

# **RESEARCH ARTICLE**

#### USING GAIL MODEL FOR BREAST CANCER RISK ASSESSMENT OF SAUDI FEMALES LIVING AT NATIONAL GUARD RESIDENTIAL CITY, JEDDAH, SAUDI ARABIA

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#### ..... Manuscript Info

# Abstract

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..... Background: The primary reason for cancer death in women worldwide is breast cancer. It is also the most prevalent cancer in Saudi Arabia. The risk factors for breast cancer development have been divided into modifiable, which can be prevented, and non modifiable risks. Factors such as menarche at early age and family history of breast cancer are nonmodifiable risks, while lifestyle-related behaviors such as dietary habits, physical activity, smoking, or secondhand smoke are modifiable. Risk assessment tools for breast cancer are used to give patients a degree of their level of risk to better-recommended screening tests. It is also informative for the women about the behaviors they should modify to lower the risk. The Gail Model is the best online available tool to estimate the breast cancer risk for early prevention. Methodology: A cross-sectional survey of 144 Saudi females is conducted. Females aged 35 - 70-year-old, who lives at the National Guard residential city in Jeddah were included. Through home visits, females were interviewed, and an individualized risk assessment was made. Body Breast cancer determinants were collected, and the Mass Index was calculated for each participant. According to the result, specific health education regarding breast cancer prevention and screening was provided for all females who participated in the study. **Results:** This study revealed that Saudi females have many protective factors against breast cancer, such as multiparity (60%), late age menarche (71%), and breastfeeding (47%). Age and family history (11%) are significant nonmodifiable determinants of breast cancer in our population. On the other hand, other factors related to a sedentary lifestyle such as Obesity (21%) and secondhand smoke (43%) can be modified.

Conclusion: Primary prevention of modifiable risk factors is essential for reducing the breast cancer burden. Raising awareness regarding early detection and screening is necessary.

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## Introduction:-

Breast cancer is the greatest cause of cancer mortality in women worldwide and the leading cause of death for women aged 20-59 years in the UnitedStates(1). It is the most prevalent malignancy in Saudi Arabia and the second cause of cancer deaths after lung cancer. Saudi Cancer Registry has confirmed that female breast cancer was the most prevalent Saudi cancer in 14 years (1994 - 2008) compared to other developed countries(2). It has distinctive

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features in Saudi females than those in western countries 1998, the median age for an example, in Stage III breast cases was  $46 \pm 11$ , which is distinct from the 60-65 years median age in Western countries 1999(3).

The risk factors for breast cancer development have been divided into modifiable, which can be prevented, and nonmodifiable risks. Factors such as age at menarche and family history of breast cancer are non-modifiable risk factors that significantly contribute to lifetime risk.Modifiable risk factors, such as drinkingalcohol and obesity, involve lifestyle choices that an individual could alter to reduce her risk of breast cancer(4).

In a comparative study published at Lancet, seven million deaths from cancer occurred worldwide in 2001, Around 2.43 million (35%) of them were associated with nine potentially modifiable risk factors. Smoking, alcohol drinking, and low fruit and vegetable diet were the leading risk factors for death from cancer globally. Overweight and obesity, in particular, were the most common causes of disease in high-income countries(5). Advanced invasive disease is widespread in Arab countries, and total mastectomy is the most commonly performed surgery(6).

The relation between modifiable risk factors, excluding reproductive factors, and breast cancer burden has been measured(5). The study shows that 21% of all breast cancer deaths worldwide are attributable to alcohol use, physical inactivity, overweight, and obesity. This proportion was high in high-income countries (27%), and the most critical risk factor was overweight and obesity. In low- and middle-income countries, the proportion of breast cancers related to these risk factors was 18%, and physical inactivity was the most important one (10%)(5)

An article published in 2011 by The Institute of Medicine reviewed current evidence on the relation between breast cancer and the environment. Indicating that females can reduce their risk of breast cancer by maintaining a healthy weight, reducing alcohol intake, avoiding smoking, and postmenopausal hormone therapy(7).

