RESEARCH ARTICLE

Breast Cancer Risk Assessment Using the Gail Model and It's Predictors in Saudi Women

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Abstract

Background: The Gail Model has been widely implemented in developed and developing countries and is considered to be the best available instrument to estimate breast cancer (BC) risk for early prevention. **Objective:** The goals of the study were to determine five-year and lifetime BC risks and to assess BC predictors among female Saudi teachers using the Gail model. **Methods:** A cross sectional study with convenience sampling was conducted among 180 female Saudi secondary school teachers. The Gail model was used to evaluate the five-year and lifetime risks of developing BC. Included were a one-day 24-hour recall to assess daily serving sizes and food groups for food intake and questions regarding daily exercise, BMI, and demographic data. **Result:** The mean age of the teachers was 41±7.2 years, with a 0.87±0.93 mean for the five-year risk and a 9.6±5.4 mean lifetime risk of developing BC. According to the general linear model, the BC risk predictors were age, age at menarche, age at first pregnancy, family history, BMI, fruit and vegetable intake, and meat intake. **Conclusion:** The present study provided new information regarding the potential factors for five-year and lifetime invasive BC risk among Saudi women. Moreover, we could confirm that the Gail model is an appropriate BC risk assessment tool for Saudi women for early prevention, particularly among women at high risk of BC.

Keywords: Breast cancer- Gail model- five-year risk- lifetime risk- diet- lifestyle

Introduction

In Saudi Arabia, recent data have indicated that breast cancer (BC) is a significant disease in this community and elsewhere in the world. The eastern region of Saudi Arabia reported the highest overall age-standardized incidence rate of female BC, at 26.6 per 100,000 women (Alghamdi et al., 2013). BC is multi-factorial disease (Keihanian et al., 2010) that can be classified into two main groups. The first group is a result of non-modifiable risk factors such as age, family history, hormonal exposure, early age at menarche, late age at menopause, high breast density, and null-parity. The second group includes modifiable risk factors such as late age at first birth, little or no breastfeeding, fewer children, long-term use of hormone replacement therapy, diet, and lifestyle. Having one or several risk factors can contribute to BC development.

Although there is no definite way to prevent BC, we can monitor risk development by predicting risk occurrence to increase the odds of early detection and thus survival. During the past three decades, several statistical models were developed to assess BC risk among individuals and populations. The most widely applicable model for general risk assessment is the Gail model (Costantino et al., 1999), which assesses a variety of potential risk factors for five-year and lifetime invasive BC risk. This model has been validated in different countries with different ethnicities worldwide (Ewaid and Al-Azzawi, 2017; Ulusoy et al., 2010).

Several studies have indicated that teachers have high rates of several cancers, particularly BC, most likely because of an unhealthy diet, life style and other non-modifiable risk factors (Teitelbaum et al., 2003). Teachers in Saudi Arabia represent one of the largest occupational groups of employed women. In addition to being mothers and wives, these women play a major role in the development of the country and must take protective action against the development of chronic diseases and some forms of cancer, including BC. To the best of our knowledge, no previous studies have used the Gail model to investigate BC risk among female Saudi teachers. We sought to determine the five-years and lifetime BC risks and assess BC predictors among female Saudi teachers.

Materials and Methods

Study Design and subjects

A cross sectional study with convenience sampling was conducted among 180 female Saudi secondary school teachers (healthy, with no focal changes in breast, no diagnosis of BC, ≥ 35 years old) in Al Hassa city in Saudi Arabia. The teachers voluntarily participated in the

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study. Teachers were informed of the study's purpose and protocol and agreed to participate. The questionnaire was completed anonymously and returned to the researcher within three days. A pilot study of 15 teachers not included in the study established the feasibility and validity of the questionnaire before the onset of data collection. Ethical approval was obtained from the College of Agriculture and Food Science to conduct the study.

