Investigation Risk Factors for Breast Cancer in Women: A Case–Control Study in Arak, Iran

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Abstract

Background

Breast cancer is the most common malignant in women globally. In Iran, breast cancer incidence rate is continuously increasing. This study aimed to investigate the risk factors for breast cancer in Iranian women.

Methods

A hospital-based case-control study was conducted between September 2016 and July 2019 in Arak, Iran. The sample size was 400 breast cancer patients and 400 healthy women. Demographical records and risk factor related data were collected. Logistic regression analysis used to calculate odds ratios (ORs) and 95% confidence intervals (CIs).

Results

Data showed that among various factors, urban life (OR = 1.361, 95% CI 1.025–1.808, $P = 0.033$), height (OR = 3.347, 95% CI 2.0443–5.480, $P = 0.000$), BMI (OR = 0.397, 95% CI 0.273–0.577, $P = 0.000$), education level (OR = 7.048, 95% CI 3.985–12.467, $P = 0.000$), awareness level (OR = 0.507, 95% CI 0.349–0.736, $P = 0.000$), job status (OR = 0.321, 95% CI 0.122–0.846, $P = 0.022$), economic status (OR = 4.333, 95% CI 1.424–13.184, $P = 0.010$), early menarche (OR = 2.815, 95% CI 1.745–4.541, $P = 0.000$), Stillbirth status (OR = 1.935, 95% CI 1.087–3.446, $P = 0.025$), family history (OR = 10.281, 95% CI 3.628–29.134, $P = 0.000$), behavioral habits (OR = 0.554, 95% CI 0.386–0.796, $P = 0.001$), and second-hand smoking (OR = 1.472, 95% CI 1.108–1.955, $P = 0.008$) significantly were associated with an increased risk for breast cancer.

Conclusion

The data suggest that lifestyle may have more impact on the incidence of breast cancer in Iranian women, suggesting change unhealthy lifestyle and screening for preventing breast cancer.

Background

Cancer is one of the main global health issues, with an estimated 10 million incidents and 6 million annual mortality rates, and this figure is estimated to reach 11 million by 2030 [1]. Breast cancer is the most prevalent cancer and the leading cause of death among women globally [1, 2]. The incidence of breast cancer and mortality rates differs in various centuries, the highest incidence rate belongs to the USA and the lowest reported in Asia. Nevertheless, the incidence is increasing in Asian countries [3]. In Iran, breast cancer is one of the most frequent cancers in women and its incidence rate is continuously increasing. Incidence age in Iranian women is in the fourth and fifth decades of life, which is a decade younger than the global age of incidence [4]. Breast cancer is a multifactorial disease that caused due genetics, hormones, environmental, sociobiology, physiology, reproductive, dietary and lifestyle-related

risk factors [5–7]. Identifying risk factors can play an important role in reducing/preventing the risk of breast cancer which, in turn, results in reducing mortality rates, improving the health of women, increasing the quality of life, and reducing the economic and social costs [1]. When risk factors are well understood, healthcare providers can supply women with more accurate information regarding their risk of developing breast cancer [8]. Worldwide, numerous studies have sought to know the risk factors for breast cancer. However, there has been no consensus because of differences in sample sizes, races that comprised study populations, and local customs [9, 10]. Besides, the risk factors of breast cancer may vary among different populations [11]. Currently, national monitoring data on risk factors among the Chinese general population are limited. The aim of this study was to investigate the risk factors for breast cancer in Iranian women in Arak. Risk factors determined in our study will help to identify Iranian women who have an increased risk of breast cancer and support effective early detection and disease prevention interventions.

