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RISK FACTORS OF BREAST CANCER AMONG WOMEN ATTENDING BREAST CLINICS IN MOSUL / A CASE CONTROL STUDY

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ABSTRACT

Background: Breast cancer is the most frequently diagnosed malignancy and a leading cause of cancer-related mortality among women worldwide. Its burden is increasing, particularly in low- and middle-income countries, including Iraq. The disease is multifactorial, with contributions from hormonal, reproductive, genetic, and lifestyle-related factors. However, locally generated data on risk factors in Mosul remain limited. **Objectives:** To identify and evaluate the risk factors associated with breast cancer among women attending breast clinics in Mosul. **Methods:** A hospital-based case–control study was conducted from May 1, 2025, to February 1, 2026, at Al-Jamhory and Al-Khansaa Teaching Hospitals in Mosul. The study included 200 women (100 cases with breast cancer and 100 controls). Data were collected using a structured questionnaire covering demographic, reproductive, menstrual, lifestyle, and hormonal factors. Statistical analysis was performed using SPSS version 26. Odds ratios (ORs) with 95% confidence intervals (CIs) were calculated, and a p-value ≤0.05 was considered statistically significant. **Results:** Advanced age (≥65 years) was significantly associated with increased breast cancer risk (OR=5.26, p=0.005). Early menarche (<12 years) (OR=6.38, p=0.0001), late menopause (≥50 years) (OR=2.89, p=0.02), and prolonged reproductive lifespan (>30 years) (OR=5.30, p=0.0001) were significant hormonal risk factors. Delayed age at first full-term pregnancy (≥30 years) markedly increased risk (OR=9.52, p=0.0001), while early pregnancy (<20 years) showed a protective effect. Short duration of breastfeeding (<6 months) was associated with increased risk (OR=4.00, p=0.0001), whereas longer duration was protective. Obesity (BMI 30–39.9) significantly increased risk (OR=2.93, p=0.0001), while normal BMI was protective. Passive smoking was also significantly associated with increased risk (OR=2.19, p=0.02). Prolonged use of oral contraceptive pills (>3 years) increased risk (OR=4.16, p=0.013). No significant association was found with marital status, residence, parity, abortion history, family history, or hormonal therapy. **Conclusions:** Breast cancer risk among women in Mosul is strongly influenced by hormonal and reproductive factors, as well as modifiable lifestyle factors such as obesity and passive smoking. Preventive strategies focusing on lifestyle modification, reproductive health awareness, and early detection are essential to reduce the burden of the disease.

KEYWORDS: Breast cancer; Breastfeeding; Obesity; Reproductive factors; Smoking.

1- INTRODUCTION

Breast cancer is the most often diagnosed cancer and the leading cause of cancer-related death among women globally, making it a major public health concern.[1] According to recent global estimates, it accounts for a significant proportion of new cancer cases and deaths each year, with a rising burden noted in low- and middle-income countries. Demographic transitions, urbanization, and shifts in reproductive and lifestyle habits are all contributing to this upward trend.[2-3] Breast cancer is a multifactorial disease caused by a complex interaction of genetic, hormonal, environmental, and lifestyle risk factors.[4] Non-modifiable risk factors include advanced age, female gender, a family history of breast cancer, and

genetic abnormalities such as BRCA1 and BRCA2. Modifiable factors, on the other hand, play an important role in disease development and provide chances for prevention. These include obesity, physical inactivity, dietary habits, alcohol use, reproductive behaviors (for example, age at menarche, parity, breastfeeding), and the use of hormone therapy.[5-6]

In Middle Eastern countries, including Iraq, the epidemiological profile of breast cancer is characterized by a considerably younger age at diagnosis and, in many cases, more advanced stages at presentation than in Western populations.[6] Breast cancer has become more prevalent in Mosul in recent years, which may be attributed to socioeconomic changes, environmental exposures, and a lack of understanding about early detection measures. Despite this, there is still a scarcity of locally generated data on the particular risk factors related with breast cancer in this group.[7]

Understanding region-specific risk factors is critical for designing tailored prevention efforts, enhancing early detection, and informing public health policies. Case-control studies are especially useful in this context because they enable the discovery and quantification of relationships between possible risk variables and disease occurrence.[8] As a result, the aim of this study is to determine and evaluate the risk factors for breast cancer among women who visit breast clinics in Mosul using a case-control methodology.

