Cancer Research

Iraqi Journal of Cancer and Medical Genetics

Exploring Dietary Patterns and Breast Cancer Risk: Epidemiological Insight from Sulaymaniyah City, Iraq

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Keywords:

Breast cancer,
Breast cancer epidemiology,
Diet,
Invasive ductal carcinoma

Abstract

Objective: An increasing number of women are being diagnosed with breast cancer, which ranks as one of the most common cancers in women globally, particularly in developed nations. Although genetic environmental factors and lifestyle choices are all contributors to breast cancer risk, dietary habits are known to play a modifiable role in both the disease›s prevalence and prognosis; therefore, the aim of this study was to correlate dietary habits with the prevalence of breast cancer in Sulaymaniyah city, Iraq.

Methods: Hiwa Oncological Hospital in Iraq›s Sulaymaniyah City was the site of the research. In all, 301 individuals who received a breast cancer diagnosis between June 2023 and January 2024 were included in the sample size. Patient demographics, medical history, eating habits, and other crucial details related to daily dietary regimens were among the data obtained. Once collected, the data were processed via IBM SPSS Statistics.

Results: Among 301 breast cancer patients, 43.5% were aged 40--49 years, and 85.6% were married. Invasive ductal carcinoma (IDC) is the most prevalent subtype. Most patients (82.7%) followed a balanced diet, with IDC being the predominant subtype (73.9%). The majority (63.5%) consumed fruits and vegetables 1–2 times daily, while only 1% exceeded five servings. Additionally, 58.1% had no dietary restrictions, whereas 29.6% avoided sugar, meat, or fatty foods. It was observed that patients with uncontrolled dietary habits and lower fruit and vegetable intake were more likely to develop invasive breast cancer subtypes.

Conclusion: These results emphasize the necessity of advocating for healthier lifestyles through nutritional habits and screening in order to decrease the increasing breast cancer burden in the region. In order to lower the incidence of breast cancer and improve outcomes, it may be essential to implement dietary interventions and early screening techniques within the population.

Key Dates

Received:
2025-01-06
Revised:
2025-02-20
Accepted:
2025-05-21
Published:
2025-06-04

URL: https://ijcmg.uomustansiriyah.edu.iq/index.php/ijcmg/article/view/403/version/406
DOI: https://doi.org/10.294098780/ff34

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Introduction

One of the most widespread forms of cancer in women is breast cancer (BC) [1]. As it is linked to social psychological variables, unhealthy habits, and environmental circumstances [2], breast cancer accounts for approximately 36% of all cancer diagnoses. The number of women diagnosed with BC in 2018 exceeded 2.089 million globally. This malignant tumor is becoming more common worldwide and is a major public health issue worldwide. However, it is more widespread in industrialized countries than in less developed countries. Notably, in one study, the incidence of cancer in Erbil city (located in the Kurdistan Region) increased from 73 to 174 cases per 100,000 people (2013–2019), whereas that in Duhok city rose from 36 to 85 cases per 100,000 people. Breast cancer was the most common cancer in females, and lung cancer was the most common cancer in males. By 2028, the number of annual cases may reach 4,547 in Erbil and 2,737 in Duhok, highlighting a rising trend [3]. Another study that was conducted in 2023 at Hiwa Hospital reported 3,000 cancer cases, 40% of which were breast cancer cases, and 99% of these patients were women. By mid-2024, 1,416 new cancer cases were registered. This increasing cancer burden emphasizes the need for early detection and improved public health initiatives [4].

Invasive breast cancer and noninvasive breast cancer are the two main types of breast cancer. More precisely, several types of cancer are mucinous carcinoma, medullary carcinoma, tubular carcinoma, infiltrating lobular carcinoma (ILC), lobular carcinoma in situ (LCIS), ductal carcinoma in situ (DCIS), and infiltrating ductal carcinoma (IDC) [5].