Instrument

A pretested self-administered questionnaire was distributed to all participants and included items related to demographic data as age, history of breast-feeding and doing regular mammogram. Body weight and height were reported by teachers and transformed by the researcher into the Body Mass Index (BMI) and then classified according to World Health Organization guidelines as underweight (< 18.5), normal weight (18.5 - 24.9), overweight (BMI 25 - 29.9), or obese (≥ 30) (WHO, 1998) . Amount of exercise was assessed by asking the teachers to recall the number of days per week spent exercising; then we categorized the number of days as more than three days/week or equal to or less than three days/week (Eadie et al., 2013). A one-day 24-hour dietary recall method was used to assess the daily serving sizes and intake of the food groups. Participants reported intake from midnight to midnight, for meals and between meals. Dishes containing combinations of food groups were calculated according to their ingredients. The researcher used household measurements (teaspoon, tablespoon, glass, soup cup and plate) to help teachers estimate portion sizes, which we then converted to metric measurements (g).

To assess BC risk, we used the National Cancer Institute's (NCI) on-line Breast Cancer Risk Assessment Tool (BCRA) or the Gail Model Risk Assessment Tool (available at http://www.cancer.gov/bcrisktool/Default.aspx). This model predicts five-year and lifetime (up to age 90) BC risk for women ≥35 years (Costantino et al., 1999). This model includes six BC risk factors: age; age at first menstrual period (7-11, 12-13, >14 years); age at first live birth (unknown, no children, < 20, 20-24, 25-29, >30 years); number of first-degree relatives with breast cancer

(0 relatives, one relative, more than one); history of breast biopsy (unknown, yes, no), number of previous biopsies (one, more than one), and presence of atypical hyperplasia on a biopsy (unknown, yes, no); and race/ethnicity. All of the teachers were entered into the system as unknown. All six of the factors were entered into the system to calculate the total BC risk score for each subject. The five-year risk was classified as low risk (<1.7%) or high risk (>1.7%) (Bevers et al., 2009); the lifetime risk (up to age 90) was classified as low risk (15%), moderate (15%-30%), and high (>30%) (Ulusoy et al., 2010).

Analysis

The data were analyzed using Statistical Package for Social Science program for statistical analysis version 21(SPSS Inc, Chicago. IL,USA, VER21). Descriptive statistics were used as the mean, SD, frequency and percentages. Analytical statistics such as Pearson correlation analysis and general linear model assessed the predictors of BC risk. P-value was considered statistically significant at less than 0.05.

Results

A total of 180 female secondary school teachers responded to the survey with a mean age of 41±7.2 years. The majority of the teachers were married (65%); the mean age of their first menstrual period and first pregnancy were 12.6±1.7 and 22.3±5.2, respectively. Twenty-nine teachers (16.1%) had a history of BC among their first-degree relatives (mother or sisters), and three (1.6%) teachers had additional relatives with a history of BC. The majority of the teachers (93.3%) were not doing regular mammogram and 71.2% practice breast-feeding. Based on the Gail model, the teachers in the present study had a mean five-year risk of 0.87± 0.93 and a mean lifetime risk of 9.6 ±5.4. Twelve (6.7%) had a higher five-year risk, 6.7% had moderate lifetime risk and five (2.8%) had a higher lifetime risk.

The mean BMI of teachers was 29.4±6.3, and only 25% had a normal body weight; 75% of the teachers were overweight or obese. The mean serving size for the fruit and vegetable group was inadequate (3.98±0.74);

Table 1. Anthropometric Measurements, Dietary Intake, Daily Exercise (n=180)

Variables	n (%)
Body mass index (kg/m²)	29.4±6.3
Normal	45 (25%)
Overweight	72 (40%)
Obese	63 (35%)
Exercise /week	
≤3days/week	151 (83.8%)
>3days/week	29 (16.2%)
Mean serving by food groups	
Cereal	6.2±0.78
Fruit and vegetable	2.1±0.7
Milk	1.5±0.4
Meats, fish, poultry, and legumes	3.7±0.5

Table 2. Predictors of Five-Years and Lifetime BC Risks

Variables	B (CI 95%)	P
Five years risk of developing BC		
Age	0.06 (0.04 to 0.08)	0.002
Age at menarche	-0.04 (-0.05 to -0.02)	0.001
BMI	1.32 (1.15 to 2.01)	0.027
Fruit and vegetable intake	1.5 (1 to 2.4)	0.041
Lifetime risk of developing BC		
Age	0.03 (0.02 to 0.05)	0.014
Age at menarche	-031 (-042 to -015)	0.003
Age at first pregnancy	0.22 (0.15 to 0.33)	0.021
Family history	-4.35 (-5.72 to -381)	0.034
BMI	1.66 (1.03 to 2.72)	0.011
Meat intake	0.22 (0.12 to 0.51)	0.001