A cohort study with a follow period of 5 years aimed to measure the association of breast cancer incidence with physical activity measures(8). It showed that women who had engaged in strenuous physical activity more or equal to 3 times a week had lessrisk of breast cancer than women who had not. Females who started physical activity at a late age (above 20-year-old) had much higher breast cancer risk than those who were active between ages 14 and 20. Although lifetime total physical activity is associated with decreased breast cancer risk, the physical activity at ages 14-20 years is the most beneficial(8).

Regardless, that does not mean all women should engage in strenuous activity. A higher amount of physical activity was associated with a lower risk of breast cancer Than no current physical activity. A study conducted among postmenopausal American women showed that high physical activity was associated with a lower risk. Every day of moderate or strenuous activity for an hour provided the most benefit(9).

A systemic review aimed to measure the association between dietary patterns and breast cancer risk shows that diet, including vegetables and limit saturated fat and red and processed meats, may lower breast cancerrisk(10).

A two-stage dose-response meta-analysis(11) shows that higher smoking intensity, the more cumulative amount of cigarette consumption, and longer time for smoking are associated with an elevated risk of mortality from BC. The same is for passive smoking; the Breast cancer-specific mortality was increased two-fold for recent passive smoke exposure compared to never smokers (HR = 2.12, 95% CI = 1.24-3.63). Smoking is a modifiable risk factor, so effective smoking cessation programs should be routinely recommended for breast cancer cases(12).

Risk assessment tools for breast cancer are used to give patients a degree of their level of risk to betterrecommended screening tests. It is also informative for the women about the behaviors they should modify to lower the risk. The Gail Model is the tool that is widely used in low and high-income countries and is assumed to be the best available online instrument to estimate breast cancer risk for early prevention(13). Assessment of the risk in our population is mandatory to identify the modifiable risks that can be prevented(14).

This study aimed to assess breast cancer determinants in the females living at the National Guard residential cityand provide individualized education regarding the control of breast cancer modifiable risk factors and the importance of early detection and screening.

# **Study Objectives:-**

- 1. To assess breast cancer determinants in the females living at the National Guard residential city, Jeddah, Saudi Arabia, 2019-2020.
- 2. To determine the level of breast cancer screening awareness among the National Guard females
- 3. To educate the females about the risks' reduction and early detection

# Methodology:-

Study setting: The study was conducted at the National Guard Residential city in Jeddah.

#### Study design and Subjects:

A cross-sectional study was conducted among 144 Saudi females (35 – 70-year-old) living at the National Guard residential city, Jeddah, Saudi Arabia.

#### Inclusion criteria:

Saudi female (aged 35 – 70-year-old), living at the National Guard residential city in Jeddah, Saudi Arabia.

#### **Exclusion criteria:**

Females not from the same age group or not living at the National Guard residential city in Jeddah.

#### Sampling:

For a cross-sectional survey at the National Guard residential city in Jeddah., all the females, aged 35 - 70-year-old, who are living there were targeted.

#### Data collection method and tools:

Data were collected during home visits. All the females above 35 years old were interviewed by a study volunteer who filled the questionnaire. The questionnaire includes demographic data, like age, history of breast-feeding, and history of mammography. Bodyweight and height will be measured, and the Body Mass Index (BMI) calculated according to World Health Organization guidelines as underweight (< 18.5), average weight (18.5 - 24.9), overweight (BMI 25 - 29.9), or obese ( $\geq$  30)(13,14). History of physical activity intensity and frequency will be obtained, and detailed information about the diet will be assessed. For breast cancer risk measurement, the Gail Model Risk Assessment Tool will be used through the National Cancer Institute's (NCI) online available survey(15). This tool is suitable for assessing the risk of females above 35 years old. It provides individualized five years and lifetime risk scores for each participant. The Gail model includes age, race, age at menarche (first menstrual period), age at first live birth, history of first-degree relatives' breast cancer, history of breast biopsy, and presence of atypical hyperplasia on a biopsy, if any.