2-PATIENTS AND METHODS

An oficial agreement was obtained from the Ministry of Health and Directorate of Health in Mosul before conduction of the present study. A verbal consent was taken from the cases and controls included in the study. The present study is conducted in the Breast clinics at Al- Jamhory and Al-Khansaa teaching hospitals in Mosul city. This is case control study was conducted from 1st of May 2025 to the 1st of Febrauary 2026.

These clinics had filing system for each patient, each file contains complete history about the patient and her complaint. The patient is examined by the specialist, then send for ultrasound or mammography or MRI. The patient may undergo FNA or excisional biopsy as needed, and send for laboratory testing as CBC, renal function test, liver function test and other tests as needed.

If the cancer is diagnosed, the patient is referred for surgical operation according to staging of the tumor after her agreement. After that the patient may be send for chemotherapy, radiotherapy to complete her treatment. Follow up of the patient by her specialist is done in the breast clinic thereafter and every visit is recorded in her file.

The questionnaire form included information in regard to; Patients' age, weight, weight, BMI, occupation, residence, marital status, menstrual history, regularity of periods, obstetric history, hormonal use and contraceptive pills, exposure to Radiation previous Breast Surgery, family history of Breast Cancer, family history of breast cancer, number of family members having breast cancer, first Degree, second degree, age of relative at time of breast cancer diagnosis, family history of other cancer, lifestyle, breast lactation, smoking, alcohol drinking, diet and exercise.

Data analysis were carried out using of Microsoft Office Excel software programs. Data analysis was conducted using the Statistical Package for Social Sciences (SPSS) version 26. Continuous variables were presented as mean ± standard deviation, while categorical variables were reported as frequencies and percentages. Relevant statistical tests were applied as appropriate, with a p-value of ≤ 0.05 considered indicative of statistical significance. Odds ratio (OR) was calculated by using two by two table, the interpretation of the value of odds ratio was as following, if OR =1 it means that the exposure is not related to the disease. when OR> 1, then this indicates that the exposure is positively related to disease. If OR<1, it means that the exposure is negatively related to the disease or protective, with 95% confidence interval (CI) for the results.

3-RESULTS

The distribution of cases and controls by age is shown in Table (3.1). The mean ages of cases was higher than that of controls. The Table shows significant association of age older than 65 years as a risk factor.

Table 3.1: The distribution of cases and controls by age.

Variable	Cases (n=100)		Controls (n=100)		OR	95% CI	P-value
Age Group (Year)	No.	%	Mean	No.			
25-29	0	0.0	0.00	11	0.000	0.000-0.316	**0.001**
30-34	3	3.0	30.33	7	0.411	0.113-1.510	0.194
35-39	8	8.0	37.13	24	0.275	0.119-0.637	**0.002**
40-44	12	12.0	41.50	10	1.227	0.514-2.926	0.651
45-49	22	22.0	47.00	13	1.888	0.900-3.955	0.094
50-54	17	17.0	52.00	8	2.355	0.985-5.618	0.054
55-59	12	12.0	57.00	16	0.716	0.324-1.582	0.415
60-64	10	10.0	62.00	8	1.278	0.496-3.290	0.621
≥65	16	16.0	70.50	3	5.264	1.560-17.360	**0.005**

The study shows that 95% of cases and 93% of controls were married. The rest were either not married, divorced or widow, Table (3.2). No significant difference was found between the distribution of cases and controls regarding marital status. Odds ratio shows that marital status played no significant role in the development of breast cancer.

Table 3.2: Distribution of the study population according to the marital status.

Marital Status	Cases (n=100)		Controls (n=100)		OR	95% CI	P-value
	No.	%	Mean	No.			
Married	95	95.0	93	93.0	1.430	0.461-4.425	0.552
Unmarried	5	5.0	7	7.0			

Table (3.3) reveals that 74% of cases and 83% of controls were residing in an urban area. No significance difference is found between the distribution of cases and controls regarding their locality, so no significant role in developing breast cancer. Table (3.3)- Distribution of the study population according to their Residence (Location).

