Journal of the Egyptian National Cancer Institute (2015) **27**, 77–82

Cairo University

Journal of the Egyptian National Cancer Institute

www.elsevier.com/locate/jnci
www.sciencedirect.com

Full Length Article

Breast cancer correlates in a cohort of breast screening program participants in Riyadh, KSA

Fahad A. Al-Amri [a], Mohammed Y. Saeedi [a], Fatina M. Al-Tahan [a], Arwa M. Ali [b,e], Shaker A. Alomary [a], Mostafa Arafa [c], Ahmed K. Ibrahim [d,*], Kassim A. Kassim [a]

[a] *Ministry of Health, Deputy Ministry for Public Health, Assistant Deputy for Primary Health Care, Riyadh, Saudi Arabia*
[b] *King Khalid University Hospitals, Medical Oncology Department, King Saud University, Saudi Arabia*
[c] *Community Medicine Department, King Saud University, Saudi Arabia*
[d] *Public Health & Community Medicine School, Faculty of Medicine, Assiut University, Asyut, Egypt*
[e] *Medical Oncology Department, South Egypt Cancer Institute, Assiut University, Asyut, Egypt*

Received 12 February 2015; revised 6 April 2015; accepted 7 April 2015
Available online 29 April 2015

KEYWORDS

Breast cancer;
Case–control studies;
Risk factors;
Screening

Abstract *Background:* Breast cancer is the first cancer among females in the Kingdom of Saudi Arabia, accounting for 27.4% of all newly diagnosed female cancers in 2010. There are several risk factors affecting the incidence of breast cancer where some factors influence the risk more than the others.

Aim: We aimed to identify the different risk factors related to breast cancer among females participating in the breast-screening program in Riyadh, KSA.

Methods: Based on data from phase-I of the breast-screening program, a case–control study was conducted on women living in Riyadh, KSA. A sample of 349 women (58 cases and 290 controls) was recruited to examine the different breast cancer correlates. Multivariate regression model was built to investigate the most important risk factors.

Results: The mean age of cases was 48.5 ± 7.1 years. Age at marriage, number of pregnancy, age at menopause, oral contraceptive pills, breast feeding and family history of breast cancer in first-degree relative were identified as the most important correlates among the studied cohort.

Conclusions: The findings of the current work suggested that age at marriage, age at menopause $\geqslant 50$ years and 1st degree family history of breast cancer were risk factors for breast cancer, while, age at menopause < 50 years, number of pregnancies and practicing breast feeding were protective factors against breast cancer. There was no effect of body mass index or physical inactivity. Further

Abbreviations: BC, breast cancer; ACS, American Cancer Society; ASR, age specific ratio; NCCN, national comprehensive cancer network; HRT, hormone replacement therapy; NCI, National Cancer Institute; BMI, body mass index

* Corresponding authors. Tel.: +20 1221476996; fax: +20 882332278 (A.K. Ibrahim).
E-mail address: ahmed.khair@yahoo.com (A.K. Ibrahim).

Peer review under responsibility of The National Cancer Institute, Cairo University.

http://dx.doi.org/10.1016/j.jnci.2015.04.002

studies are needed to explore the hereditary, familial and genetic background risk factors in Saudi population.

Background

Breast cancer (BC) is considered as the most common female cancer comprising almost one third of all malignancies afflicting females. It is ranked as the second cause of death after lung cancer in women, worldwide [1,2]. The lifetime risk of developing invasive BC was 12.6% in 2013 in the USA [3]. American Cancer Society (ACS) estimated that 64,640 cases of carcinoma in situ of the breast and 234,580 invasive breast cancer will be diagnosed in the USA in 2013 [4].

According to the last Saudi Cancer Registration report in April 2014, BC was ranked the first among all female cancers, accounting for 27.4% of all newly diagnosed female cancers (1473/5378 cases) in 2010 [5]. The age specific rate (ASR) was 24.9/100,000 for Saudi female population while in the USA, it was 118.7/100,000 and in the UK, ASR was 129.4/100,000. Incidence increased with age, and the probability of developing BC was one in 69 in the 40s, one in 38 in the 50s, and one in 27 in the 60s, in the USA [6]. Likewise, in the KSA, incidence was correlated with age, whereby probability was one in 2000 in the 40s, one in 1400 in the 50s, and one in 1100 in the 60s [5].