Methods

This hospital-based and case-control study was approved from the ethics committee of Arak University of Medical Sciences, Arak, Iran (IR.ARAKMU.REC.1395.288) and conducted between September 2016 and July 2019 at the Ayatollah Khansari Hospital in Arak, Iran. The sample size is determined using Quanto 1.2 application. That was obtained using substitution on the software with $\alpha = 0.05$ and power of 80% and calculated sample size of 400 in each group [12]. A sample size of 400 cases including women with breast cancer that diagnosed with breast cancer by an oncologist with pathological tests and 400 controls including healthy women without breast cancer was found to be adequate to test the significance. Control samples were prepared by women in the same hospital. Cases and controls were age-matched. Socio-demographic, reproductive, behavioral habits and chronic diseases data as probable risk factors data were collected from both groups using a questionnaire face to face. The questionnaire consisted of details including socio-demographic data such as name, age, height, weight, location, education status, job status, economic status, awareness of breast cancer and reproductive information including age at menarche, age at menopause, nulliparous status, number of births, marital status and first childbirth status, stillbirth, abortion status, oral contraceptives status, breastfeeding, and behavioral habits information like diet (lack of consumption of vegetables and fruits and consumption of food high-fat, fried food and fast food), smoking, physical activity, second-hand smoking and chronic diseases information including hypertension, diabetes mellitus, family history of breast cancer (first and second degree relatives). BMI (kg/m^2) was categorized as; normal range 18.5 to 24.9 kg/m^2 , overweight 25 to 30 kg/m^2 and obese $\geq 30 \text{ kg/m}^2$ [13, 14]. Statistical analysis was done using the software SPSS version 16. Binary logistic regression analysis was performed to evaluate the association of various risk factors with the risk of breast cancer, displayed as odds ratios (OR) with 95% confidence intervals. $P < 0.05$ was considered statistically significant.

Results

Risk factors for breast cancer in a statistical population that total of 800 women, including women who have been diagnosed with breast cancer (cases, $n = 400$) and women who don't have breast cancer (controls, $n = 400$), were studied. Socio-demographic characteristics and their association with risk of breast cancer for the case and control groups are shown in Table 1. Mean age of the cases was 51.50 years ranging from 26 to 87 years and mean age of control was 50.47 years ranging from 24 to 85 years. As shown in Table 1, of the 400 cases, 4 (1%) were aged 20–30 years, 40 (10%) were aged 31–40 years, 149 (37.25%) were aged 41–50 years, 131 (32.75%) were aged 51–60 years, 55 (13.75%) were aged 61–70 years, 17 (4.25%) were aged 71–80 years and 4 (1%) were aged 81–90 years. There were no significant differences between cases and controls about age (Table 1).

Table 1

Socio-demographic risk factors for breast cancer derived from binary logistic regression analysis.

Variable	Defined status	Cases, n (%)	Controls, n (%)	OR	95% CI	p-value
Age (year)	81–90	4 (1%)	6 (1.5%)	1.00 (ref.)	1.00 (ref.)	0.525
	71–80	17 (4.25%)	16 (4%)	1.594	0.379–6.711	0.565
	61–70	55 (13.75%)	56 (14%)	1.473	0.394–5.508	0.408
	51–60	131 (32.75%)	114 (28.5%)	1.724	0.475–6.261	0.436
	41–50	149 (37.25%)	134 (33.5%)	1.668	0.461–6.038	0.836
	31–40	40 (10%)	69 (17.25%)	0.780	0.231–3.267	0.845
	20–30	4 (1%)	5 (1.25%)	1.200	0.194–7.441	
Weight (Kg)	≥ 76	108 (27%)	96 (24%)	1.00 (ref.)	1.00 (ref.)	0.647
	63–75	208 (52%)	200 (50%)	0.924	0.660–1.294	0.103
	≤ 62	84 (21%)	104 (26%)	0.718	0.482–1.069	
Height (Cm)	≥ 165	24 (6%)	96 (24%)	1.00 (ref.)	1.00 (ref.)	0.000
	158–164	164 (41%)	196 (49%)	3.347	2.044–5.480	0.000
	≤ 157	212 (53%)	108 (27%)	7.852	4.745–12.994	
Body mass index (kg/m ²)	≥ 30	144 (36%)	100 (25%)	1.00 (ref.)	1.00 (ref.)	0.113
	25–30	176 (44%)	160 (40%)	0.764	0.548–1.066	0.000
	18.5–24.9	80 (20%)	140 (35%)	0.397	0.273–0.577	
Location status	Urban	249 (62.25%)	220 (55%)	1.00 (ref.)	1.00 (ref.)	0.033
	Rural	148 (37%)	178 (44.5%)	1.361	1.025–1.808	
	NA*	3 (0.75%)	2 (0.5%)			

