Mastectomy Axillary LNs resection Hormonal therapy (tamoxifen)	3	0	3	

BIRAD: Breast Imaging-Reporting and Data System; HER2: Human Epidermal Growth Factor Receptor 2; LNs: Lymph Nodes; MRI: Magnetic resonance imaging.

categories except "Unremarkable" had cases of breast cancer. The "Mass" category had 2 cases, "Palpable axillary Lymph node (LN)" had 0 cases, and others had varying numbers. A significant association between the results of the physical exam and breast cancer risk. Specifically, the presence of certain physical findings like a mass or discharge appears to be associated with a higher risk of breast cancer. Mammography reports based on Breast Imaging-Reporting and Data System (BIRADs) classifications. For instance, cases classified as "1/negative, for annual screening follow-up" had no breast cancer cases, while "4/5suspect malignancy" had 2 cases. A significant association between the performance of breast ultrasound and breast cancer risk. Notably, those who had a breast ultrasound had 3 cases of breast cancer, whereas those for whom it was not indicated had none. For example, cases with "Suspicious mass/findings for biopsy" had 3 breast cancer cases, while "No abnormal findings" had none, suggesting that certain ultrasound findings are associated with a higher risk of breast cancer. Those who were referred for biopsy had 3 cases of breast cancer, while those who were not referred had none. Cases with "Invasive ductal Carcinoma, hormonal positive, Human Epidermal Growth Factor Receptor 2 (HER2-negative) had 3 breast cancer cases, indicating a high association with breast cancer risk. Notably, cases where "Excisional biopsy, Mastectomy, Axillary LNs resection, Hormonal therapy (tamoxifen)" was indicated had 3 breast cancer cases. In summary, this analysis indicates several significant associations between investigation and examination factors and the risk of breast cancer. Findings from breast ultrasound, biopsy referrals, biopsy results and management plans all show significant relationships with breast cancer risk except physical examinations, mammography reports.

Fig. 2 titled "Frequency Distribution of Biopsy Finding" provides a detailed breakdown of the biopsy results for individuals with breast cancer. One individual with breast cancer was found to have a biopsy result of fibroadenoma, a benign (non-cancerous) condition. Another individual with breast cancer had a biopsy result of ductal ectasia without an intraductal component, which is also a benign finding. One case of sclerosing adenosis was identified among individuals with breast cancer. Sclerosing adenosis is a condition involving abnormal breast tissue growth but is not cancerous. One individual with breast cancer had a biopsy result indicating tissue fibrosis, another benign condition. Three cases of invasive ductal carcinoma were identified among individuals with breast cancer. This is a malignant (cancerous) condition characterized by the presence of invasive cancer cells in the breast tissue. While some individuals had benign findings, such as fibroadenoma, ductal ectasia, sclerosing adenosis and tissue fibrosis, others had invasive ductal carcinoma, which is a malignant and more serious form of breast cancer.

In this logistic regression model with categorical predictor variables, several key findings emerge. Firstly, for the "Breast US" variable, patients with a positive result ("Yes") have significantly increased odds (odds ratio of 40.48) of experiencing the event compared to those with a negative result ("No"). This effect is statistically significant ($p = 0.015$). Secondly, within the "Breast US results" category, patients with specific conditions, such as "Benign cyst for follow-up", "Benign fibrocystic changes", "Benign mass for US follow-up" or "Suspicious mass/findings for biopsy", exhibit decreased odds of the event, although these differences are not statistically significant ($p > 0.05$). The "Referral for biopsy" variable shows a substantial increase in odds (odds ratio of 300.07) for patients referred for biopsy compared to those not referred, and this effect is highly statistically significant ($p = 0.0001$). Finally, the "Biopsy result findings" significantly impact the odds of the event, with substantial odds ratios compared to Biopsy result findings not indicated with high statistical significance ($p \leq 0.0001$) (Table 5).

4. Discussion

Breast cancer screening is one of the most important ways of prevention of cancer.

In this study, 3 out of 331 individuals were diagnosed with breast cancer. This represents 0.9% of the total study population. Whereas Abulkhair *et al*. [30] showed the findings of a retrospective review of 1215 women who were screened by using mammograms during the first national breast cancer screening center which was established by a non-governmental collaboration between Abdul Lateef Charitable Screening Center and the Saudi Cancer Society in Riyadh city between September 2007 and April 2008. Only 16 cases were positive for breast cancer which represents 1.31% of the whole population there over a period of one year, slightly higher than our study population. Another non-governmental screening program was conducted in the Eastern province of Saudi Arabia by using mobile mammogram machines where 8061 women were screened between 2009 and 2014 and only 47 cases were detected at that time, representing 0.58% of the total study population over a period of 5 years, slightly lower than our study population [31].