Table 3. Comparisons the BC-Risk Values to Other Cross-Sectional Studies

Study	Country	Sample Size	Age	Five-years risk	Lifetime risk
Fikree and Hamadeh, 2013	Bahrain	300	>35	0.7	9.3
Eadie et al, 2013	UK	355	>46	1.5	9
Erbil et al, 2015	Turkey	231	>35	0.88	9.37
Khazaee-Pool et al, 2016	Iran	3847	>35	1.61	11.71
Mirgahfourvand et al, 2016	Iran	560	>35	0.6	8.9
Khaliq et al,2016	USA	250	>50	1.67	-
Ewaid and Al-Azzawi, 2017	Iraq	250	>35	0.95	11.3
Bener et al, 2017	Qatar	1488	>35	1.12	10.57
Present study, 2017	Saudi Arabia	180	>35	0.87	9.6

however, the meat group daily intake was more than is recommended (3.7±0.5). The majority of the teachers (83.8%) spent three or fewer days exercising (Table 1).

The teachers in the present study only demonstrated a relation between the risk of BC over the next five years and age, age at menarche, age at first pregnancy, history of breastfeeding, BMI, exercise, and fruit and vegetable intake (P<0.005). All of these variables were entered into the general linear model; only age, age at menarche, BMI, and fruit and vegetable intake were predictors of BC risk in the next five years (Table 2). We identified a relation between lifetime risk of BC and the variables of age, age at menarche, age at first pregnancy, family history, history of breastfeeding, marital status, fruit and vegetable intake, meat intake, and BMI, (P<0.005). Only age, age at menarche, age at first pregnancy, family history, BMI, and meat intake are predictors of lifetime risk of BC (Table 2).

Discussion

In the past ten years, the incidence of BC has gradually increased among Saudi women because of an unhealthy lifestyle. Early detection has been emphasized by the health services in Saudi Arabia. The Gail model has been widely implemented in developed and developing countries and considered to be the best available instrument to estimate the risk factors for early prevention. The mean estimated five-year risk in this study was 0.87±0.93, which is quite similar to Turkish women at 0.88±0.91 (Erbil et al., 2015) and Bahraini women at 0.7% (Fikree and Hamadeh, 2013) but lower than for Iraqi women at 95±0.84 (Ewaid and Al-Azzawi, 2017) (Table 3). The mean estimated lifetime BC risk of 9.8±5.4 reported in this study is within the range of other cross-sectional studies (Table 3).

It is well established that BC risk increases with age, which was observed in the present study for five-year and lifetime risk. In Saudi Arabia, that risk occurs at an earlier age than in Western countries, at 48 years, and ranges from 43-52 years (Saggu et al., 2015; Al-Rikabi and Husain, 2012). This difference may be a result of changes in dietary behaviors, reduced physical activity, and obesity. Age at menarche was a predictor of five-year and lifetime risk of BC among teachers, consistent with a study conducted among 560 healthy Iranian women with a mean age at first menarche of 13.1±1.3 years (Mirghafourvand et al., 2016). A meta-analysis of 117 epidemiological studies that included approximately 118,964 women with BC concluded that every year earlier at menarche increased BC risk (Collaborative Group on Hormonal Factors in Breast Cancer, 2012). A recent study estimating the age at menarche of 265 Saudi girls observed a declining age at first menarche (13.08 ± 1.1 years) compared with their mothers 13.67±1.4 years. Girls with early menarche are at increased risk of BC because of elevated levels of estrogen at an early age (Al Alwan et al., 2015).

In Saudi Arabia, there is a lack of literature regarding the relation between age at first birth and risk of BC. We observed age at first birth to be a predictor of lifetime risk, consistent with a result reported among 1488 Qatari women aged 35 years and older (Bener et al., 2017). Early age at first pregnancy is a strong preventive factor for BC, particularly before 18 years of age. In the present study, 11% of teachers had children after 30 years of age. A published document by Quandl (2016) indicated that in Saudi Arabia, women frequently marry at age 25, resulting in a relatively delayed age at first birth, which may increase the risk of BC.