The term "noninvasive breast cancer" refers to a type of breast cancer in which the cancerous cells do not spread beyond the ducts and do not expand into the fatty and connective tissue layers surrounding the breast.

[6]. The invasive breast cancer cells are capable of penetrating the lobular and ductal walls of the breast and then progressing to invade the fatty and connective tissue layers that are distributed in the surrounding region [7]. Moreover, lobular carcinoma in situ (LCIS) is characterized by significant proliferation of cells within the breast's lobules [8]. Furthermore, the most common type of noninvasive breast cancer, ductal carcinoma in situ (DCIS), is characterized by its confinement to the breast ducts [9]. Finally, infiltrating lobular carcinoma (ILC) is an alternative term for invasive lobular cancer. The lobules of the breast are the usual starting point for ILCs, but they frequently metastasize or spread to other parts of the body [5]. IDC is the most prevalent form of breast cancer, accounting for 80% of cases [10]. Approximately 10% to 15% of breast cancers are ILCs [11].

Nutrition and diet are acknowledged as important modifiable risk factors that affect the probability of developing breast cancer as well as the prognosis [12]. A report by the American Institute for Cancer Research (AICR) and the World Cancer Research Fund International (WCRF) estimates that adopting a suitable lifestyle—specifically, avoiding the use of tobacco, increasing physical activity, maintaining an optimal body weight, and consuming a nutritious diet—could potentially decrease the incidence of the 13 most commonly diagnosed cancers by 29% [13]. It has been demonstrated that certain components that are part of food provide protective features. This comprises the consumption of freshly picked fruits and vegetables, as well as polyunsaturated fatty acids, along with vitamins C and E, which have been linked to the prevention or slowed progression of breast cancer. [14]. A study revealed that saturated fats, processed meats, and red meat are examples of potentially carcinogenic foods [15]. Another study revealed that diets high in unhealthy fats, low fiber, sugars, and fried foods may increase the risk of breast cancer in the Middle East. In contrast, diets such as Mediterranean and plant-based diets, which are rich in fiber, healthy fats, and vitamins, may reduce risk [16]. Our study aimed to explore and analyze the diet patterns of patients who were diagnosed with different subtypes of breast cancer and were located in Sulaymaniyah city, Iraq.

Methods and Patients

Ethical Consideration

This study was ethically approved by the Hiwa Oncological Hospital Ethics Committee in collaboration with the Sulaymaniyah Health Directorate. Approval was granted under Approval Number HEC-23120-SHD, dated May 15, 2023. All participants provided written informed consent for the use of their anonymized data in research. Confidentiality and data privacy were strictly maintained throughout the study. The data for this research were gathered from Hiwa Oncological Hospital, which is based in Sulaymaniyah city, Iraq. The patients provided consent for the collection of their medical data. The confidentiality of the patients› identities was preserved throughout the procedure. Finally, no third parties unaffiliated with the research or the writing process were given access to any collected

Data collection criteria

This data-centric study commenced in June 2023 and concluded in January 2024. During this period, data from 350 patients were gathered from the Hiwa Oncological Hospital. However, the final data analysis included data from only 301 patients. The data collected included information about the patient›s medical history, common dietary/type constituents, fruit and vegetable consumption rates and dietary constrictions. The included patients were females from Sulaymaniyah City who had been diagnosed only with breast cancer and no other type of cancer and were aged between 18 and 75 years. In contrast, patients with multiple cancers were excluded along with pregnant women and pediatrics.

Inclusion and exclusion criteria

Patients who were exclusively diagnosed with breast cancer, female, aware of their dietary habits and located in Sulaymaniyah city were included in the study. In contrast, patients who had more than one type of cancer, who were pregnant, who were younger than 18 years and who were not aware of their dietary habits were excluded from the study.