For environmental factors such as eating habits, physical activity, and active and passive smoking history, the investigator constructed a questionnaire. According to the recent literature on the research subject, the questionnaire's content is constructed and validated by preventive medicine experts. The questionnaire's face validity was tested on a pilot group of 38 women of the same inclusion criteria—the pilot group excluded from the study.

#### Data management and analysis plan:

Data were coded and analyzed through the Statistical Package for Social Sciences (SPSS) v.18. Demographic and clinical data analyzed using descriptive statistics, including means, standard deviations, and frequencies. This study used an alpha level of 0.05 for statistical significance.

#### **Ethical consideration:**

The study was approved by the King Abdullah Medical Research Center of the National Guard Health Affairs (KMARC-NGHA). The collected data is confidential and will not be disclosed except for the study purpose. Written and verbal consents were taken from the participants. Privacy and confidentiality of the patient are completely protected. Research data, both soft and hard copies maintained in a secure unit within NGHA premises and are only accessible by the Research team.

# **Results:-**

# **Demographic characteristics:**

A total of 144 women participated in breast cancer risk assessment. The mean age was around 40 years, with a range between 21-70-year-old.

Age		
N	Valid	144
	Missing	0
Mean		37.39
Minimum		21
Maximum		70

The majority are married (74%) having a high education level (54%) but not working (54%), and a high family income, more than 10000 SR, about 25% are employed.



# History of previous Brest Cancer and other types of cancer

Three women had a previous or current history of breast cancer. The national cancer institute (NIH) risk assessment tool did not run analysis among those who had a previous breast cancer history, so these participants were excluded from the analysis.

All the participants (144 women) showed no previous history of ovarian cancer, whilenine women had a history of benign breast illness (6.25%).

		Frequency	Percent
History of breast	No	140	97.22
cancer	Yes	3	2.08
	Not sure	1	0.69
History of benign	No	134	93.05
breast disease	Yes	9	6.25
	Not sure	1	0.69

## **Family history**

The proportion of participants who responded "yes" to first and second-degree family history was for breast cancer (11%), ovarian (8%), and other types of cancer (35%). The majority was not sure about the triple-negative history and abnormal family genes in the family.

Family History		Frequency	Percent
Breast cancer	no	128	88.88
	yes	16	11.11
Ovarian cancer	no	132	91.66
	yes	12	8.33
Triple-negative	Not sure	140	97.22
breast	yes	3	2.08
cancer	no	1	0.69
Other type of	no	91	63.19
Cancer in the	yes	51	35.41
family	not sure	2	1.38
History of	Not sure	137	95.13
abnormal family	yes	3	2.08
genes	no	4	2.77

#### **Obstetric history:**

Having a birth before the age of 35 is a protective factor. Most of the participants married at a young age and had a first child's delivery before the age of 35. The number of children is another protective factor. About 60% of the participates having more than three children, while 13% have 1 or 2 kids.

Breastfeeding for more than one year reduces the risk of breast cancer dramatically. More than 47% of women breastfeed for at least one year.

		Frequency	Percent
First child before	Yes	92	63.88
the age of 35	No	52	36.11
Number of the children	3 or more	85	59.02
	1 or 2	20	13.88
	None	39	27.08
Breast feeding for at least a year	Yes	68	47.2
	No	74	51.38
	Not sure	2	1.38

# **Gynecological history:**

Our population is young, so the majority of them are not at the menopause age yet. However, for menarche before 12, about 71% of the participants started menstruating after 12, which is a positive finding. Exogenous hormonal therapy is unremarkable among our population.



## History of Screening for breast cancer:

The majority of the participants did not make screening for breast cancer (82%). Around 18% of women undergo the screening for once, and only one woman screened regularly multiple times. The screening reasons were different, either due to feeling a mass, attending a campaign, or responding to a specialist's advice.