BC: Breast Cancer, NA: Not Available, CI: Confidence Interval, OR: Odds Ratio.

Variable	Defined status	Cases, n (%)	Controls, n (%)	OR	95% CI	p-value
Education level	College	19 (4.75%)	79 (19.75%)	1.00 (ref.)	1.00 (ref.)	0.131
	High school	51 (12.75%)	134 (33.5%)	1.582	0.872–2.871	0.000
	Elementary	186 (46.5%)	101 (25.25%)	7.657	4.390–13.356	0.000
	Uneducated	139 (34.75%)	82 (20.5%)	7.048	3.985–12.467	
	NA	5 (1.25%)	4 (1%)			
Awareness level of BC*	High	52 (13%)	92 (23%)	1.00 (ref.)	1.00 (ref.)	0.000
	Poor	339 (84.75%)	304 (76%)	0.507	0.349–0.736	
	NA	9 (2.25%)	4 (1%)			
Job status	Retired	13 (3.25%)	8 (2%)	1.00 (ref.)	1.00 (ref.)	0.418
	Housewife	338 (84.5%)	301 (75.25%)	0.691	0.238–1.690	0.022
	Employee	36 (9%)	69 (17.25%)	0.321	0.122–0.846	0.688
	Farmer	6 (1.5%)	5 (1.25%)	0.738	0.168–3.237	0.059
	University student	4 (1%)	10 (2.5%)	0.246	0.057–1.056	
	NA	3 (0.75%)	7 (1.75%)			
Economic status	High	6 (1.5%)	11 (2.75%)	1.00 (ref.)	1.00 (ref.)	0.010
	Poor	52 (13%)	22 (5.5%)	4.333	1.424–13.184	0.196
	Average	258 (64.5%)	243 (60.75%)	1.947	0.709–5.344	0.722
	Good	79 (19.75%)	120 (30%)	1.207	0.429–3.396	
	NA	5 (1.25%)	4 (1%)			
BC: Breast Cancer, NA: Not Available, CI: Confidence Interval, OR: Odds Ratio.						

We found a significant difference in the height value of controls (158.6 ± 4.2 cm) and cases (161.4 ± 5.3 cm) ($P < 0.05$). The mean weight of controls was 70 ± 7.5 kg and that of cases 68 ± 7.3 kg ($P > 0.05$). In addition, 37% of the cases and 44.5% of the controls lived in the rural area. 7.25% of cases lived in the

urban area, which was higher than of controls; there was statistical significant difference between location statuses and breast cancer in two groups (OR = 1.361, 95% CI 1.025–1.808, P = 0.033) (Table 1).

The mean BMI was 27.3 for cases and 25.7 for controls. 36% of cases had BMI ≥ 30 kg/m² against 25% of controls. The BMI 18.5 to 24.9 kg/m² for controls was 1.75 times higher than that of cases. We found a significant association between BMI 25 to 30 kg/m² and breast cancer (OR = 0.397, 95% CI 0.273–0.577, P = 0.000). In other words, high BMI (overweight and obese) is associated with an increased risk of breast cancer.