Statistical analysis

Descriptive statistics were used to summarize the characteristics of the study population. Categorical variables are presented as frequencies and percentages. The associations between variables were assessed via a chi-square test for independence. Odds ratios (ORs) with 95% confidence intervals (CIs) were computed to determine the likelihood of the outcome in exposed versus unexposed

groups. A P value ≤ 0.05 was considered to indicate statistical significance. All the statistical analyses were performed via IBM SPSS Statistics version 24.

Results

A sample size of three hundred and fifteen eligible patients consented to participate in the research. However, only 301 studies were included in the research according to the inclusion and exclusion criteria of the study. Table 1 summarizes the study participants› baseline information and provides a thorough overview of their demographic attributes. The predominant age group was 40–49 years (43.5%), followed by 50–59 years (26.2%) and 30–39 years (14.6%). Smaller proportions are observed in the 60–69 years (10.6%), 20–29 years (1.0%), and 70 years and above (4.0%) age categories. The participants› mean age and standard deviation were 50.33 ± 29.01 years.

Table 1: Baseline characteristics of the study participants.

Baseline Characteristics		Frequency (%) (n=301)
Age Group (Years)	20 – 29	3 (1.0%)
	30 - 39	44 (14.6)
	40 - 49	131 (43.5)
	50 - 59	79 (26.2)
	60 - 69	32 (10.6)
	70 and above	12 (4.0)
	Mean + SD: 50.33 ± 29.01	
Marital Status	Married	262 (85.6)
	Widow	5 (1.6)
	Separated	3 (1.0)
	Single	30 (9.8)
	Other	1 (0.3)
Menstrual Cycle Status	Medication-induced amenorrhea	185 (60.5)
	Menopause	83 (27.1)
	Premature ovarian failure	18 (5.9)
	Eumenorrhea	14 (4.6)
Receiving Chemotherapy	Yes	206 (67.3)
	No	95 (31.0)
Smoker	Yes	2 (0.7)
	No	297 (97.1)
	Smoked before	1 (0.3)
	Social smoker	1 (0.3)
Alcoholic	No	300 (98.0)
	Before	1 (0.3)
	Yes	0 (0.0)

Regarding their marital status, the majority of the participants were married (85.6%), while smaller percentages were single (9.8%), widowed (1.6%), separated (1.0%), or categorized as other (0.3%). In terms of menstrual cycle status, the largest group of participants experienced medication-induced amenorrhea (60.5%), followed by those who were menopausal (27.1%), had premature ovarian failure (5.9%), or maintained eumenorrhea (4.6%). The data concerning chemotherapy status revealed that 67.3% of the participants had received or had previously received chemotherapy, whereas 31.0% had not. Smoking habits indicate that a vast majority of participants do not smoke (97.1%), with 0.7% currently smoking, 0.3% smoking in the past, and 2.0% being social smokers (smoking only at occasional events). Finally, 98.0% of the participants reported not consuming alcohol, 0.3% reported currently consuming alcohol, and 0.3% reported having consumed alcohol in the past.

Moreover, Table 2 shows the distribution of breast cancer subtypes among patients categorized by age group, marital status, menstrual cycle status, and chemotherapy status. The subgroups included patients with IDC, ILC, DCIS, no remaining invasive or in situ tumor, and combined IDC and ILC. The majority of the patients were aged 40--49 years, with 131 total cases. IDC was the most common subtype across all age groups, particularly 40--49 years (94 cases). On the other hand, married individuals constituted the largest group, with 262 cases, with IDC being the predominant subtype (189 cases). Single individuals accounted for 30 cases, followed by widows (5 cases) and separated individuals (3 cases). There was only 1 case categorized as ‹Other›, where

the patient chose none of the available options. Regarding their menstrual status, the majority of patients experienced medication-induced amenorrhea (185 patients), with IDC again being the most prevalent (140 patients). Additionally, 206 patients received chemotherapy, especially those who were diagnosed with IDC, constituting 163 patients. Ninety-five patients did not undergo chemotherapy, among whom 60 had IDC.

Table 2. The demographic characteristics of the study patients are presented according to their breast cancer subtype.