Whereas governmental breast screening program was the first published report by a pilot study of breast screening program in the Alqassim region in the center of Saudi Arabia conducted from January 2007 to 30 June 2008, and the cancer detection rate was found 0.24%, slightly lower than our study population [32].

However, a national public awareness campaign was done to raise awareness regarding early screening for breast cancer conducted by the Saudi Ministry of health in 2015 as a promotion for the National Program for Early Detection for Breast Cancer [33, 34].

Although due to cultural constraints, the process of seeking screening for breast cancer is not clear in Saudi Arabia, El Bcheraoui *et al*. [35] reported that among 1135 women who were aged 50 and older, 92% of them reported never having a mammogram, where our study population showed 24% of women had history having a mammogram. However, language and lack of knowledge regarding breast cancer was considered a factor for low rate of response for screening mammogram in a study conducted at Turkey [36].

In the present study, one individual with breast cancer was found to have a biopsy result of fibroadenoma, a benign (non-cancerous) condition. Another individual with breast cancer had a biopsy result of ductal ectasia without an intraductal component, which is also a benign finding. One case of sclerosing

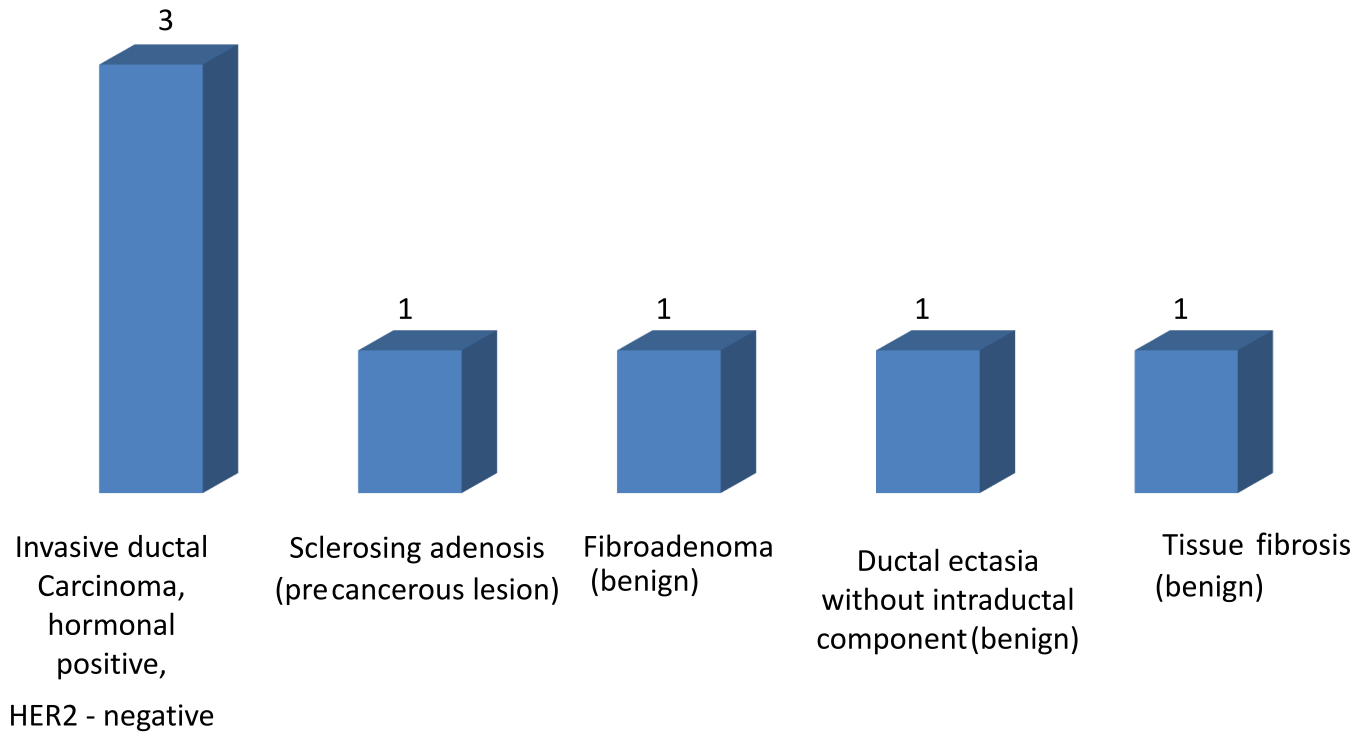

FIGURE 2. Frequency Distribution of Biopsy Finding. HER2: Human Epidermal Growth Factor Receptor 2.