Table 3.3: Place of residence.

Residence	Cases (n=100)		Controls (n=100)		OR	95% CI	P-value
	No.	%	Mean	No.			
Urban	74	74.0	83	83.0	0.583	0.295 - 1.152	0.212
Rural	26	26.0	17	17.0			

Table (3.4) shows the distribution of cases and controls according to age at first ful term birth. Women who had their first full term birth at age <20 years may have protective effect against breast cancer. Old primi has more than 9.5 times risk of development of breast cancer (OR= 9.52, p= 0.0001). Moreover, the difference between cases an controls regarding the parity was not significant.

Table 3.4: Reproductive history.

Variable	Cases (n=100)		Controls (n=100)		OR	95% CI	P-value
	No.	%	Mean	No.			
Maternal age at first full term birth (Year)							
<20	16	16.0	36	36.0	0.329	0.167-0.66	**0.001**
20-24	22	22.0	31	31.0	0.625	0.33-1.13	0.154
25-29	29	29.0	20	20.0	1.692	0.87-3.29	0.120
≥30	22	22.0	3	3.0	9.522	2.9-31.7	**0.000**
Number of children							
Nulliparous	11	11.0	10	10.0	1.112	0.46- 2.63	0.818
1-3	28	28.0	24	24.0	1.200	0.6- 2.3	0.574
4-6	34	34.0	44	44.0	0.621	0.3 - 1.2	0.109
>7	27	27.0	22	22.0	1.280	0.6- 2.5	0.457

Table (3.5) shows that 46% of cases and 40% of controls reported having a previous history of abortion. The difference was not significant, this factor has no significant association in developing breast cancer.

Table 3.5: Abortion history.

Variable	Cases (n=100)		Controls (n=100)		OR	95% CI	P-value
	No.	%	Mean	No.			
Previous history of abortion							
Present	46	46.0	40	40.0	1.278	0.73-2.24	0.391
Absent	54	54.0	60	60.0			
Number of abortion							
1	20	20.0	20	20.0	0.769	0.33 - 1.80	0.540
2	13	13.0	13	13.0	0.818	0.32- 2.04	0.661
>3	13	13.0	7	7.0	1.857	0.67-5.12	0.239

Table (3.6) depicts the association of breast cancer and age at menarchae. Women who had their first cycle at the age <12 years were significantly 6.3 times more prone to develop breast cancer than other groups (p= 0.0001). Beginning of the cycle at age >15 years could be of protective effect on breast cancer (p= 0.03). Additionally, menopause at age (45-49) seems to be protective against breast cancer (p=0.027), while menopause at age ≥ 50 years played a significant association as a risk factor (OR=2.89, p= 0.02). Further, there was a significant association between the length of time passed since the first cycle and the development of breast cancer, longer duration >30 years had a significant in the development of breast cancer (OR=5.302,p=0.0001). While duration <30 seems to be a protective factor.

Table 3.6: Menstrual history.

Variables	Cases		Controls		OR	95% of C.I	P-value
	No.	%	No.	%			
Age at Menarchae (Year)							
< 12	21	21.0	4	4.0	6.380	2.19-18.41	**0.0001**
12- 14	74	74.0	82	82.0	0.625	0.31-1.22	0.172
≥15	5	5.0	14	14.0	0.323	0.11 - 0.91	**0.030**
Age at Menopause							
(Year) <40	0	0.0	1	1.0	0.230	0.00-2.72	**0.000**
40-44	4	4.0	2	2.0	1.434	0.28- 7.03	0.685
45-49	27	27.0	28	28.0	0.382	0.16-0.90	**0.027**
≥50	26	26.0	9	9.0	2.891	1.18-7.01	**0.020**
Duration of menstruation (Year)							
<15	0	0.0	10	10.0	0.148	0.000- 0.351	**0.001**
15-30	20	20.0	47	47.0	0.280	0.15- 0.53	**0.0001**
>30	80	80.0	43	43.0	5.302	2.82-9.92	**0.000 1**

Table (3.7) shows that majority of both cases (84%) and controls (90%) had a history of lactation, the Table depicts the association between breast cancer and the duration of lactation, women who had duration of lactation less than 6 months were four times more prone to develop breast cancer than women who had longer duration of lactation (OR= 4, p= 0.0001). Duration of lactation for (13-18 months) seems to play a protective role against breast cancer (OR= 0.318, p=0.011).