WHO reported that, early detection was the cornerstone for BC control and it could improve breast cancer outcome and survival. Early detection and development of more effective treatments have led to significant declines in BC deaths and improved the outlook for women living with the disease [7,8]. The components of breast screening are dependent on the risk assessment, physical examination and screening mammogram. Therefore, if a woman has an abnormal mammographic finding on screening or a concerning finding on physical examination, additional breast imaging, ultrasonography, or even MRI and biopsy may be needed [6,9].

Several risk factors affecting the incidence of BC were reported by the national comprehensive cancer network (NCCN) as part of the clinical practice guideline in oncology, in addition to, numerous clinical trials and epidemiological studies carried out both in developed and developing countries, over the last three decades [9–17].

Risk factors can be classified into four main groups: *first*, family history/genetic background, which accounts for approximately 15% of all BC causes [17]. *The second* and most well-known risk factor for BC is hazardous effects of hormonal exposures such as early age at menarche, late age at menopause, fewer number of children or nulliparity, late age at first birth, little or no breastfeeding and long-term use of hormone replacement therapy (HRT) [11,16]. *The third* category is the high breast density, which has been recognized as one of the most significant markers of BC risk [15]. *Last but not least*, history of benign proliferative breast disease [10].

In spite of the fact that having a single risk factor or even several factors does not mean that the females will get the disease, many women with BC have no apparent risk factors (other than being a woman and growing old). Even in-patients with BC who have evident risk factors, it is difficult to trace the exact mechanism by which those risk factors have contributed to the disease development. Some factors influenced risk more than others and the BC risk can change over time, due to factors such as aging or lifestyle [9]. Although, there is no definite way to prevent the disease, wide range of preventive approaches have been outlined that might lead to risk reduction and help to increase the odds of early detection and survival i.e. periodic self-examination and mammography [12]. Certain socio-demographic factors may modulate the pattern of BC among Saudi women i.e. they tend to get married early, according to the traditional conservative values of the society, with childbearing period extending practically over their entire reproductive age. Due to the conservative nature of the society, many females would have refrained from seeking medical advice out of shyness until their disease became far advanced. Often they fear the treatment more than the disease itself [18].

Several models were developed to assess the interactive effect of multiple risk factors on overall patient risk. The most widely applicable model for general risk assessment is the Gail model, which assessed a variety of potential risk factors. A computerized version of the modified Gail model is available on the World Wide Web and has been widely distributed by the National Cancer Institute (NCI) [19].

The current work aimed to explore the most important BC correlates among females participating in the breast-screening program in Riyadh, KSA. These factors included; socioeconomic status (SES), body mass index (BMI), menstrual and reproductive factors, family history of breast and ovarian cancer.

Subjects and methods

Based on phase I data of the National Breast Cancer Screening program (NBCS), a case–control study was conducted on women living in Riyadh, KSA in the period from September 2013 to August 2014. The sample consisted of 348 women (58 cases and 290 controls). The 58 cases were the total newly diagnosed BC cases in Riyadh region during our study period (1 year), whereas phase-I NBCS is still running. The number screened during our study period was 5639 women. Cases were female patients diagnosed during screening via mammogram and their diagnosis was confirmed by clinical and pathological examination in the King Fahd Medical City Hospital in Riyadh. For each case, five age-comparable controls were selected from the same mobile clinics with normal screening mammogram.

A pre-coded designed questionnaire was used for data collection by well-trained female interviewers. Prior to interview, full explanation of the research objective, methods and expected benefits and hazards was introduced.

The study questionnaire was designed after reviewing literatures, books of BC risk factors and questionnaires used in similar studies carried out in the KSA and other countries. It was composed of 32 questions distributed over four sections. The 1st section included five questions on the following demographic characteristics: age, educational level, marital status, residence and occupation in first section. The 2nd and 3rd sections contain 22 questions for menstrual and reproductive history including; parity, age at first pregnancy, age at menarche, menopausal status, breast-feeding (history and duration), oral contraceptive pill (OCP) use (history and duration), infertility, abortion, history of benign breast lumps, breast biopsy, screening mammography and HRT. The 4th section included anthropometric measurements (weight and height for BMI calculation) and questions on diet.