		Frequency	Percent
	Yes	26	18.06
	No	118	81.94
Total		144	100.0

## **Body Mass Index**

The body mass index of the participants is ranging from 18 (underweight) to 44 (severe obesity) with a mean of 28 (overweight). For waist circumference, the range was huge with a mean of 90 cm, which considered as high waist circumference if compared with the standard value (below 88cm)



# **Nutritional History:**

Participants were asked about their dietary habits. Around 50% of the women are consuming whole grains on daily basis. The majority (69%) are eating food in tomato sauce daily which is healthy habit although the same percentage have high fat diet regularly.



# **Exercise history:**

Most participants (58%) reported that they exercise regularly by walking for at least half an hour daily for at least four days a week. 27% of them are doing the house chores for a continuous 3 hours and 50% for 1-2 hours.

		Frequency	Percent
Exercise	Yes	83	57.64
(walking)	No	37	25.69
	Not sure	24	16.66
Doing the house	3 hours or more	39	27.08
chores	1-2 hours	72	50.0
	Don't do house chores	30	20.83

## **Smoking History:**

Smoking causes several diseases and is associated with a higher risk of breast cancer in younger, premenopausal women. Studies have also revealed that there may be links between lifetime exposure to secondhand smoke exposure and breast cancer risk in postmenopausal women. Our female population is mainly non-smoker (93%). Only two women are current smokers, and seven others quitted for at least one year. Secondhand smoke (passive smoking) is a problem in our population. Approximately 43% are exposed to secondhand smoke.

## **Risk Score:**

The risk of breast cancer was measured at the participants above the age of 30 and not diagnosed previously with breast cancer. It was measured by the National Cancer Institute breast cancer assessment tool. It depends on the patient's age, race, gynecological history, and family history of breast cancer only. It provides a 5-year risk score and a lifetime score.

	Ν	Minimum	Maximum	Mean
5 years average score	141	0.3	2.2	0.732
lifetime average score	141	6.3	12.6	11.739

# **Discussion:-**

In a Saudi study, estimating breast cancer risks, family history of breast cancer contributed to a higher risk of cancer incidence. Thirty-six cases with family history out of 20, whereas females with no family history showed 48 cases out of 111 with a highly significant difference (P-value <0.05)(16). About 11% of our females have a positive first or

second-degree family history. a case-control study, in Saudi Arabia, for assessing breast cancer determinants revealed that 17% of cases had first-degree family history if compared to the control group (6%)

The risk of breast cancer incidence in females who had their first child after 30 years is about twice that of women who had their first child before the age of 20 years(17). This protective factor is noticeable in our community . Approximately all married women in our sample had their first child before the age of 35.

According to a 2002 collaborative study published in Lancet(18), a female's risk for breast cancer reduced by about 4.3% for every 12 months she breastfed, and the risk went down 7% more for every child born. Our results showed that 60% of the participates having more than three children , and More than 47% of women breastfed for at least one year.

Exposure to estrogen for a prolonged period in life increases the risk of breast cancer. So, having menarche before the age of 12 and menopause after age 55 are risky. Women with below 13 years of onset age of menarche are at an 85% higher risk of breast cancer(19). Most of our females (71%) started menstruating after 12 and did not reach menopause yet. Using oral contraceptives is always contradictory in literature, which is unremarkable in our sample.

Smoking causes several diseases and is associated with a higher risk of breast cancer in women(20). for fortunate, our female population is mainly non-smoker (93%). Only two women are current smokers, and seven others quitted for at least one year.

Researchers also suggest a link between lifetime exposure to secondhand smoke and breast cancer risk in women. Secondhand smoke (passive smoking or environmental smoking) in some studies, is associated with a higher risk of multiple types of Breast cancer(20). It seems a significant problem in our population. Our results showed that approximately 43% are exposed to spouse smoking daily. A similar result is shown in a study in Saudi Arabia, estimating secondhand smoke's effect on birth weight, where more than 50% of pregnant females are exposed to secondhand smoke for at least 4 hours daily(21).