Table (3.7) Lactational history.

Variables	Cases		Controls		OR	95% of C.I	P-value
	No.	%	No.	%			
History of Lactation							
Present	84	84.0	90	90.0	0.583	0.25-1.34	0.207
Absent	16	16.0	10	10.0			
Duration of Lactation (Month)							
<6	28	28.0	10	10.0	4.000	1.82- 8.78	**0.0001**
6- 12	35	35.0	33	33.0	1.234	0.67- 0.07	0.499
13-18	7	7.0	20	20.0	0.318	0.13-0.79	**0.011**
19-24	13	13.0	26	26.0	0.451	0.21-0.95	**0.034**
>24	1	1.0	1	1.0	1.072	0.11 -10.43	0.961

Table (3.8) shows distribution of the cases and controls according to the body mass index. The Table reveals that normal BMI had a protective effect against breast cancer (OR= 0.098, p= 0.0001). BMI of (30 -39.9) prone a woman to develop breast cancer 2.9 times than others (OR= 2.929, p= 0.0001).

Table (3.8) Body mass index.

BMI (Kg/m²)	Cases		Controls		OR	P-value	95% of C.I
	No.	%	No.	%			
<18.5	1	1.0	2	2.0	0.459	0.064-3.855	0.561
18.5- 24.9	3	3.0	24	24.0	0.098	0.030- 0.319	**0.0001**
25-29.9	41	41.0	47	47.0	0.784	0.449- 1.370	0.393
30-39.9	52	52.0	27	27.0	2.929	1.627-5.274	**0.0001**
≥40	3	3.0	0	0.0	---	---	0.081

Table (3.9) shows that majority of cases (63%) and controls (81%) were non smoker, 31% of cases and 17% of controls were passive smokers, 6% of cases and 2% of controls were active smokers. The Table shows that not smoking plays a protective effect against breast cancer (OR= 0.399, p= 0.005), while passive smoking (OR= 2.194, p= 0.02) seems to be a risk factor.

Table 3.9: Smoking history.

Smoking Habit	Cases		Controls		OR	95% of C.I	P-value
	No.	%	No.	%			
Active	6	6.0	2	2.0	3.128	0.70 - 13.86	0.149
Passive	31	31.0	17	17.0	2.194	1.12- 4.27	0.02
Non smoker	63	63.0	81	81.0	0.399	0.21-0.76	0.005

Table (3.10) indicates that 17% of cases and 10% of controls reported a family history of breast cancer. The difference is of no significant value. The Table shows that 9% of cases and 3% of controls had a first degree relatives with the breast cancer. Similarly 8% of cases and 7% of controls had asecond degree relatives, odd ratio reveals no significant role in the association of breast cancer.

Table 3.10: Family history.

Variable	Cases		Controls		OR	95% of C.I	P-value
	No.	%	No.	%			
Family history of breast cancer							
Present	17	17.0	10	10.0	1.843	0.811-4.183	0.147
Absent	83	83.0	90	90.0			
Degree of family history							
First degree	9	9.0	3	3.0	2.625	0.530-12.660	0.247
Second degree	8	8.0	7	7.0			

Table (3.11) indicates that 27% of cases and also 27% of controls had history of OCP. The Table shows that the women who used OCP more than three years were four times more prone to develop breast cancer than women used OCP for shorter duration (OR= 4.156, p= 0.013).

Table 3.11: Oral contraceptive pills.

Contraceptive pills	Cases		Controls		OR	95% of C.I	P-value
	No.	%	No.	%			
Contraceptive pills history							
Present	27	27.0	27	27.0	1.000	0.50 - 1.82	1.000
Apsent	73	73.0	73	73.0			
Contraceptive pills duration (Year)							
<1	3	3.0	7	7.0	0.357	0.089-1.466	0.161
1-3	8	8.0	13	13.0	0.453	0.151-1.367	0.163
>3	16	16.0	7	7.0	4.156	1.332-12.923	**0.013**

Table (3.12) indicates that 20% of cases and 19% of controls had history of hormonal therapy. The Table shows that no significant association with the use of hormonal therapy and breast cancer.