TABLE 5. Logistic regression to estimate parameters.

Variables	Coefficient	Standard Error	Odds ratio	95% CI		*p* value
				Lower	Upper	
Breast US (referent: No)						
Yes	3.70	1.54	40.48	2.06	796.15	0.015
Breast US results (referent: No abnormal findings)						
Benign cyst for follow-up	−2.19	2.13	0.11	0.01	6.92	0.297
Benign fibrocystic changes	−1.08	2.05	0.34	0.01	18.31	0.590
Benign mass for US follow-up	−0.57	2.03	0.56	0.01	29.74	0.770
Suspicious mass/findings for biopsy	3.21	1.60	0.04	0.00	0.78	0.034
Not indicated	−1.60	2.00	0.20	0.01	3.45	0.271
Referral for biopsy (referent: No)						
Yes	5.70	1.57	300.07	14.21	6338.57	<0.0001
Biopsy result findings (referent: Not indicated)						
Excisional biopsy Mastectomy Axillary Lymphnodes resection Hormonal therapy (tamoxifen)	6.22	2.08	504.78	22.61	11,270.82	<0.0001
Constant	−24.02					

CI: Confidence Interval.

adenosis was identified among individuals with breast cancer. Sclerosing adenosis is a condition involving abnormal breast tissue growth but is not cancerous. One individual with breast cancer had a biopsy result indicating tissue fibrosis, another benign condition. Three cases of invasive ductal carcinoma were identified among individuals with breast cancer. This is a malignant (cancerous) condition characterized by the presence of invasive cancer cells in the breast tissue. While some individuals had benign findings, such as fibroadenoma, ductal ectasia, sclerosing adenosis and tissue fibrosis, others had invasive ductal carcinoma, which is a malignant and more serious form of breast cancer. The cancer cases in our study were between 40–60 years. Interestingly, the median age at diagnosis in an analysis reached 51 years in 2017 [37]. Their prevalence rates are as follows: breast cancer 53%; colon-rectal 313 cancer (CRC) 50.9%; prostate cancer 42.6%; 314 brain/Central Nervous System it is also suggested that past surgical history cancer 9.6%; Hodgkin and non-Hodgkin's

315 lymphoma 9.2%; kidney cancer 4.6%, and thyroid cancer 12.9% [38]. Evidence suggested that higher age, lower age of menarche, higher age at first birth, higher age of menopause current and past use of contraceptives, were considered as higher risk factors for breast cancer development. Whereas breast feeding for >16 months, high parity and exercise were considered as protective factors for breast cancer [39, 40]. This analysis suggests that among the study subjects, factors such as nationality, marital status, age, BMI, past medical history, parity and abortion history do not appear to be significant predictors of breast cancer risk. However, past radiotherapy/chemotherapy, and maternal problems during pregnancy are associated with varying levels of breast cancer risk. In our study 3.3% of population had a history of bariatric surgery, 5.7% cholecystectomy, 16% C-section and 1.5 % tonsillectomy. However, literature suggested reduced breast cancer incidence among patients who underwent bariatric surgery [41]. It is also evident that patients with cholecystectomy have greater risk of breast cancer development [42]. Literature also showed that patients with a history of tonsillectomy also showed a higher subsequent risk of breast cancer development however more studies are required to prove further this association [43]. Results from another Saudi Arabian study displayed that determinants of breast cancer were associated significantly ($p < 0.05$) with unemployment, large family size, lack of knowledge and awareness about breast cancer, obesity, sedentary lifestyle, smoking, starting menarche at an early age, as well as hormonal and non-hormonal contraceptive use [44]. The logistic regression model showed that there are important risk factors were age, marital status, family history, parity, age at first full-term pregnancy, menopausal status, body mass index and breastfeeding in the development of breast cancer among Saudi women in a recent study [45].