The collected data were analyzed using the Statistical Package for Social Sciences (SPSS/PC/VER 21). Means, standard deviations (SD), and odds ratio (OR) with 95% confidence intervals (CI) were calculated. Test of significances: Chi square test was used to compare the difference in distribution of frequencies of various risk factors among the two groups. Student *t*-test was calculated to test the mean differences in continuous variables between the two groups; $p \leqslant 0.05$ was considered statistically significant. Factors significantly associated with breast cancer risk as well as the borderline variables in the univariate analysis ($p \leqslant 0.7$) were entered into multivariate logistic regression models.

Ethical consideration

The Institutional Review Board (IRB) of King Saud University (KSU) has ethically approved the study with reference number E-14-1101. Written informed consents were obtained from all participants and confidentiality was assured. Participants have the right to withdraw, without any consequence, at any time prior to or at any point, during or after the start of the study. Participants were assured that any information provided will be used only for research purposes.

Results

Socio-demographic characteristics of the participants are summarized in Table 1.

The age of the study cohort ranged between 30 and 71 years (mean age of cases was 48.5 ± 7.1 years and that of controls 49.1 ± 6.9 years). In both cases and controls, around 75% were currently married. About one-third of cases were working while 24% in the control group were working (Table 1).

Table 2 shows the results of the Univariate logistic regression analysis of BC risk factors. BC significant correlates included; age at marriage, number of pregnancies, age at menopause, oral contraceptive pill use, family history of BC in first-degree relative and history of exposure to radiation. However, age at menarche, physical activity, BMI were not associated with BC in the current sample.

The resulting final logistic regression model was composed of five explanatory factors for BC risk factors; age at marriage, menopausal age, number of pregnancies, breast feeding and family history (Table 3).

When all other independent variables are kept constant, the findings revealed that there was 13% increase in the risk of BC with each year increase in the age at marriage (OR = 1.13 and 95% CI 1.04–1.24). Additionally, each pregnancy was associated with 8% BC risk reduction (OR = 0.92 and 95% CI 0.87–0.98). Both results showed significant test ($p < 0.01$ and < 0.05, respectively).

Moreover, menopausal women below the age of 50 had 38% BC risk reduction (OR = 0.62 and 95% CI 0.40–0.94) with a significant test result ($p < 0.01$) compared with premenopausal ones while those aged 50 or more had 40% increase in the risk (OR = 1.43 and 95% CI 1.08–3.15) with a significant test ($p < 0.05$).

Furthermore, women who practice breast-feeding were 70% less likely to have BC (OR = 0.3 and 95% CI 0.13–0.69) with a significant test result ($p < 0.01$). For the family history, patients with positive BC family history were 3.2 times more likely to get the disease (OR = 3.2 and 95% CI 1.52–6.75) compared to those with negative BC family history, with a significant test result ($p < 0.01$).

Table 1 Socio-demographic characteristics of the study participants, cases vs. controls (Sample of women enrolled in phase-I breast screening program, Riyadh, KSA, 2014).

	Control (No. = 290)	Case (No. = 58)	*p*-Value
Age			
Mean ± SD	49.2 ± 6.9	48.5 ± 7.1	0.243*
Median and IQR[$]	48.5 and 10	48 and 11	
Range	30–69	32–64	
Marital status			
Single	0 (0%)	2 (3.4%)	
Married	218 (75.2%)	44 (76.9%)	0.052***
Divorced	34 (11.7%)	4 (6.9%)	
Widow	38 (13.1%)	8 (13.8%)	
Occupation			
Working	70 (24.1%)	18 (31%)	0.270**
House wife	220 (75.9%)	40 (69%)	
Education level			
Illiteracy	95 (32.8%)	14 (24.1%)	
Primary	77 (26.6%)	16 (27.6%)	
Secondary	56 (19.3%)	13 (22.4%)	0.362***
Diploma	13 (4.5%)	4 (6.9%)	
University	45 (15.5%)	10 (17.2%)	
Postgraduate	4 (1.4%)	1 (1.7%)	

* *T*-test analysis was used to compare the difference in means.
** Chi-square test analysis was used to compare the difference in proportions.
*** Exact test analysis was used to compare the difference in proportions.
[$] IQR = Inter-quartile range.

Discussion

BC continues to be a major cause of morbidity and mortality throughout the world. In countries with high incidence, such as the United States, it received great attention in both scientific and public media [12]. Even in countries where its incidence is lower, such as Japan, the disease remains a cause for concern and attention but still its etiology remained uncertain [20]. Saudi National Cancer Registry reported increasing proportions of BC among women of different ages from 10.2%

Table 2 Association between BC and the most important risk factors among the studied sample: univariate analysis.