The impact of education status was studied in two groups. The level of college education in controls was about 4-fold that of cases. There was a significant association between the level of education in statuses uneducated (OR = 7.048, 95% CI 3.985–12.467, P = 0.000) and elementary (OR = 7.657, 95% CI 4.390–13.356, P = 0.000) and breast cancer; so that increased levels of education are associated with a reduced risk of breast cancer. In case of awareness level, there was a significant association between awareness level and breast cancer (OR = 0.507, 95% CI 0.349–0.736, P = 0.000). In addition, the job status of the employee exhibited a significant association with the risk of breast cancer (OR = 0.321, 95% CI 0.122–0.846, P = 0.022) (Table 1). The economic status was investigated. We showed a significant relationship between the economic status of the poor and breast cancer in two groups (OR = 4.333, 95% CI 1.424–13.184, P = 0.010).

In keeping, we studied the association between reproductive factors and breast cancer (Table 2). We found that the mean age of menarche was 12.9 for cases and 13.3 for controls. There was significant statistical difference between the age of menarche in statuses < 12 (OR = 2.815, 95% CI 1.745–4.541, P = 0.000) and 12–13 (OR = 2.013, 95% CI 1.485–2.729, P = 0.000) with risk of breast cancer. Early menarche is associated with increased risk of breast cancer. Furthermore, menopause status (yes or no) and age were studied, which can be seen in Fig. 3. Mean age of menopause was 47.7 for cases and 47.5 for controls. There was no significant association between risk of breast cancer and menopause status as well as age (Table 2).

Table 2
Reproductive risk factors for breast cancer derived from binary logistic regression analysis.

Variable	Defined status	Cases, n (%)	Controls, n (%)	OR	95% CI	p-value
Age at menarche (year)	≥ 14	121 (30.25%)	193 (48.25%)	1.00 (ref.)	1.00 (ref.)	0.000
	12–13	212 (53%)	168 (42%)	2.013	1.485–2.729	0.000
	< 12	60 (15%)	34 (8.5%)	2.815	1.745–4.541	
	NA*	7 (1.75%)	5 (1.25%)			
Age at menopause (years)	No	197 (49.25%)	204 (51%)	1.00 (ref.)	1.00 (ref.)	0.467
	> 50	47 (11.75%)	41 (10.25%)	1.187	0.748–1.885	0.538
	45–50	99 (24.75%)	92 (23%)	1.114	0.789–1.573	0.595
	< 45	57 (14.25%)	57 (14.25%)	0.890		
	NA	49 (12.25%)	6 (1.5%)		0.580–1.367	
		8 (2%)				
Marital status	Widowed	26 (6.5%)	25 (6.25%)	1.00 (ref.)	1.00 (ref.)	0.677
	Single	33 (8.25%)	37 (9.25%)	0.858	0.416–1.766	0.962
	Married	321 (80.25%)	318 (79.5%)	0.986	0.557–1.745	0.300
	Divorced	13 (3.25%)	15 (3.75%)	0.625		
	NA	7 (1.75%)	5 (1.25%)		0.257–1.519	
Number of children	≥ 2	219 (54.75%)	202 (50.5%)	1.00 (ref.)	1.00 (ref.)	0.097
	< 2	113 (28.25%)	136 (34%)	0.766	0.560–1.049	0.950
	No children	61 (15.25%)	57 (14.25%)	0.987	0.656–1.485	
	NA	7 (1.75%)	5 (1.25%)			

NA: Not Available, CI: Confidence Interval, OR: Odds Ratio.

Variable	Defined status	Cases, n (%)	Controls, n (%)	OR	95% CI	p-value
Use of oral contraceptive pills	Yes	199 (49.75%)	197 (49.25%)	1.00 (ref.)	1.00 (ref.)	0.892
	No	183 (45.75%)	187 (46.75%)	0.980	0.737–1.304	
	NA	18 (4.5%)	16 (4%)			
Abortion status	Yes	48 (12%)	39 (9.75%)	1.00 (ref.)	1.00 (ref.)	0.295
	No	345 (86.25%)	356 (89%)	1.270	0.812–1.987	
	NA	7 (1.75%)	5 (1.25%)			
Stillbirth status	Yes	35 (8.75%)	19 (4.75%)	1.00 (ref.)	1.00 (ref.)	0.025
	No	356 (89%)	374 (93.5%)	1.935	1.087–3.446	
	NA	9 (2.25%)	7 (1.75%)			
Breastfeeding status	Yes	312 (78%)	326 (81.5%)	1.00 (ref.)	1.00 (ref.)	0.262
	No	81 (20.25%)	69 (17.25%)	0.815	0.571–1.165	
	NA	7 (1.75%)	5 (2.25%)			
NA: Not Available, CI: Confidence Interval, OR: Odds Ratio.						