The presence or absence of menstrual irregularity does not appear to be significantly associated with breast cancer risk in this study. Whether individuals had a history of PCOS or not does not seem to significantly influence breast cancer risk. Similarly, a history of fibroids does not show a significant association with breast cancer risk. The presence or absence of endometrial hyperplasia and having or not having ovarian cysts is not significantly linked to breast cancer risk. The age at which menarche and the age of menopause occurred does not seem to be significantly associated with breast cancer risk in the present study. However, on the contrary significant associations were reported in other studies [46, 47]. The age at which individuals had their first pregnancy, current or past use of contraceptives the type of contraceptives, and the duration of contraceptive use (less than 5 years or more than 5 years) does not appear to significantly influence breast cancer risk. The presence or absence of a family history of cancer, a specific type of family history of cancer, individuals who had previous breast imaging (ultrasound, mammography or both), presence or absence of breastfeeding and smoking, in general, does not seem to significantly affect breast cancer risk. However, some factors like breast complaints show a significant association, indicating the need for further investigation. Many factors are associated with the risk of breast cancer including; the use of oral contraceptives, menstrual history, nulliparity obesity, family history of breast cancer, and low vitamin D [48–50]. Early diagnosis, positive attitude and awareness are some of the possible measures to mitigate the mortality rate due to breast cancer [51]. Data collection related to breast cancer must be enhanced in the region to fully understand its epidemiology and improve national guidelines. Saudi females with increased breast density have a higher risk of breast cancer and thus could benefit from supplementary screening with ultrasound, digital breast tomosynthesis or MRI. However, this would be more beneficial if there was a systematic approach inviting eligible females in Saudi to attend routine breast screening to aid detection of breast cancer in its early stages and pre-symptomatically [52].

Moreover, a study conducted at Guangdong Province of China also suggested that breast cancer image screening consultation network (BISCN) is of good feasibility in construction and applicability in the management by raising diagnosis level of breast cancer [53]. However, for the better participation of any population for screening programs it is mandatory to provide quality of care and minimize disparities related to the screening programs [54].

Our study has a few limitations. The limitation of this study is the recall bias as the variables were self-reported. Also, self-report data may potentially result in residual confounding; however, it is likely to be non-differential across the variables of interest. Another study's weakness is that it was conducted in a single city of the Aseer Region of KSA. We hope in the future to have all the required resources to do multicentric/nationwide studies. There are other major known breast cancer risk factors which in this study have not been included or correlated with breast cancer risk. Further, longitudinal studies with large sample size sand more study parameters are needed to understand the association of other risk factors with breast cancer. However, an extensive analysis has been made is the strength of our study. Also it brings new knowledge to the current literature as detailed published epidemiologic data on breast cancer screening are scarce from the region.

5. Conclusions

Our study findings indicate the need for health education for the prevention of breast cancer risk factors and health promotion and the implementation of regular screening programs for the early detection of the disease in the community.

AVAILABILITY OF DATA AND MATERIALS

The data presented in this study are available on reasonable request from the corresponding author.

AUTHOR CONTRIBUTIONS

HAA, ASH and SAAlSa—designed the research study. HAA, ASH, AAAlH, SAAH, AAAlq, NSA, SAAlah, FJA, RHA—performed the research. SEM and FR—analyzed the data. HAA, FR and SEM—wrote the manuscript. All authors read and approved the final manuscript.

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

The study was approved by the ethical committee (ECM#2023-3101) of King Khalid University. Informed consent was obtained from all subjects. All the information was gathered by the principle investigator and coinvestigators by using a questionnaire. Patients were ensured to keep their identity anonymous and unidentified at any point during research, also ensured that their data would be utilized only for research purposes by keeping their identity confidential.

ACKNOWLEDGMENT

Thanks to the King Khalid University, KSA for providing all the technical support and help. We would also like to thank all the patients who have participated in this study.

FUNDING

The authors extend their appreciation to the Deanship of Scientific Research at King Khalid University for funding this work through large group Research Project under grant number: RGP2/263/44.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

REFERENCES

[1] Gao Y, Heller SL. Breast cancer screening in men. Journal of Breast Imaging. 2023; 5: 104–111.

[2] Giaquinto AN, Sung H, Miller KD, Kramer JL, Newman LA, Minihan A, *et al*. Breast cancer statistics, 2022. CA: A Cancer Journal for Clinicians. 2022; 72: 524–541.