	Control (n = 290)	Case (n = 58)	p-Value	OR[$]	95% CI[$]
No. of pregnancy (mean ± SD)	7.9 ± 3.6	6.6 ± 3.4	0.012[*]	1.15	1.02–2.54
Age at marriage (mean ± SD)	18.4 ± 4.1	19.9 ± 5.2	0.043[*]	0.94	0.85–0.98
Age at menarche (> 13 years)	109 (86.5%)	17 (13.5%)	0.231[**]	1.45	0.79–2.68
Age at menopause					
Pre-menopausal	180 (62.1%)	26 (44.8%)		1	
< 50 years	19 (6.5%)	6 (10.4%)	0.027[**]	0.58	0.24–0.96
⩾ 50 years	91 (31.4%)	26 (44.8%)		1.65	1.23–3.82
Breast feeding	273 (94.1%)	45 (77.6%)[x]	0.0004[**]	3.26	1.29–5.69
Duration of breast feeding (> 2 years)[x]	231 (79.7%)	31 (53.5%)	0.073[**]	1.68	0.98–4.53
Previous history of contraception	214 (73.8%)	36 (62.1%)	0.042[**]	3.64	1.52–8.75
Duration of contraception (> 2 years)[xx]	116 (40.0%)	21 (36.2%)	0.213[**]	1.51	0.79–2.88
Family history of BC	24 (8.3%)	13 (22.4%)	0.004[**]	0.68	0.31–0.82
History of radiation	14 (4.8%)	7 (12.1%)	0.016[**]	1.29	1.11–7.28
Weight (kg)	82.1 ± 18.0	80.6 ± 16.1	0.530[*]	0.99	0.98–1.01
BMI (> 30)	207 (71.4%)	41 (70.7%)	0.916[**]	1.04	0.56–1.92

[–] Significance level is considered when $p \leqslant 0.05$.
[*] t-test analysis was used to compare the difference in means.
[**] Chi-square test analysis was used to compare the difference in proportions.
[$] OR = un-adjusted odds ratio CI for OR = confidence interval.
[x] Total no. = 56 in cases group. Total duration of all breast feedings period for all children.
[xx] Total no. = 56 in cases group. Total duration of all contraception periods.

Table 3 Independent risk factors for BC among the studied patients: multivariate logistic regression analysis.

	AOR[*]	95% CI[**]	p-Value[***]
Age at marriage	1.13	1.04–1.24	0.013
No. of pregnancy	0.92	0.87–0.98	0.041
Age at menopause			
Pre-menopausal	1		
< 50 years	0.62	0.40–0.94	0.005
⩾ 50 years	1.43	1.08–3.15	0.036
Breast feeding	0.30	0.13–0.69	0.004
Family history of BC	3.20	1.52–6.75	0.002
Family history (1st degree relative)	3.31	1.51–7.28	0.006

[*] AOR = adjusted odds ratio.
[**] CI for AOR = confidence interval.
[***] Significance level is considered when $p \leqslant 0.05$.

(2000), 24.3% (2005) to 27.4% (2010) [5,21]. In a recent study by Ibrahim et al. it was estimated that the future burden of BC in Saudi Arabia is expected to reach approximately 350% increase by the year 2025 [22]. Several risk factors have been identified to contribute to the pattern of BC [23]. The main goal of the national BC screening program was to detect cancer cases at early stage or even before the start of symptoms. The patient's survival and line of treatment depended heavily on early diagnosis [24]. So, adequate primary prevention and early detection remains the first priority for the national health promotion programs, worldwide [25].

The current work was carried out to clarify the different risk factors related to breast cancer among a sample of 348 females who were enrolled in phase I NBCS in Riyadh, KSA, in the period from September 2013 to August 2014. This study showed that, the mean age of cases with breast cancer in this study was 48.5 ± 7.05 years which is consistent with the findings of previous studies in Riyadh and Eastern Province reported that most of the patients were below 50 years of age [26–28]. Saadat [25] and Najjar and Easson [29] reported that the occurrence of BC in the Arab countries was almost 10-year younger than in the USA and the European countries. The median age at presentation was 48–52 years and 50% of cases were below the age of 50. But Vogel et al. [30] suggested that, the risk of breast cancer increases among women older than 50 years of age especially those with benign breast disease, in particular patients with atypical ductal or lobular hyperplasia.