		IDC[a]	DCIS[b]	ILC[c]	IDC and ILC	IDC and DCIS	NA*	No Residual Invasive or in-suit Tumor	P-Value	N (%)
Age Group	20 - 29	2 (61.1)	0 (0.0)	0 (0.0)	0 (0.0)	1 (0.3)	0 (0.0)	0 (0.0)	0.21	3 (1.0)
	30 - 39	33 (4.7)	1 (0.3)	4 (1.3)	0 (0.0)	5 (1.7)	0 (0.0)	1 (0.3)		44 (14.6)
	40 - 49	94 (1.0)	9 (3.0)	9 (3.0)	0 (0.0)	13 (4.3)	1 (0.3)	5 (1.7)		131 (43.5)
	50 - 59	62 (20.6)	3 (1.0)	4 (1.3)	0 (0.0)	4 (1.3)	1 (0.3)	5 (1.7)		79 (26.2)
	60 - 69	24 (8.0)	1 (0.3)	3 (1.0)	1 (0.3)	1 (0.3)	0 (0.0)	2 (0.7)		32 (10.6)
	70 and above	8 (2.7)	2 (0.7)	1 (0.3)	0 (0.0)	0 (0.0)	1 (0.3)	0 (0.0)		12 (4.0)
Marriage Status	Married	189 (62.8)	16 (5.3)	17 (5.6)	1 (0.3)	23 (7.6)	3 (1.0)	13 (4.3)	0.45	262 (87.0)
	Widow	5 (1.7)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)		5 (1.7)
	Separated	2 (0.7)	0 (0.0)	1 (0.3)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)		3 (1.0)
	Single	26 (8.6)	0 (0.0)	3 (1.0)	0 (0.0)	1 (0.3)	0 (0.0)	0 (0.0)		30 (10.0)
	Other	1 (0.3)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)		1 (0.3)
Menstrual Cycle Status	Medication-induced amenorrhea	140 (46.5)	8 (2.7)	12 (4.0)	0 (0.0)	16 (5.3)	2 (0.7)	7 (2.3)	0.10	185 (61.5)
	Menopause	63 (20.9)	5 (1.7)	4 (1.3)	1 (0.3)	4 (1.3)	0 (0.0)	6 (2.0)		83 (27.6)
	Premature ovarian failure	11 (3.7)	2 (0.7)	3 (1.0)	0 (0.0)	2 (0.7)	0 (0.0)	0 (0.0)		18 (6.0)
	Eumenorrhea	9 (3.0)	1 (0.3)	1 (0.3)	0 (0.0)	2 (0.7)	1 (0.3)	0 (0.0)		14 (4.7)
Receiving Chemotherapy	Yes	163 (54.2)	8 (2.7)	15 (5.0)	0 (0.0)	13 (4.3)	3 (1.0)	4 (1.3)	0.17	206 (68.4)
	No	60 (19.9)	8 (2.0)	6 (2.0)	1 (0.3)	11 (3.7)	0 (0.0)	9 (3.0)		95 (31.6)

Table 3 presents the relationships between dietary patterns and the study participants' characteristics according to the questionnaire and patients' face–face interviews. Cross-tabulation analyses were conducted to explore whether variables such as age group, marital status, menstrual status, and chemotherapy history influenced dietary behavior.

Table 3. Relationships between dietary patterns and patient characteristics

Patients' characteristics	Dietary variables	Key observation
Age group	Type of diet	No big difference. All age groups mostly followed a balanced diet.
	Fruits & vegetables intake	Most patients (in all age groups) ate fruits & vegetables 1–2 times/day.
Marital status	Type of Diet	Married women were more likely to follow a balanced diet.
	Dietary restrictions	Most married women had no dietary restrictions.
Menstrual status	Fruits & vegetables intake	Slightly better intake in medication-induced amenorrhea group, but not major.
	Dietary restrictions	Similar across groups.
Chemotherapy status	Dietary restrictions	Patients on chemotherapy more often avoided sugar/fatty food.