Table 3.11: Hormonal therapy and duration.

Hormonal therapy	Cases		Controls		OR	95% of C.I	P-value
	No.	%	No.	%			
Hormonal therapy							
Present	20	20.0	19	19.0	1.066	0.55-2.15	0.858
Apsent	80	80.0	81	81.0			
Hormonal therapy (Year)							
<1	1	1.0	3	3.0	0.281	0.037-2.230	0.267
1-3	18	18.0	13	13.0	4.154	0.792-20.772	0.095
>3	1	1.0	3	3.0	0.281	0.037-2.230	0.267

4- DISCUSSION

This case-control study explored the association between a variety of demographic, reproductive, hormonal, and lifestyle factors and the risk of breast cancer among Mosul women. The data demonstrate that breast cancer is a complicated condition caused primarily by cumulative

hormonal exposure, reproductive characteristics, and modifiable lifestyle factors. These findings are generally consistent with recent global and regional evidence.[9-10]

The study found that advanced age (≥65 years) is a significant risk factor for breast cancer. This observation is well corroborated by new epidemiological data, which show that breast cancer incidence rises significantly after the age of 50 due to cumulative exposure to toxins and prolonged hormonal stimulation.[11] Furthermore, regional study has found an increased risk among elderly women.[12]

In terms of sociodemographic variables, this study found no significant association between marital status or place of residence and breast cancer risk. Recent study indicates that these determinants have limited direct biological effect on disease development, but may impact access to healthcare and screening practices.[13]

Reproductive variables were strongly associated with breast cancer risk. Early full-term pregnancy (<20 years) is protective, but delayed first pregnancy (≥30 years) increases the risk greatly. As early pregnancy promotes breast tissue differentiation, lowering the risk of malignant transformation, while delayed pregnancy increases estrogen exposure.[14] While, parity did not demonstrate a significant association, indicating that timing of childbirth may be more relevant than number of births.[15] Additionally, menstrual and hormonal variables were substantially associated with breast cancer risk. Early menarche (<12 years), late menopause (≥50 years), and long reproductive lifespan (>30 years) were associated to higher risk, but late menarche (≥15 years) appeared protective. The hormonal theory of breast cancer suggests that prolonged exposure to endogenous estrogen contributes to carcinogenesis.[16] Large pooled analyses show that both early menarche and late menopause greatly increase the risk of breast cancer.[17]

Lactation was shown to be protective, especially when done over a longer period of time. Women who breastfed for less than 6 months were at significantly higher risk than those who breastfed for longer periods of time. This finding is reinforced by recent study demonstrating that nursing reduces estrogen exposure and promotes differentiation of breast tissue, reducing cancer risk.[16]

Body mass index was also found to be substantially associated with the probability of developing breast cancer. Obesity (BMI 30-39.9) increased the risk, while normal BMI provided protection. This is consistent with recent study which link obesity to increased estrogen synthesis from adipose tissue, particularly in post-menopausal women.[15]

Smoking was another significant factor reported in this investigation. Passive smoking was strongly associated with an elevated risk of breast cancer, but nonsmoking had a protective effect. Recent systematic evaluations confirm that tobacco exposure causes breast cancer through mechanisms like DNA damage and oxidative stress, though active smoking did not approach statistical significance.[18]

In this study, a family history of breast cancer did not significantly increase risk. This finding opposes well-established data that family history is a substantial risk factor.[11] The absence of association in this study could be due to a small sample size, recall bias, or underreporting.

In terms of hormonal exposures, the study discovered that long-term use of oral contraceptives (>3 years) significantly raised breast cancer risk, however overall use was not associated with an increased risk. Comparable study indicates that prolonged exposure to exogenous hormones may raise the risk of breast cancer.[14] Moreover, hormonal therapy did not produce a significant association, which could be attributed to differences in length, kind of therapy, or sample size limits.