Marital status was investigated in two groups (Table 2). The frequency of single and married individuals in both groups did not differ much, thus, we found no association between the marital statuses and breast cancer.

Having children (yes or no) and number it (< 2 or ≥ 2) was investigated in two groups. Our finding indicated that there was no relationship between the numbers of children and breast cancer. In addition, data from Table 2 demonstrated that there was no significant relationship between the uses of oral contraceptive pills (OR = 0.980, 95% CI 0.737–1.304, $P = 0.892$), abortion status (OR = 1.270, 95% CI 0.812–1.987, $P = 0.295$) and breastfeeding status (OR = 0.815, 95% CI 0.571–1.165, $P = 0.262$) and breast cancer; in contrast there was a significant relationship between the stillbirth status (OR = 1.935, 95% CI 1.087–3.446, $P = 0.025$) and breast cancer.

Through Table 3, we presented the association between risk of breast cancer and either chronic diseases or behavioral habits. There was no significant association between breast cancer and the hypertension (OR = 1.252, 95% CI 0.737–1.304, $P = 0.306$) as well as diabetes mellitus (OR = 1.332, 95% CI 0.638–

2.781, $P = 0.445$). However, we showed a statistically significant association between the family history and breast cancer (first-degree relatives, OR = 10.281, 95% CI 3.628–29.134, $P = 0.000$) and (second-degree relatives, OR = 3.324, 95% CI 1.403–7.874, $P = 0.000$).

Table 3
Chronic diseases and behavioral habits risk factors for breast cancer derived from binary logistic regression analysis.

Variable	Defined status	Cases, n (%)	Controls, n (%)	OR	95% CI	p-value
Hypertension	Yes	52 (13%)	43 (10.75%)	1.00 (ref.)	1.00 (ref.)	0.306
	No	340 (85%)	352 (88%)	1.252	0.814–1.926	
	NA*	8 (2%)	5 (1.25%)			
Diabetes mellitus	Yes	17 (4.25%)	13 (3.25%)	1.00 (ref.)	1.00 (ref.)	0.445
	No	375 (93.75%)	382 (95.5%)	1.332	0.638–2.781	
	NA	8 (4%)	5 (1.25%)			
Family history of BC (first-degree relatives)	Yes	37 (9.25%)	4 (1%)	1.00 (ref.)	1.00 (ref.)	0.000
	No	350 (87.5%)	389 (97.25%)	10.281	3.628–29.134	
	NA	13 (3.25%)	7 (1.75%)			
Family history of BC (second-degree relatives)	Yes	22 (5.5%)	7 (1.75%)	1.00 (ref.)	1.00 (ref.)	0.006
	No	365 (91.25%)	386 (96.5%)	3.324	1.403–7.874	
	NA	13 (3.25%)	7 (1.75%)			
Dietary status	Healthy diet	295 (73.75%)	334 (83.5%)	1.00 (ref.)	1.00 (ref.)	0.001
	Unhealthy diet	94 (23.5%)	59 (14.75%)	0.554	0.386–0.796	
	NA	11 (2.75%)	7 (1.75%)			

NA: Not Available, BC: Breast Cancer, CI: Confidence Interval, OR: Odds Ratio.