The findings indicate that the majority of patients across all demographic categories followed a balanced diet and consumed fruits and vegetables 1–2 times per day. Compared with single or separated patients, married individuals tend to adopt healthier dietary habits. Menstrual status showed minimal variation in dietary intake, whereas patients who were receiving chemotherapy were more likely to avoid sugar, fatty foods, and meat. Although most associations were not statistically significant, these trends highlight potential behavioral differences within patient subgroups.

On the other hand, Table 4 presents the distribution of breast cancer subtypes among patients categorized by their dietary habits of the last year (1 year duration), which included the type of diet, the frequency of vegetable and fruit consumption per day and diet restrictions. The main key findings include that a balanced diet was the most common, with 249 cases and IDC being the predominant subtype, with 184 cases. Vegetable-only diets were followed by 17 patients, with 14 having IDC. Fruit-only diets were followed by four patients, with 3 having IDC, and light eaters comprised only three patients who were diagnosed with IDC. The rest of the patients (19 patients) reported their type of diet.

Additionally, patients who consumed fruits and vegetables 1–2 times/day composed the largest group, with 191 cases, and IDC was the predominant subtype, with 141 cases. Moreover, 85 patients consumed fruits and vegetables 3–4 times/day, 63 had IDC, and only 3 patients consumed more than five fruits and vegetables/day. However, 22 patients did not consume fruits or vegetables daily, and 16 had IDC.

With respect to diet restrictions, most of the included patients had no dietary restrictions. Approximately 124 patients had IDC, with 88 patients being the predominant subtype. In addition, 89 patients did not consume sugar, meat, or fatty food, whereas 75 patients were restricted from consuming sugar. More detailed data are shown in Table 4.

Table 4. The dietary habits of the recruited patients according to their breast cancer subtype are shown.

Type of diets		IDC	DCIS	ILC	IDC and ILC	IDC and DCIS	NA*	No Residual Invasive or in-suit Tumor	P-Value	N (%)
Common diet constitutes	Balanced diet	184 (61.1)	12 (4.0)	19 (6.3)	0 (0.0)	22 (7.3)	2 (0.7)	10 (3.3)	0.141	249 (82.7)
	Vegetables	14 (4.7)	1 (0.3)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	2 (0.7)		17 (5.7)
	Fruits	3 (1.0)	1 (0.3)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)		4 (1.3)
	Light eater	3 (1.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)		3 (1.0)
	Others	19 (6.3)	2 (0.7)	2 (0.7)	1 (0.3)	2 (0.7)	1 (0.3)	1 (0.3)		28 (9.3)
F&V consumed per day	Doesn't consume	16 (5.3)	3 (1.0)	0 (0.0)	0 (0.0)	1 (0.3)	2 (0.7)	0 (0.0)	0.007*	22 (7.3)
	1-2 times/day	141 (46.8)	9 (3.0)	20 (6.6)	1 (0.3)	11 (3.7)	1 (0.3)	8 (2.7)		191 (63.5)
	3-4 times/day	63 (20.9)	4 (1.3)	1 (0.3)	0 (0.0)	12 (4.0)	0 (0.0)	5 (1.7)		85 (28.2)
	More than 5 times/day	3 (1.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)		3 (1.0)
Diet restrictions	No restrictions	88 (29.2)	7 (2.3)	9 (3.0)	1 (0.3)	12 (4.0)	1 (0.3)	6 (2.0)	0.253	124 (41.2)
	Only meat	1 (0.3)	1 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	1 (0.3)		3 (1.0)
	Only sugar	59 (19.6)	5 (1.7)	5 (1.7)	0 (0.0)	3 (1.0)	0 (0.0)	3 (1.0)		75 (24.9)
	Sugar + Diary products	2 (0.7)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	1 (0.3)		3 (1.0)
	Sugar + Meat + Fatty food	67 (22.3)	2 (0.7)	7 (2.3)	0 (0.0)	9 (3.0)	2 (0.7)	2 (0.7)		89 (29.6)
	Sugar + Meat + Diary products	1 (0.3)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)		1 (0.3)
	Sugar + processed food	3 (1.0)	1 (0.3)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)		4 (1.3)
	Vegetables	1 (0.3)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)		1 (0.3)
	Sugar + Meat	1 (0.3)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)		1 (0.3)

