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Exploratory study of dietary risk factors for breast cancer in women from Annaba region, Algeria.

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ABSTRACT

Introduction: *Breast cancer is a complex disease caused by a variety of factors. Although substantial study has been conducted to uncover several risk factors, it is vital to emphasize that the causes extend beyond environmental impacts and include nutritional considerations.*

Objective: *The purpose of this research is to look at the dietary factors that lead to the development of breast cancer in women living in Algeria's Annaba region. The study included 250 breast cancer patients and 363 healthy women as controls. The patients were drawn from the CLCC's medical oncology department (CHU Ibn Rochd) in the Annaba Wilaya, while the control group consisted of people who had never been diagnosed with cancer before.*

Results: *the study's findings indicate that particular diets may contribute to the prevalence of this illness among women in the study area. These include the consumption of various types of bread, flour-based bread, wheat-based pasta, wheat-based galette, barley-based galette, rice, fruit and vegetables, dried fruit, olive oil, coffee and green tea, potatoes (fried/chips), various pastries, white sugar, and various types of chocolate.*

Conclusion: *The link between breast cancer risk and dietary products has been established, although protective and specific risk factors warrant additional investigation.*

Keywords: *Breast cancer, Risk factors, Dietary factors, Oncology.*

1. INTRODUCTION

Breast cancer is the most frequent cancer in women worldwide, accounting for more than 2.2 million (11.7%) cases in 2020 (IARC). Numerous authors believe it is a complex disease, as thenumber of women affected continues to climb dramatically. In Algeria, the incidence has likewise skyrocketed, with over 12,000 cases reported in 2020 (IARC., 2020). The disease is more common in women than in men. It is difficult to pinpoint the actual origin of this gender gap, as differences in behavior, diet, and environment all have a role. However, we understand that early detection and treatment are critical in the fight against this disease.

Women in Algeria are less likely to receive screening, diagnosis, and treatment, as well as access to high-quality care. Furthermore, societal and cultural factors contribute to decreased awareness. Women with breast cancer frequently suffer in silence due to the shame and stigma associated with the disease. Since the beginning of 2021, 15,000 new cases of breast cancer have been found in the Annaba region, with more than 300 cases being recruited each year (Annaba Cancer Registry).

Numerous epidemiological studies have implicated numerous nutritional variables. The foods we eat, as well as the quantity and quality of nutrients, have been identified as risk factors by researchers. However, there has been limited research in this field in Algeria. Therefore, we set out to investigate the numerous nutritional risk variables associated with breast cancer in Algerian women in the Annaba region.

2. MATERIAL AND METHODS

2.1. Study population

Between February 2020 and December 2022, a case-control research was carried out in the Annaba region of northeastern Algeria. In total, 250 breast cancer patients and 363 age-matched female controls were recruited. The cases were newly diagnosed at the Service d'Oncologie Médicale du Centre de Lutte Contre le Cancer du CHU d'Annaba, the region's onlyoncology center. Controls were chosen at random from women without a history of cancer who were recruited from public clinic.

Cases and controls were told about the purpose of our study and had the option to accept or decline participation. Additional eligibility criteria for cases and controls included the control group being composed of healthy, non-pregnant women capable of providing informed consent.

2.2. Data Collection

During the study, trained investigators interviewed patients and controls in person and gathered data using a questionnaire that included dietary information.

2.2.1. Dietary survey

The nutritional risk factor survey consists of the assessment of women's dietary intake over the last 12 months using a food frequency questionnaire, which was carried out after consulting several research articles on the same subject (Karimi *et al*., 2013; Ahmadnia *et al*., 2016; Heidari *et al*., 2018; El Kinany *et al*., 2018; Khalis., 2019). However, it was developed according to the dietary habits of the Algerian population.

The nutritional survey contained 242 food products, including 32 specific Algerian food groups. A measurement was given for each food, and participants in the study had to choose from eight replies based on frequency(rarely or never, 1-3 times a month, 1 time a week, 2-4 times a week, 5-6 times a week, 1 time a day, 2-3 times a day, 4 or more times a day).