[3] Sung H, Ferlay J, Siegel RL, Laversanne M, Soerjomataram I, Jemal A, *et al*. Global cancer statistics 2020: GLOBOCAN estimates of incidence and mortality worldwide for 36 cancers in 185 countries. CA: A Cancer Journal for Clinicians. 2021; 71: 209–249.

[4] Wilkinson L, Gathani T. Understanding breast cancer as a global health concern. The British Journal of Radiology. 2022; 95: 20211033.

[5] Zendehdel M, Niakan B, Keshtkar A, Rafiei E, Salamat F. Subtypes of benign breast disease as a risk factor for breast cancer: a systematic review and meta-analysis protocol. Iranian Journal of Medical Sciences. 2018; 43: 1–8.

[6] Chokoev A, Akhunbaev S, Kudaibergenova I, Soodonbekov E, Kulayev K, Ospanov K, *et al*. Breast cancer incidence in Kyrgyzstan: report of 15 years of cancer registry. Asian Pacific Journal of Cancer Prevention. 2022; 23: 1603–1610.

[7] Kim Y, Yoo K, Goodman MT. Differences in incidence, mortality and survival of breast cancer by regions and countries in Asia and contributing factors. Asian Pacific Journal of Cancer Prevention. 2015; 16: 2857–2870.

[8] Qi SA, Kumar N, Xu JY, Patel J, Damaraju S, Shen-Tu G, *et al*. Personalized breast cancer onset prediction from lifestyle and health history information. PLOS ONE. 2022; 17: e0279174.

[9] Thakur P, Seam RK, Gupta MK, Gupta M, Sharma M, Fotedar V. Breast cancer risk factor evaluation in a Western Himalayan state: a case-control study and comparison with the Western World. South Asian Journal of Cancer. 2017; 06: 106–109.

[10] Wang H, MacInnis RJ, Li S. Family history and breast cancer risk for Asian women: a systematic review and meta-analysis. BMC Medicine. 2023; 21: 239.

[11] Laamiri FZ, Bouayad A, Hasswane N, Ahid S, Mrabet M, Amina B. Risk factors for breast cancer of different age groups: Moroccan data? Open Journal of Obstetrics and Gynecology. 2015; 5: 79–87.

[12] Zolfaroli I, Tarín JJ, Cano A. Hormonal contraceptives and breast cancer: Clinical data. European Journal of Obstetrics & Gynecology and Reproductive Biology. 2018; 230: 212–216.

[13] Collaborative Group on Hormonal Factors in Breast Cancer. Type and timing of menopausal hormone therapy and breast cancer risk: individual participant meta-analysis of the worldwide epidemiological evidence. The Lancet. 2019; 394: 1159–1168.

[14] Cobain EF, Milliron KJ, Merajver SD. Updates on breast cancer genetics: Clinical implications of detecting syndromes of inherited increased susceptibility to breast cancer. Seminars in Oncology. 2016; 43: 528–535.

[15] Melvin JC, Wulaningsih W, Hana Z, Purushotham AD, Pinder SE, Fentiman I, *et al*. Family history of breast cancer and its association with disease severity and mortality. Cancer Medicine. 2016; 5: 942–949.

[16] Byrne C, Ursin G, Martin CF, Peck JD, Cole EB, Zeng D, *et al*. Mammographic density change with estrogen and progestin therapy and breast cancer risk. JNCI: Journal of the National Cancer Institute. 2017; 109: djx001.

[17] Arthur R, Wang Y, Ye K, Glass AG, Ginsberg M, Loudig O, *et al*. Association between lifestyle, menstrual/reproductive history, and histological factors and risk of breast cancer in women biopsied for benign breast disease. Breast Cancer Research and Treatment. 2017; 165: 623–631.

[18] Miller ER, Wilson C, Chapman J, Flight I, Nguyen AM, Fletcher C, *et al*. Connecting the dots between breast cancer, obesity and alcohol consumption in middle-aged women: ecological and case control studies. BMC Public Health. 2018; 18: 460.

[19] Tong JH, Li Z, Shi J, Li HM, Wang Y, Fu LY, *et al*. Passive smoking exposure from partners as a risk factor for ER+/PR+ double positive breast cancer in never-smoking Chinese urban women: a hospital-based matched case control study. PLOS ONE. 2014; 9: e97498.

[20] Jordan I, Hebestreit A, Swai B, Krawinkel MB. Dietary patterns and breast cancer risk among women in northern Tanzania: a case-control study. European Journal of Nutrition. 2013; 52: 905–915.