aInvasive Ductal Carcinoma; bDuctal Carcinoma In Situ; cInvasive Lobular Carcinoma; F&V: Fruit and Vegetables; NA*; Not Assigned.
* Indicates significancy.

Finally, the ORs and 95% CIs for the associations between dietary patterns and the presence of IDC were calculated. The comparison between fruit and vegetable consumption of 1–2 times per day versus 3–4 times per day yielded an OR of 0.98 (95% CI: 0.55–1.76), suggesting no significant difference in IDC odds between these groups. Similarly, individuals with no dietary restrictions had lower odds of IDC than those who consumed only sugar did (OR = 0.64, 95% CI: 0.33–1.26), although the confidence interval suggested that this association was not statistically significant. Additionally, individuals with no dietary restrictions had lower IDC odds than did those consuming a diet high in sugar, meat, or fatty foods (OR = 0.78, 95% CI: 0.42–1.45), but this finding did not reach statistical significance, as shown in Table 5.

Table 5. OR and 95% CI for the association between dietary patterns and IDC.

Comparison	OR	95% CI (Lower - Upper)
Fruit and vegetables consumption (1-2 times/day vs. 3-4 times/day)	0.98	0.55 – 1.76
Diet restriction (No restrictions vs. Only sugar)	0.64	0.33 – 1.26
Diet restriction (No restrictions vs. Sugar + Meat + Fatty food)	0.78	0.42 – 1.45

OR: Odds ratio; CI: Confidence Interval.

Additionally, Figure 1 shows the receiver operating characteristic (ROC) curve that illustrates the predictive relationship between selected dietary patterns, specifically fruit and vegetable consumption (1–2 times/day, 3–4 times/day) and dietary restrictions (no restrictions, only sugar, and sugar + meat + fatty food), and the occurrence of IDC. The area under the curve (AUC) was 0.79.

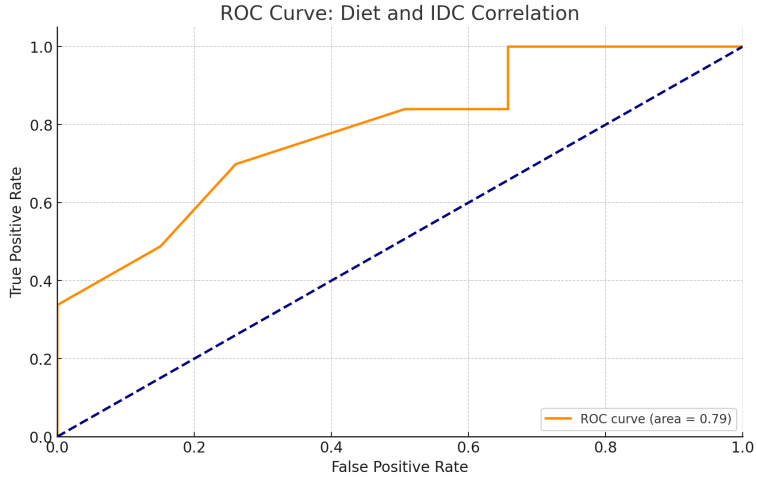

Figure 1: ROC curve that correlates the mentioned diet with IDC occurrence

Discussion

This study investigated the relationship between dietary patterns and breast cancer risk, with a focus on IDC, because it is the predominant subtype of breast cancer in Sulaymaniyah city. By analyzing patient demographics, menstrual cycle status, chemotherapy history, and dietary habits, we aimed to determine how these factors contribute to the prevalence of breast cancer subtypes.