Variable	Defined status	Cases, n (%)	Controls, n (%)	OR	95% CI	p-value
Physical activity	Yes	119 (29.75%)	128 (32%)	1.00 (ref.)	1.00 (ref.)	0.552
	No					
	NA	270 (67.5%)	265 (66.25%)	0.912	0.675–1.234	
		11 (2.75%)	7 (1.75%)			
Smoking status	Yes	4 (1%)	3 (0.75%)	1.00 (ref.)	1.00 (ref.)	0.700
	No	389 (97.25%)	392 (98%)	1.344	0.299–6.043	
	NA	7 (1.75%)	5 (1.25%)			
Second-hand smoking status	Yes	244 (61%)	208 (52%)	1.00 (ref.)	1.00 (ref.)	0.008
	No	149 (37.25%)	187 (46.75%)	1.472	1.108–1.955	
	NA	7 (1.75%)	5 (1.25%)			
Alcohol consumption	Yes	1 (0.25%)	2 (0.5%)	1.00 (ref.)	1.00 (ref.)	0.573
	No	392 (98%)	393 (98.25%)	0.501	0.045–5.551	
	NA	7 (1.75%)	5 (1.25%)			
NA: Not Available, BC: Breast Cancer, CI: Confidence Interval, OR: Odds Ratio.						

In keeping, we evaluated the impact of behavioral habits on the risk of breast cancer. Dietary status of individuals in both groups was studied by asking questions. In this regard, 73.75% of cases have healthy diet including high or sufficient consumption of vegetables and fruits, low or no consumption of high-fat food, fried food and fast food and 23.5% of controls have unhealthy diet including low or no consumption of vegetables and fruits, high consumption of high-fat food, fried food and fast food. The dietary status was associated with risk of breast cancer in cases and controls (OR = 0.554, 95% CI 0.386–0.796, P = 0.001). There was no significant association between the physical activity (OR = 0.912, 95% CI 0.675–1.234, P = 0.552), smoking status (OR = 1.344, 95% CI 0.299–6.043, P = 0.700) and alcohol drinking status (OR = 0.501, 95% CI 0.045–5.551, P = 0.573) and breast cancer, in contrast the second-hand smoking status exhibited a significant relationship with risk of breast cancer (OR = 1.472, 95% CI 1.108–1.955, P = 0.008) (Table 3).

Discussion

In Iran, along with worldwide, breast cancer is one of the most frequent cancers [4]. We performed a case-control study involving 800 Iranian women to evaluate the relationship between breast cancer and such risk factors as socio-demographic, reproductive, chronic diseases, and behavioral habits.

As shown in Table 1, we found that more than 48% of patients were younger than 50 years, patients were between 41–50 years, which is in line with results of Akbari *et al.* study [4]. This confirms breast cancer patients in Iran are relatively young and breast cancer occurs a decade earlier in Iranian women in comparison with women of western countries [15]. In addition, our study provides additional support for a great risk factor for patients living in urban regions, a finding that is consistent with previous studies [16, 17]. Breast cancer shows a large urban-rural difference worldwide [18]. Due to differences in lifestyle, dietary choices, and the environmental pollution in urban life, it was considered as a risk factor for breast cancer incidence in contrast to rural life factor [14, 19, 20]. In contrast, in a study conducted on Chinese women by Liu *et al.* the converse results were reported, where the rural life was considered as a risk factor for breast cancer [11].

Weight gain increases the risk of breast cancer [21]. Weight loss in early adulthood and after menopause is related to reduced breast cancer risk [22, 23]. In contrast, it was confirmed that excess body weight protects against premenopausal breast cancer risk [24]. Our study showed no significant relationship between weights and breast cancer. Besides, previous studies showed that taller women have a higher risk of breast cancer than shorter women [25, 26]. But in our study, there was a significant association between height status of short and the risk of breast cancer. Further studies are needed on the association between height and the risk of breast cancer. High values of BMI are associated with increased risk of breast cancer after menopause [27, 28]. Similar to previous reports, we found an association between increasing BMI and the risk of breast cancer [11, 13]. This is probably due, in part, to higher estrogen levels because fat tissue is the largest source of estrogen in postmenopausal women [22].