The association with grand multiparity observed in this study is also supported by recent evidence suggesting cumulative vascular and metabolic stress as contributing mechanisms.[20]

Chronic hypertension was the most significant medical risk factor found in this analysis (OR = 14.52). This finding is highly confirmed by recent studies. According to a 2024 cohort research, persistent hypertension raises the incidence of preeclampsia by more than five times and is a major contributor to catastrophic maternal outcomes.[21]

Chronic hypertension was a significant medical risk factor (OR = 14.52). This finding is highly confirmed by recent studies. According to a 2024 cohort research, persistent hypertension raises the incidence of preeclampsia by more than five times and is a major contributor to catastrophic maternal outcomes. In contrast, this study found no significant association between diabetes mellitus and renal disease. However, recent study continues to indicate their involvement as contributory variables, particularly when linked to metabolic syndrome or poor glycemic control.[20] The comparatively small sample size may explain the study's lack of significance.

Long interpregnancy intervals were associated to a significantly higher risk of preeclampsia, while shorter intervals were protective. This finding is in line with recent pathophysiology findings supporting the immunological tolerance concept, suggesting that extended intervals may result in a lack of maternal immunological adaptability, increasing vulnerability to abnormal placentation and preeclampsia.[22]

Previous preeclampsia was the strongest predictor in this study (OR = 137.05), indicating a high probability of recurrence. According to a 2024-2025 review, women who have previously had preeclampsia have a much higher chance of recurrence, especially if the disease was diagnosed early or was severe.[23] The combination of preeclampsia and pregnancy-induced hypertension raised the risk, highlighting the necessity of a thorough obstetric history in risk assessment.

Positive family history of preeclampsia and hypertension was found to be strongly related with an increased risk in this study. This is consistent with recent genetic and epidemiological study, which emphasizes the importance of hereditary susceptibility.[22]

Although multiple pregnancy and gestational diabetes had higher odds ratios, they were not statistically significant in this analysis. However, recent studies consistently identifies multiple pregnancy as a risk factor, due to increased placental mass and enhanced antiangiogenic hormones.[17] Similarly, gestational diabetes and preeclampsia are linked via common metabolic and endothelial dysfunction mechanisms.[20]

This study has many limitations that must be addressed when evaluating the results. First, the limited sample size may restrict the statistical ability to detect significant association between less prevalent risk variables like renal disease and autoimmune illnesses. Second, because this is a hospital-based case-control study, there is a risk of selection bias, which may limit the data' applicability to the larger Mosul population. Third, recall bias cannot be ruled out, especially for variables related to previous obstetric and family history. Furthermore, some potential confounding variables, such as body mass index, nutritional status, and comprehensive socioeconomic indicators, were not thoroughly examined.

This study has many limitations that must be addressed when evaluating the results. First, the case-control design is prone to recall bias, especially for self-reported factors including reproductive history, smoking exposure, and contraceptive use. Second, the small sample size may reduce statistical power to identify significant association, particularly for less prevalent risk factors like family history and active smoking. Third, selection bias may have occurred since participants were recruited from breast clinics, which may not accurately represent the broader population. Finally, certain potential confounding variables, such as food habits, physical activity, and genetic susceptibility, were not completely evaluated.

5- CONCLUSION AND RECOMMENDATION

This case-control study found many significant risk factors for breast cancer in Mosul women. Advanced age, early menarche, late menopause, prolonged reproductive lifetime, delayed age at first full-term pregnancy, short nursing length, obesity, passive smoking, and long-term use of oral contraceptives were all significantly associated with an elevated risk of breast cancer. In contrast, early pregnancy, prolonged nursing, and a normal body mass index appeared to be protective. This study found no significant association between sociodemographic characteristics such as marital status and place of residence, as well as family history and hormonal therapy. Overall, the data show that hormonal and reproductive factors, as well as modifiable lifestyle factors, have a significant impact on breast cancer risk among the study women. It is advised that public awareness of breast cancer risk factors, particularly modifiable ones like obesity and passive smoking, be increased, as well as enhancing healthy lifestyle choices including maintaining a normal body weight and increasing physical activity. Efforts should also be directed on increasing prolonged breastfeeding and enhancing reproductive health education. Improving early detection and screening programs, particularly for high-risk groups, is critical. Furthermore, bigger multicenter studies that include additional variables such as genetic and environmental factors are required to gain a more complete understanding of breast cancer risk in the local population.

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