The baseline characteristics of the recruited patients were recorded. The 40--49 years age group comprised the largest proportion of patients (43.5%), followed by the 50--59 years age group (26.2%), with smaller proportions in the 30--39 years (14.6%) and older age groups. The predominance of breast cancer cases in the 40–49 years age group aligns with global data, which suggests that the incidence of breast cancer peaks during perimenopause, particularly in the Middle East [17]. Another study revealed that the age at diagnosis varies less than that in Western countries, especially among 62-year-old Dutch females [18]. This result may be directly or indirectly related to the overall life expectancy difference of 71 years in Middle Eastern countries and 76 years for Americans. In addition, genetics plays a significant role in breast cancer susceptibility; in many populations, the BRCA1 and BRCA2 genes are directly associated with an increased risk of developing breast cancer at an earlier age [19]. BRCA1 and BRCA2 mutations have been linked to breast cancer cases in the Middle East and North Africa, according to a number of studies. This correlation is associated with the early age at which breast cancer cases begin [2022-].

With respect to marital status, the majority (85.6%) of the participants were married, whereas smaller proportions were single (9.8%), widowed (1.6%), or separated (1.0%). Research suggests that married women often have a lower breast cancer risk, possibly due to higher parity and breastfeeding rates, which have protective effects against hormone-dependent cancers [23]. In terms of menstrual cycle status, 60.5% of patients experienced medication-induced amenorrhea, 27.1% were menopausal, and 5.9% had premature ovarian failure. Although hormonal factors are well-established contributors to breast cancer development, postmenopausal estrogen exposure increases the risk of IDC [24]. Moreover, smoking and alcohol consumption are not common among women in

Middle Eastern countries according to multiple studies. [25] According to our statistics, 98% of the cases reported no consumption of beverages containing alcohol, and 97.1% were nonsmokers, suggesting that these statistics may represent cultural traditions rather than a direct influence of these factors on breast cancer development.

Table 2 categorizes breast cancer subtypes by demographic factors. IDC was the most prevalent subtype across all age groups, particularly in the 40–49 years age group (94 cases out of 131 total cases in this group). Similarly, IDC was the dominant subtype among married women, accounting for 189 out of 262 cases. The high incidence of IDC aligns with global data, where IDC constitutes 80% of all breast cancer cases [26].

In terms of menstrual status, patients with medication-induced amenorrhea formed the largest group (185 patients), with IDC present in 140 patients. This finding suggests that treatment-induced hormonal changes may not significantly alter the distribution of IDC.

The cross-tabulation results between patient characteristics and dietary habits are displayed in the revised Table 3. Although patients undergoing chemotherapy were more likely to report dietary restrictions—particularly avoiding sugar, meat, or fatty foods—this association did not reach statistical significance. This may be due to the aggressive nature of IDC, which requires more frequent chemotherapy interventions, as stated by Goldhirsch et al. [27].

In terms of dietary habits and breast cancer subtypes and prevalence, 82.7% of the IDC patients had a balanced diet. With respect to fruit and vegetable consumption, 63.5% of patients consumed fruit and vegetables 1–2 times per day, whereas only 1% consumed more than five servings daily. Given that a higher intake of plant-based foods was associated with reduced breast cancer risk, the relatively low fruit and vegetable intake in this population could contribute to IDC incidence, as proposed by one study conducted by Aune et al. [28].

In terms of dietary restrictions, 58.1% of patients had no dietary restrictions, whereas 29.6% avoided sugar, meat, or fatty foods. The impact of dietary restrictions on the incidence of breast cancer remains controversial, but processed foods and high-fat diets have been linked to increased breast cancer risk, making this an important area for further investigation according to an analysis conducted by Zamzam et al. [29].