The findings of various studies on the relationship of levels of education and breast cancer risk are controversial, but some studies have suggested an association [29, 30]. We found a correlation between low levels of education with an increased risk of breast cancer. In contrast, it was reported that there is no relationship between education status and risk of breast cancer [13, 31]. In keeping, in consistent with Liu *et al.* [11], we also showed a statistical significance difference between awareness level with risk of breast cancer. The high level of awareness about risk factors related to breast cancer and screening may help to prevent/ reduce the risk of breast cancer [32]. Women's job is another factor that we involved in our study and showed a significant association between job status and breast cancer, supporting the results of previous studies [33, 34]. Women in professional and managerial jobs have 1.4-2.0 times greater risk of breast cancer than women in lower-status jobs [35]. A case-control study conducted by Chatchai *et al.* [36] reported an increased risk of breast cancer in women who worked in manufacturing, transport equipment operators and laborers. There was a significant association between the job status of the

employee and the risk of breast cancer. In another word, the job status of the employee is associated with a reduced risk of breast cancer. Researchers believe that employee women generally have higher income and are more likely to use health insurance and spend the most on healthcare [37]. However, it seems that the association of job status with risk of breast cancer remains unknown or controversial [38, 39]. This needs further investigation. It was suggested that higher economic status is associated with increased breast cancer risk [40]. In contrast, our result suggested an association of the economic status of the poor with breast cancer that is consistent with data of Liu and co-workers [11].

The association between reproductive risk factors and breast cancer has previously been reported [41]. As can be seen in Table 2, we found the early menarche increased risk of breast cancer. Correlation between early menarche and increased breast cancer risk may be attributed to the earlier exposure and higher levels of estrogen experienced by women who had early menarche [42]. The results of our study on the age of menarche are consistent with other studies [42, 43]. Breast cancer risk increases with later menopause [44]. Women who experience menopause at age 55 or older have about a 12% higher risk compared to those who do so between ages 50–54 [45, 46]. In our study, we found no significant association between breast cancer risk and late menopauses. This is in good agreement with previous studies [29, 31]. In case of the marital status, in consistent with previous reports [13, 33], we demonstrated that there was no relationship between the marital status with the risk of breast cancer. However, others found a significant correlation between marital status and breast cancer [47].

A growing body of evidence showed that single women have a higher risk of breast cancer than married women [48]. Married, divorced, and widowed women have no inherent differences in their risk of breast cancer than with single women, and that the apparent protective effect of marriage maybe because of the age of their first pregnancy and childbirth [31, 49]. Nulliparous women are more at risk to attain breast cancer than those who have given birth many times. Women having children have 30% reduced risk compared to nulliparous women, in other words with each full-term pregnancy, the risk falls overall by 7% [50]. But in our study, as shown in Table 2, there was no association between the number of children (having or not having children) with breast cancer, which substantiates previous findings in the literature [13, 29]. These findings significantly differ from previous results reported in the literature [11, 31].

Use oral contraceptives pills has been associated with increased risk of breast cancer in young women [51, 52]. The International Agency for Research on Cancer came to deduction that there was sufficient evidence to support combined estrogen–progestin oral contraceptives carcinogenicity in humans, with an increased breast cancer risk [53]. In our study, there was no association between the use the oral contraceptives pills and breast cancer that is consistent with previous reports [54–57]. Similarly, we found no association between abortion and breast cancer, which is consistent with previous studies [11, 54]. To best our knowledge, few studies have been conducted on the association between stillbirth and breast cancer. In a study, a significant association between stillbirth and reduced risk of breast cancer was reported [58]. We also found an association between the stillbirths and increased risk of breast cancer [58]. Breastfeeding has a protective role against risk of breast cancer [59]. In the 47 studies in 30 countries, the risk of breast cancer was reduced by 4% for any 12 months of breastfeeding [59].