The present study did not show any significant relationship between physical activity for both pre and postmenopausal women and BC. This was consistent with Friedenreich [31] who reported that there was no association between physical activity and BC in premenopausal women, but in postmenopausal women, physical activity throughout the lifetime reduced the risk of BC [31]. The latter inconsistence finding could be explained by the fact that Saudi women had a sedentary life style because of the restricted feminine roles and tradition in the KSA.

Moreover, it was found that breast-feeding played a protective role against BC, which was in agreement with the finding of al-Idrissi [32]. Similarly, Kuru et al. [33] reported that Turkish women who practice breastfeeding had decreased risk of BC. Likewise, the majority of studies on the relationship between BC and breast feeding concluded that those with a history of breastfeeding had a lower BC risk and that the longer the duration of lactation, the lower the risk of BC [13,34,35]. The association between the BC risk and the period of prolonged lactation could be explained in part by the reduction of the total number of ovulatory menstrual cycles and consequently the cumulative ovarian hormone exposure [36].

One of the major BC risk factors is the family history of the disease. A meta-analysis of 52 epidemiological studies showed that 12% of women with breast cancer had one affected family

member and 1% had one or more relatives affected [37]. Similarly, in the current study, women with positive BC family history were three times more likely to get the disease. This was in concordance with previous studies which reported that women with one, two, three or more first-degree affected relatives have an increased breast cancer risk when compared with women who do not have an affected relative (risk ratios 1.8, 2.9 and 3.9, respectively) [37–39].

Obesity plays a major role in the development and spread of BC, many studies have examined the association between BMI and BC incidence [13,14]. Large studies conducted both in the US and Europe had demonstrated that obesity and weight gain increased the BC risk among postmenopausal women. Risk is particularly evident among obese women who do not use HRT, with risk ratios up to two. For each 5 kg of weight gain since the lowest adult weight, breast cancer risk increased by 8% [40–43]. Among the Arab population, breast cancer risk was significantly higher among females who were over-weight or obese both pre- and post-menopausal (OR = 2.73 and OR = 2.22 respectively; $p < 0.001$) [38]. Surprisingly, the association between BMI and BC risk in the present study was not significant and this may be due to that BMI variability was not evident in our cohort because the majority of people in the Gulf countries are physically inactive and spend their leisure time in sedentary activities [44].

Lifetime exposure to endogenous sex hormones is determined by several indicators including; age at menarche, age at first full-term pregnancy, number of pregnancies and age at menopause, which have been studied all in relation to the risk of BC [45]. For the age at menopause, the current research revealed that menopausal women above the age of 50 were 1.4 times at higher risk of BC compared with premenopausal ones. This could be explained by the fact that BC risk is related to the extent of mitotic activity in the breast which is driven by estrogen and progesterone exposure during the luteal phase of the menstrual cycle. This in turn determines the probability of tumorigenic somatic events; early menarche increases these mitotically active periods in the breast and consequently increases the risk of BC [13].

The current study found that the more the number of pregnancies, the lower the risk of BC. This was conformed to a study conducted by Beiler [46], where women who have had no children or who had their first child after the age of 30 had a higher BC risk. Having many pregnancies and becoming pregnant at young age reduced the BC risk. This could be justified by that pregnancy might reduce a woman's total number of life time menstrual cycles, which may be the reason for this effect.

Conclusion

The findings of the current work suggested that the following correlates were independently associated with the risk of BC; age at marriage, menopausal age, number of pregnancies, breast feeding and family history. However, there was no association between BMI and physical inactivity and BC risk.

Competing interests

None declared.

Authors' contributions

All authors contributed equally to this work. They have read and approved the final draft.

Acknowledgements

We are very grateful for the Ministry of Health, KSA specially the Deputy Ministry for Public Health, Assistant Deputy for Primary Health Care for sponsoring our work. It is a pleasure to express my deepest gratitude and grateful appreciation to the Breast Cancer Project Team and to the patients who took part in this study. It would not have been possible without their help.