[21] Park S, Lee DH, Jeon JY, Ryu J, Kim S, Kim JY, *et al*. Serum 25-hydroxyvitamin D deficiency and increased risk of breast cancer among Korean women: a case-control study. Breast Cancer Research and Treatment. 2015; 152: 147–154.

[22] Henderson TO, Moskowitz CS, Chou JF, Bradbury AR, Neglia JP, Dang CT, *et al*. Breast cancer risk in childhood cancer survivors without a history of chest radiotherapy: a report from the childhood cancer survivor study. Journal of Clinical Oncology. 2016; 34: 910–918.

[23] Saudi Cancer Registry. Cancer incidence report Saudi Arabia. Available at: https://shc.gov.sa/Arabic/NCC/Activities/AnnualReports/2014.pdf (Accessed: 08 January 2024).

[24] Mavaddat N, Pharoah PD, Michailidou K, Tyrer J, Brook MN, Bolla MK, *et al*. Prediction of breast cancer risk based on profiling with common genetic variants. JNCI: Journal of the National Cancer Institute. 2015; 107: djv036.

[25] Morris E, Feig SA, Drexler M, Lehman C. Implications of overdiagnosis: impact on screening mammography practices. Population Health Management. 2015; 18: S3–S11.

[26] Cakir M, Kucukkartallar T, Tekin A, Selimoglu N, Poyraz N, Belviranli MM, *et al*. Comparison of mammography sensitivity after reduction mammoplasty targeting the glandular and fat tissue. Turkish Journal of Surgery. 2015; 31: 68–71.

[27] Pal UM, Saxena M, Anil Vishnu GK, Parsana D, Sarvani BSR, Varma M, *et al.* Optical spectroscopy-based imaging techniques for the diagnosis of breast cancer: a novel approach. Applied Spectroscopy Reviews. 2020; 55: 778–804.

[28] Mehnati P, Tirtash MJ. Comparative efficacy of four imaging instruments for breast cancer screening. Asian Pacific Journal of Cancer Prevention. 2015; 16: 6177–6186.

[29] Tan XJ, Cheor WL, Lim LL, Ab Rahman KS, Bakrin IH. Artificial intelligence (AI) in breast imaging: a scientometric umbrella review. Diagnostics. 2022; 12: 3111.

[30] Abulkhair OA, Al Tahan FM, Young SE, Musaad SM, Jazieh AM. The

first national public breast cancer screening program in Saudi Arabia. Annals of Saudi Medicine. 2010; 30: 350–357.

[31] Al Mulhim FA, Syed A, Bagatadah WA, Al Muhanna AF. Breast cancer screening programme: experience from Eastern province, Saudi Arabia. Eastern Mediterranean Health Journal. 2015; 21: 111–119.

[32] Akhtar SS, Nadrah HM, Al Habdan MA, El Gabbani SA, El Farouk GM, Abdelgadir MH, *et al*. First organized screening mammography programme in Saudi Arabia: preliminary analysis of pilot round. Eastern Mediterranean Health Journal. 2010; 16: 1025–1031.

[33] Gosadi IM. National screening programs in Saudi Arabia: overview, outcomes, and effectiveness. Journal of Infection and Public Health. 2019; 12: 608–614.

[34] Cheema S, Maisonneuve P, Lowenfels AB, Abraham A, Doraiswamy S, Mamtani R. Influence of age on 2040 cancer burden in the older population of the gulf cooperation council (GCC) countries: public health implications. Cancer Control. 2021; 28: 10732748211027158.

[35] El Bcheraoui C, Basulaiman M, Wilson S, Daoud F, Tuffaha M, AlMazroa MA, *et al*. Breast cancer screening in Saudi Arabia: free but almost no takers. PLOS ONE. 2015; 10: e0119051.

[36] Topal F, Van Roosbroeck S, Van Hal G, Jacquemyn Y. Factors contributing to the low participation rate of Turkish women to a breast cancer screening program in Antwerp, Belgium. European Journal of Gynaecological Oncology. 2015; 392: 520–523.

[37] Basudan AM. Breast cancer incidence patterns in the Saudi female population: a 17-year retrospective analysis. Medicina. 2022; 58: 1617.

[38] Alqahtani WS, Almufareh NA, Domiaty DM, Albasher G, Alduwish MA, Alkhalaf H, *et al*. Epidemiology of cancer in Saudi Arabia thru 2010–2019: a systematic review with constrained meta-analysis. AIMS Public Health. 2020; 7: 679–696.