Breastfeeding considered as an uncertain protective factor due to indecisive results [60]. But we obtained different results so that, there was no significant association between breastfeeding and breast cancer. Our results share a number of similarities with previous findings [11, 54]. It may discuss that marital status by itself is not a decisive factor for reduced or increased breast cancer risk.

We also investigated an association between chronic diseases and behavioral habits and risk of breast cancer. As shown in Table 3, the hypertension was not associated with breast cancer risk. Our data is consistent with studies conducted by Wang *et al.* [61] and Sun *et al.* [62]. One cohort study, one nested case-control study and ten case-control studies showed that hypertension is associated with increased risk of breast cancer [63]. In addition, in our study, in contrast with literature, there was no significant association between the risk of breast cancer and either diabetes [64–66] or the physical activity [33, 67] and or the smoking status [33, 68]. But we found a significant association between the second-hand smoking and breast cancer, which shares similarity with findings of Reynolds *et al.* [69]. The majority of studies have shown that a family history of breast cancer is one of the major risk factors [24, 25]. In our study, we demonstrated that the family history of breast cancer, in the first degree relatives and second-degree relative was associated with the susceptibility to breast cancer.

We investigated behavioral habits as a risk factor for breast cancer (Table 3). The positive association between unhealthy dietary patterns (low or no consumption of vegetables and fruits, high consumption of high-fat food, fried food and fast food) and breast cancer has been reported [68]. In our study, we found that a healthy dietary was associated with a reduced risk for breast cancer risk, while an unhealthy dietary pattern was increased the risk of breast cancer. Our finding is consistent with previous reports [70, 71]. Increased consumption of fatty, fried, and fast foods should be replaced with an increase intake of fruits and vegetables so that, it is necessary to raise awareness about healthy diets and reduced risk of breast cancer. In some studies, the role of alcohol carcinogens and its association with breast cancer has been addressed [72, 73]. Numerous studies show that alcohol consumption increases the risk of breast cancer in the female by about 7%-10% for each 10 grams of alcohol consumed per day on average [74, 75]. We found a non-significant relationship between alcohol consumption and breast cancer so that consistent with some studies conducted [11, 76].

Our study has some limitations; since the present study is a hospital-based case-control study rather than population-based, it may make selection bias. In addition, it is notable that this hospital treats a part of the breast cancer cases in Arak, Iran. Most of the data were recorded from the women's self-reports, thus bias was more possible; thus participants history records were checked.

Conclusion

In the present study, we showed that breast cancer patients in Iran are relatively young. We found a significant association between risk of breast cancer and urban life, height, BMI, awareness level, job status, economic status, early menarche, second-hand smoking, family history, and behavioral habits. However, we showed that there was no a significant association between breast cancer and such factors

as weight, education level, late menopauses, marital status, the number of children, the oral contraceptives pills, abortion, chronic diseases, alcohol consumption, and breastfeeding. It seems that lifestyle factors exhibit a greater risk than the effects of chronic diseases and reproductive factors for breast cancer of women in Arak, Iran. Therefore, various modifiable factors may participate in the prevention of breast cancer risk in women in Iran. Determining and identifying the risk factors of breast cancer can play an important role in preventing the incidence of this disease so that a screening plan for high-risk female must be put on the agenda.

Abbreviations

BC: Breast Cancer, **BMI:** Body Mass Index, **NA:** Not Available, **CI:** Confidence Interval, **OR:** Odds Ratio

Declarations

Availability of data and materials

The primary data for this study is available from the authors on direct request.

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Contributions

M.P. and J.A. conceived and designed the experiments. M.P performed the experiments. M.P and M. A, validated and analyzed the data and wrote the manuscript. J.R reviewed and edited the manuscript. All the authors discussed and approved the manuscript

Ethics declarations

Ethics approval and consent to participate

This hospital-based and case-control study was approved from the ethics committee of Arak University of Medical Sciences, Arak, Iran (IR.ARAKMU.REC.1395.288).

Consent for publication

Not applicable.

Competing interests

The authors declare that they have no competing interests

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