In the present study, we have demonstrated that a family history of BC is a predictor of lifetime risk. This result is consistent with studies on 534 Saudi women with a positive family history of BC who were at twice the risk of BC (OR =2.31, P <0.0001) (Elkum et al., 2014) as well as Qatari women (P <0.001) (Bener et al., 2017) and Iranian women (P <0.001) (Mirghafourvand et al., 2016). Obesity was an important risk factor for BC for five-year and lifetime risk in the present study; the majority of the teachers were overweight or obese (40% and 35%, respectively). These findings are consistent with the findings of Elkum et al., (2014), who noted that Saudi women in Riyadh who were overweight/obese were twice as likely to develop breast cancer (OR =2.29, P <0.0001) than women with a normal BMI. Avoiding pre-menopausal overweight and obesity can prevent BC after menopause. Generally, teachers are physically inactive; 83.8% exercised fewer than three days weekly; that inactivity is a major cause of overweight/obesity. Similar results were reported in a review of eight studies in Gulf Cooperation Council countries; the prevalence of women who were physically active for at least 150 min/week ranged from 26.3% to 28.4%, and the majority of women spent their

leisure time in sedentary activities (Mabry et al., 2010). Physical activity provides some protection against BC that may be achieved by the influence of physical activity on energy balance, hormonal levels and/or immune function. According to the American Cancer Society (2014), engaging in at least 150 minutes of moderate intensity activity or 75 minutes of vigorous intensity activity each week may enhance the reduction in the risk of BC and other cancers.

Data from epidemiologic studies indicate that diet and lifestyle are associated with decreased risk of BC, recommending a high intake of vegetables and fruits and reduced meat intake (World Cancer Research Fund, 2007). Teachers in the percent study consumed inadequate daily servings of fruits and vegetables compared with the Ministry of Health recommendations (five servings or more daily) (MOH, 2013), which is a predictor of five-year BC risk. Ahmadnia et al. (2016) studied the role of dietary patterns and the risk of BC among 450 Iranian women with BC and concluded that consumption of less than two servings of fruit/day compared with consumption of more than 4 servings increases the risk of BC (OR=1.5, 95%CI= 1-2.2). Fruits and vegetables are generally rich in fiber, which can reduce circulating estrogen. Some studies demonstrated that a high intake of meat/animal protein increases the risk of BC and recommended limiting daily intake to two or fewer servings (ACS, 2014). Teachers in the percent study consumed nearly four serving daily (3.7±05), which is a predictor of lifetime risk of BC. Increasing consumption of fruits and vegetables and decreasing the consumption of animal protein before puberty may lower peak height growth velocity, which would delay menarche, protecting girls against BC. Girls who increased vegetable intake and decreased animal protein intake at ages three to five years had a low risk of BC (Colditz et al., 2014). In Saudi Arabia, the intake of large amounts of animal protein and high caloric foods is common to all Saudis. The main meal for the majority of Saudis is meat with rice, and fast food consumption has increased in recent years.

The present study had several limitations. First, this was a cross-sectional design, which did not allow us to observe any changes in behavior over time. Second, we used a convenience sample from one city in Saudi Arabia, which is not representative of the entire population. Third, the only lifestyle factors studied were exercise and daily food group intake. More lifestyle factors should be included in future studies, including nutrient analysis, cooking methods, and more details regarding daily life activities. Finally, the study used a self-administered questionnaire that was dependent on the subjects' honesty and ability to recall; therefore, the data may have accrued some errors. The study has many strengths, including the use of a valid prediction model in the Gail model, which was previously validated in Arab women, particularly in the Gulf Cooperation Council countries (Fikree and Hamadeh, 2013; Bener et al., 2017). We studied the effects of factors on the risk of developing BC that were not included in the Gail model, such as dietary intake, BMI, physical activity, and history of breast-feeding. To the best of our knowledge, the current study is the first to examine the potential risk factors for five-year and lifetime BC risk among female Saudi teachers.

In conclusion, the present study provided new information regarding the potential risk factors for five-year and lifetime invasive BC risk among Saudi women. The primary BC risks are age, age at menarche, age at first pregnancy, family history, BMI, fruit and vegetable intake, and meat intake. The BC risk assessment can be helpful in screening and early prevention, particularly among women with high BC risk incidence.

Conflict of interest
The authors declare no potential conflicts of interest.

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