Regarding the ORs for dietary habits and IDC presence. The comparison between fruit and vegetable consumption of 1–2 times/day versus 3–4 times/day yielded an OR of 0.98 (95% CI: 0.55–1.76), suggesting no significant difference in IDC odds between these groups. This finding contrasts with global studies suggesting that a diet rich in fruits and vegetables lowers breast cancer risk but may reflect the limited variation in dietary intake among participants [30].

Finally, regarding dietary restrictions, patients with no restrictions had lower IDC odds than those who avoided only sugar (OR = 0.64, 95% CI: 0.33–1.26) and those who avoided sugar, meat, and fatty foods (OR = 0.78, 95% CI: 0.42–1.45). While not statistically significant, this suggests that extreme dietary restrictions may not necessarily reduce breast cancer risk, possibly due to compensatory intake of other unhealthy foods, as concluded by one study [31]. As shown in Figure 1, the AUC was 0.79, indicating a moderately strong ability of these dietary factors to distinguish IDC patients from non-IDC patients. The data suggest that individuals who consume fruits and vegetables 1–2 times/day or who adhere to high-sugar and high-fat diets have a higher incidence of IDC, whereas those with no dietary restrictions or who consume fruits and vegetables 3–4 times/day have a comparatively lower IDC occurrence. This trend may reflect the influence of unhealthy dietary habits on IDC development or could be influenced by confounding factors such as lifestyle or metabolic status.

The absence of statistically significant associations in our study may be due to several factors, including sample size limitations, recall bias in self-reported dietary data, and the complex multifactorial nature of breast cancer. Future research with larger cohorts and more detailed dietary assessments are needed to further investigate these relationships.

Conclusion

This study highlights the impact of dietary habits on the incidence and progression of breast cancer. The findings of this study suggest that those women in this region are about to develop breast cancer at an earlier age than Western populations are, with the most widespread cases being diagnosed in women aged 40--49 years. This early onset may be influenced by a combination of factors, including genetic susceptibilities, lifestyle, and cultural habits, mainly dietary habits. According to the findings of this study, a diet that is high in fruits and vegetables, as well as one that is low in sugar and foods that are high in fat, is directly associated with a lower incidence of breast cancer. In contrast, patients with uncontrolled dietary habits or poor patterns of diet, including low consumption of fruits and vegetables, were more likely to develop invasive breast cancer subtypes, particularly invasive ductal carcinoma (IDC). Future research in Middle Eastern populations is needed to investigate the relationships among dietary habits, genetic factors, and the risk of breast cancer.

Acknowledgment

We would like to extend our heartfelt gratitude to the staff of Hiwa Hospital for Cancer, which is located in Sulaymaniyah city, North Iraq, for their invaluable assistance during the data collection and patient interviews.

Funding

This research received no external funding.

Ethical Approval

This study received ethical approval from the Ethics Committee of Hiwa Oncological Hospital in coordination with the Sulaymaniyah Health Directorate (Approval No. HEC-23120-SHD, dated May 15, 2023). Written informed consent was obtained from all participants for the use of their anonymized clinical data. Patient confidentiality and data privacy were rigorously upheld throughout the study. Data collection was conducted at Hiwa Oncological Hospital, located in Sulaymaniyah, Iraq. Access to identifiable patient information was restricted, and no data were shared with individuals or entities not directly involved in the research or manuscript preparation.

Conflict of interest

The authors declare that they have no conflicts of interest.

Author contributions

H.A.A, G.A.M, D.T.A and R.M.K designed the study, developed the research methodology; R.M.K conducted statistical analyses and interpreted the results; L.I.S, H.A.A and P.F.S participated in data collection; R.S.A, N.S.H.K, H.A.A and B.A.T contributed to writing the results and discussion sections. G.AM, H.A.A and R.S.A conducted the literature review and ensured proper citation of references; all the authors approved the final version for submission.

Data availability statement

Data will be provided by the corresponding author upon reasonable request

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