There is a startling epidemic of obesity among Arab females, especially the Gulf Cooperation Council (GCC) countries. Excess body weight could attribute to the rise in breast cancer incidence among women. Their dietary habits, which correlates with obesity, can be an important factor in cancer's etiology. Although very few studies were found to establish a direct causal relationship between obesity and breast cancer, circumstantial evidence points to the possible role of the epidemic, obesity, and the alarming rise in breast cancer. More systematic studies are urgently needed to confirm these associations and to elucidate potential mechanisms(22).

About 40% of our females are overweight and are 21% are obese, while the mean waist circumference 90 cm (above the standard 88 cm). Some healthy dietary habits are noticed, such as consuming whole grains daily (50%). The majority (69%) eat food in tomato sauce daily, which is a healthy dietary habit following the healthy Mediterranean diet. A cohort showed that adherence to a Mediterranean diet, excluding alcohol, was related to a moderately lowered risk of breast cancer in older women(23)(24).

Although other unhealthy behaviors like eating sweets and pastries at least three times a week (66%). A study among Brazilian females showed that Obese and overweight females were respectively 4.489 and 1.340 times more likely to have triple-negative breast cancer(25). Triple-negative is the second common subtype of breast cancer in the Saudi population, according to a 20-year retrospective study(3).

Exercise or physical activity is essential to overcome the high obesity prevalence(26). Exercise means scheduled training to achieve a specific purpose. Physical activity is the body movement that requires some energy and can include routine daily activities as working at home(27). A lack of physical activity is a part of living a sedentary lifestyle. A case-control study showed that most breast cancer cases and controls were not in regular exercise routines. Regular exercise is a significant factor that is positively associated with decreasing breast cancer incidence in several different studies(27)(28). About 58% of our participants reported that they exercise regularly by walking for at least half an hour daily for at least four days a week. 27% of them are doing the house chores for a continuous 3 hours and 50% for 1-2 hours.

The Gail model was generated to render individualized breast cancer risk prediction for American women, and it was the primary tool for high-risk counseling women and identifying women eligible for breast cancer prevention. The Gail model's application was worked on women with different ethnic groups, including African American women, and reached different outcomes. Establishing risk assessment models can be more critical in countries where breast cancer incidence is rising to implement high-risk group screening and early detection programs(29). In this study, we used the Gail model as a standardized tool for assessing the risk factors related to breast cancer in our community. Although it does not include lifestyle-related factors such as diet and exercise, we consider it according to literature.

According to the Canadian task force of preventive health care, a score below 1.66 for a 5-year risk score is considered low or average risk(30). The mean 5-year risk score of our females is 0.73. A similar result was shown in another Saudi study(13). Any woman who had a score above 1.66 had an individualized education regarding her specific risk factors. For lifetime risk, 11.8 was the average.

For breast cancer screening, about 82% never underwent a mammogram. Only 18% of women experience screening for once. Similar results reported, of a Saudi study, a low prevalence of breast cancer screening behaviors, only 12% of the females screened previously for breast cancer, and 43% reported performing breast self-exam(31). In another Saudi survey on 10735 women(32), 92% reported never having a mammogram. Those who had the screening had different reasons. Having a family history was the primary motivator in our population. Educational campaigns (27.8%) and media (27.8%) are the primary sources of Saudi females' information(31). We strongly recommend that efforts must be carried out to raisethe awareness of women.

This first study advantage is using a standardized tool, which is the Gail model for risk assessment. It allows comparison with other local and international studies. Second, estimating various environmental and behavioral factors besides the other Gail model factors related to breast cancer incidence.

Our study has some limitations. First, the cross-sectional design lowers the ability to make causal inferences. Second, the sample was from females living at the National Guard King Faisal Residential city in Jeddah city, which decreases the generalizability of the findings to other regions in the country.

# **Conclusion:-**

Although cancer treatment advances have reduced cancer mortality, primary prevention through lifestyle and environmental interventions remains the top way to reduce the cancer burden. The reduction of exposure to critical behavioral and environmental risk factors would prevent a substantial proportion of cancer deaths. This study highlights the use of the Gail model for individualized risk assessment. It will help as an initial step before providing education regarding the control of breast cancer-related risks and breast cancer screening tools.

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