[39] Hoxha I, Sadiku F, Hoxha L, Nasim M, Christine Buteau MA, Grezda K, *et al*. Breast cancer and lifestyle factors. Hematology/Oncology Clinics of North America. 2024; 38: 137–170.

[40] Migliavacca Zucchetti B, Peccatori FA, Codacci-Pisanelli G. Pregnancy and lactation: risk or protective factors for breast cancer? Advances in Experimental Medicine and Biology. 2020; 43: 195–197.

[41] Sjöholm K, Carlsson LMS, Svensson P, Andersson-Assarsson JC, Kristensson F, Jacobson P, *et al*. Association of bariatric surgery with cancer incidence in patients with obesity and diabetes: long-term results from the Swedish obese subjects study. Diabetes Care. 2022; 45: 444–450.

[42] Kharazmi E, Sundquist K, Sundquist J, Fallah M, Bermejo JL. Risk of gynecological cancers in cholecystectomized women: a large nationwide cohort study. Cancers. 2022; 14: 1484.

[43] Kacimi SEO, Elgenidy A, Cheema HA, Ould Setti M, Khosla AA, Benmelouka AY, *et al*. Prior tonsillectomy and the risk of breast cancer in females: a systematic review and meta-analysis. Frontiers in Oncology. 2022; 12: 925596.

[44] Alsolami FJ, Azzeh FS, Ghafouri KJ, Ghaith MM, Almaimani RA, Almasmoum HA, *et al*. Determinants of breast cancer in Saudi women from Makkah region: a case-control study (breast cancer risk factors among Saudi women). BMC Public Health. 2019; 19: 1554.

[45] Babiker S, Nasir O, Alotaibi SH, Marzogi A, Bogari M, Alghamdi T. Prospective breast cancer risk factors prediction in Saudi women. Saudi Journal of Biologica. 2020; 27: 1624–467.

[46] Goldberg M, D'Aloisio AA, O'Brien KM, Zhao S, Sandler DP. Pubertal timing and breast cancer risk in the Sister Study cohort. 2020; 22: 112.

[47] Rahman S, Zayed H. Breast cancer in the GCC countries: a focus on BRCA1/2 and non-BRCA1/2 genes. Gene. 2018; 668: 73–76.

[48] Abulkhair O, Saadeddin A, Makram O, Gasmelseed A, Pasha T, Shehata H, *et al*. Vitamin D levels and breast cancer characteristics: findings in patients from Saudi Arabia. The Journal of Steroid Biochemistry and Molecular Biology. 2016; 164: 106–109.

[49] Voutsadakis IA. Vitamin D baseline levels at diagnosis of breast cancer: a systematic review and meta-analysis. Hematology/Oncology and Stem Cell Therapy. 2021; 14: 16–26.

[50] Ifediora CO. Re-thinking breast and cervical cancer preventive campaigns in developing countries: the case for interventions at high schools. BMC Public Health. 2019; 19: 503.

[51] Luna-Abanto J, Gamarra L, Armestar DD, Condori BH, Tisoc GBM, Trujillo GF, *et al*. Impact of cancer awareness campaigns in Peru: a 5-year Google trends analysis. Ecancermedicalscience. 2022; 16: 1477.

[52] Aloufi AS, AlNaeem AN, Almousa AS, Hashem AM, Malik MA, Altahan FM, *et al*. Mammographic breast density and breast cancer risk in the Saudi population: a case-control study using visual and automated methods. The British Journal of Radiology. 2022; 95: 20211197.

[53] Hong Q, Guo Q, Wang W, Zhang Y, Wang Q, Lai Z. Study on female breast cancer imaging screening consultation network in Guangdong Province, China. European Journal of Gynaecological Oncology. 2016; 37: 189–193.

[54] Robbel C, Vesel L, Ernst E, He Y, Vesel T. Community member and health care provider perspectives on communication with Chinese American patients with cancer: a qualitative study. JCO Oncology Practice. 2022; 18: e1927–e1934.

How to cite this article: Hayfa A. AlHefdhi, Asma Saad Habbash, Safar Abadi Al-Saleem, Fatima Riaz, Syed Esam Mahmood, Amal A. AlHefdhi, *et al*. Breast cancer screening outcomes and risk assessment among women of Abha city, Saudi Arabia. European Journal of Gynaecological Oncology. 2024; 45(3): 102-113. doi: 10.22514/ejgo.2024.001.