References

[1] Richie RC, Swanson JO. Breast cancer: a review of the literature. J Insur Med 2003;35:85–101.
[2] Shah R, Rosso K, Nathanson SD. Pathogenesis, prevention, diagnosis and treatment of breast cancer. World J Clin Oncol 2014;5:283–98.
[3] DeSantis C, Ma J, Bryan L, Jemal A. Breast cancer statistics, 2013. CA Cancer J Clin 2014;64:52–62.
[4] Siegel R, Naishadham D, Jemal A. Cancer statistics, 2013. CA Cancer J Clin 2013;63:11–30.
[5] Haya S, Al-Eid SD. Cancer incidence report, Saudi Arabia 2010, vol. 14. Kingdom of Saudi Arabia: Ministry of Health, Saudi Cancer Registry; 2014:103.
[6] Chagpar AB, McMasters KM. Trends in mammography and clinical breast examination: a population-based study. J Surg Res 2007;140:214–9.
[7] Glass AG, Lacey Jr JV, Carreon JD, Hoover RN. Breast cancer incidence, 1980–2006: combined roles of menopausal hormone therapy, screening mammography, and estrogen receptor status. J Natl Cancer Inst 2007;99:1152–61.
[8] Gralow J, Ozols RF, Bajorin DF, Cheson BD, Sandler HM, Winer EP, et al. Clinical cancer advances 2007: major research advances in cancer treatment, prevention, and screening – a report from the American Society of Clinical Oncology. J Clin Oncol 2008;26:313–25.
[9] Theriault RL, Carlson RW, Allred C, Anderson BO, Burstein HJ, Edge SB, et al. Breast cancer, version 3.2013: featured updates to the NCCN guidelines. J Natl Compr Canc Netw 2013;11:753–60 [quiz 761].
[10] Abulkhair OA, Al Tahan FM, Young SE, Musaad SM, Jazieh AR. The first national public breast cancer screening program in Saudi Arabia. Ann Saudi Med 2010;30:350–7.
[11] Albrektsen GH, Hansen S, Kvåle G. Breast cancer risk by age at birth, time since birth and time intervals between births: exploring interaction effects. Br J Cancer 2005 Jan;17:167–75.
[12] American Cancer Society. Cancer facts and figures 2013. http://www.bcrfcure.org/breast-cancer-statistics, [accessed 24/11/2014].
[13] Hadjisavvas A, Loizidou MA, Middleton N, Michael T, Papachristoforou R, Kakouri E, et al. An investigation of breast cancer risk factors in Cyprus: a case control study. BMC Cancer 2010;10:447.
[14] Hosseinzadeh M, Eivazi Ziaei J, Mahdavi N, Aghajari P, Vahidi M, Fateh A, et al. Risk factors for breast cancer in Iranian women: a hospital-based case-control study in Tabriz, Iran. J Breast Cancer 2014;17:236–43.
[15] Kerlikowske K, Shepherd J, Creasman J, Tice JA, Ziv E, Cummings SR. Are breast density and bone mineral density

independent risk factors for breast cancer? J Natl Cancer Inst 2005;97:368–74.
[16] Lipworth L, Bailey LR, Trichopoulos D. History of breast-feeding in relation to breast cancer risk: a review of the epidemiologic literature. J Natl Cancer Inst 2000;92:302–12.
[17] Martin AM, Weber BL. Genetic and hormonal risk factors in breast cancer. J Natl Cancer Inst 2000;92:1126–35.
[18] Alam AA. Knowledge of breast cancer and its risk and protective factors among women in Riyadh. Ann Saudi Med 2006;26:272–7.
[19] Singletary SE. Rating the risk factors for breast cancer. Ann Surg 2003;237:474–82.
[20] Shibuya K, Mathers CD, Boschi-Pinto C, Lopez AD, Murray CJ. Global and regional estimates of cancer mortality and incidence by site: II. Results for the global burden of disease 2000. BMC Cancer 2002;2:37.
[21] Al-Diab SQ, Al-Saleh KA, Al-Qahtani FH, Aleem A, Alghamdi MA, Alsaif A, et al. Review on breast cancer in the Kingdom of Saudi Arabia. Middle-East J Sci Res 2013;14:532–43.
[22] Ibrahim EM, Zeeneldin AA, Sadiq BB, Ezzat AA. The present and the future of breast cancer burden in the Kingdom of Saudi Arabia. Med Oncol 2008;25:387–93.
[23] Dumitrescu RG, Cotarla I. Understanding breast cancer risk – where do we stand in 2005? J Cell Mol Med 2005;9:208–21.
[24] Smith RA, Duffy SW, Tabar L. Breast cancer screening: the evolving evidence. Oncology (Williston Park) 2012;26, 471–475, 479–481, 485–476.
[25] Saadat S. Can we prevent breast cancer? Int J Health Sci (Qassim) 2008;2:167–70.
[26] Abdelhadi MS. Breast cancer management delay – time for improvement: a reflection from the eastern province of Saudi Arabia. J Family Community Med 2008;15:117–22.
[27] Ibrahim EM, Al-Mulhim FA, Al-Amri A, Al-Muhanna FA, Ezzat AA, Stuart RK, et al. Breast cancer in the eastern province of Saudi Arabia. Med Oncol 1998;15:241–7.
[28] Rudat V, Brune-Erbe I, Noureldin A, Bushnag Z, Almuraikhi N, Altuwaijri S. Epidemiology of breast cancer patients at a tertiary care center in the Eastern Province of Saudi Arabia. Gulf J Oncolog 2012:45–9.
[29] Najjar H, Easson A. Age at diagnosis of breast cancer in Arab nations. Int J Surg 2010;8:448–52.
[30] Vogel VG. Epidemiology, genetics, and risk evaluation of postmenopausal women at risk of breast cancer. Menopause 2008;15:782–9.
[31] Friedenreich CM. Physical activity and breast cancer: review of the epidemiologic evidence and biologic mechanisms. Recent Results Cancer Res 2011;188:125–39.
[32] al-Idrissi HY. Pattern of breast cancer in Saudi females in eastern province of Saudi Arabia. Indian J Med Sci 1991;45:85–7.
[33] Kuru B, Ozaslan C, Ozdemir P, Dinc S, Camlibel M, Alagol H. Risk factors for breast cancer in Turkish women with early pregnancies and long-lasting lactation–a case-control study. Acta Oncol 2002;41:556–61.
[34] Collaborative Group on Hormonal Factors in Breast C. Breast cancer and breastfeeding: collaborative reanalysis of individual data from 47 epidemiological studies in 30 countries, including 50302 women with breast cancer and 96973 women without the disease. Lancet 2002;360:187–95.
[35] Enger SM, Ross RK, Paganini-Hill A, Bernstein L. Breastfeeding experience and breast cancer risk among postmenopausal women. Cancer Epidemiol Biomarkers Prev 1998;7:365–9.
[36] Bernstein L. Epidemiology of endocrine-related risk factors for breast cancer. J Mammary Gland Biol Neoplasia 2002;7:3–15.
[37] Collaborative Group on Hormonal Factors in Breast C. Familial breast cancer: collaborative reanalysis of individual data from 52 epidemiological studies including 58,209 women with breast cancer and 101,986 women without the disease. Lancet 2001;358:1389–99.
[38] Elkum N, Al-Tweigeri T, Ajarim D, Al-Zahrani A, Amer SM, Aboussekhra A. Obesity is a significant risk factor for breast cancer in Arab women. BMC Cancer 2014;14:788.
[39] Colditz GA, Rosner BA, Speizer FE. Risk factors for breast cancer according to family history of breast cancer. For the Nurses' Health Study Research Group. J Natl Cancer Inst 1996;88:365–71.
[40] Friedenreich CM. Review of anthropometric factors and breast cancer risk. Eur J Cancer Prev 2001;10:15–32.
[41] Huang Z, Hankinson SE, Colditz GA, Stampfer MJ, Hunter DJ, Manson JE, et al. Dual effects of weight and weight gain on breast cancer risk. JAMA 1997;278:1407–11.
[42] Lahmann PH, Hoffmann K, Allen N, van Gils CH, Khaw KT, Tehard B, et al. Body size and breast cancer risk: findings from the European Prospective Investigation into Cancer And Nutrition (EPIC). Int J Cancer 2004;111:762–71.
[43] Trentham-Dietz A, Newcomb PA, Egan KM, Titus-Ernstoff L, Baron JA, Storer BE, et al. Weight change and risk of postmenopausal breast cancer (United States). Cancer Causes Control 2000;11:533–42.
[44] Mabry RM, Reeves MM, Eakin EG, Owen N. Evidence of physical activity participation among men and women in the countries of the Gulf cooperation council: a review. Obes Rev 2010;11:457–64.
[45] Feigelson HS, Henderson BE. Estrogens and breast cancer. Carcinogenesis 1996;17:2279–84.
[46] Beiler JS, Zhu K, Hunter S, Payne-Wilks K, Roland CL, Chinchilli VM. A case-control study of menstrual factors in relation to breast cancer risk in African-American women. J Natl Med Assoc 2003;95:930–8.