In our study, we considered the main food groups (all types of bread, flour bread, barley cake, wheat cake, wheat pasta, all types of pastry, rice, white sugar, all types of chocolate, dried fruit, coffee, green tea, olive oil, vegetables, potatoes (French fries and potato chips) and fruit.

2.3. Data analysis

The data was processed using the Epi info 7 program version 7.2.6.0. During data analysis, a P value less than or equal to 0.05 was deemed significant. This software was used to discover characteristics related to disease onset. The Chi-Squared test was used to investigate the link between nutritional risk factors and the development of breast cancer.

3. RESULTS

Table 01 displays the frequency distribution of individuals based on diet:

Table.1. Dietary distribution of participants.

Food consumption	cases (N=250)	Controls (N=363)	P
All bread types			***P<10^{-3}***
never/rarely/1 time/month	2 (1%)	29 (8%)	
1-4 times/week	3 (1%)	15 (4%)	
5-6 time/week and 1 time/day	29 (12%)	91 (25%)	
>= 2 times/day	212 (86%)	227 (63%)	
Flour based bread			***P<10^{-3}***
never/rarely/1 time/month	21 (9%)	49 (14%)	
1-4 times/week	24 (10%)	67 (19%)	
5-6 time/week and 1 time/day	33 (14%)	88 (24%)	
>= 2 times/day	166 (68%)	158 (44%)	
Barley cake			***P= 0.02***
never/rarely/1 time/month	225 (99%)	335 (94%)	
1-4 times/week	1 (0%)	15 (4%)	
5-6 time/week and 1 time/day	2 (1%)	5 (1%)	
>= 2 times/day	0 (0%)	2 (1%)	
Wheat cake			***P=0.01***
never/rarely/1 time/month	125 (51%)	152 (42%)	
1-4 times/week	75 (31%)	154 (43%)	
5-6 time/week and 1 time/day	19 (8%)	30 (8%)	
>= 2 times/day	25 (10%)	23 (6%)	
Wheat pasta			***P=0.0001***
never/rarely/1 time/month	120 (50%)	241 (67%)	
1-4 times/week	120 (50%)	121 (33%)	
5-6 time/week and 1 time/day	1 (0%)	0 (0%)	
>= 2 times/day			
All type of pastry			***P=0.001***
never/rarely/1 time/month	67 (27%)	144 (40%)	
1-4 times/week	138 (56%)	182 (50%)	
5-6 time/week and 1 time/day	31 (13%)	33 (9%)	
>= 2 times/day	9 (4%)	3 (1%)	
Rice			***P= 0.01***
never/rarely/1 time/month	67 (27%)	136 (38%)	
1-4 times/week	179 (72%)	222 (61%)	
5-6 time/week and 1 time/day	1 (0%)	3 (1%)	
White sugar			***P<10^{-3}***
never/rarely/1 time/month	21 (9%)	81 (22%)	
1-4 times/week	8 (3%)	21 (6%)	
5-6 time/week and 1 time/day	40 (16%)	96 (27%)	
>= 2 times/day	177 (72%)	164 (45%)	
All types of chocolates			***P= 0.01***
never/rarely/1 time/month	135 (56%)	194 (54%)	
1-4 times/week	72 (30%)	134 (38%)	
5-6 time/week and 1 time/day	22 (9%)	23 (6%)	
>= 2 times/day	13 (5%)	6 (2%)	

Dried fruits			***P= 0.0002***
never/rarely/1 time/month	161 (65%)	176 (49%)	
1-4 times/week	81 (33%)	159 (44%)	
5-6 time/week and 1 time/day	5 (2%)	18 (5%)	
>= 2 times/day	0 (0%)	6 (2%)	
Coffee			$P<10^{-3}$
never/rarely/1 time/month	106 (43%)	102 (28%)	
1-4 times/week	23 (9%)	23 (6%)	
5-6 time/week and 1 time/day	93 (38%)	152 (42%)	
>= 2 times/day	25 (10%)	85 (23%)	
Green tea			$P<10^{-3}$
never/rarely/1 time/month	218 (92%)	256 (71%)	
1-4 times/week	14 (6%)	79 (22%)	
5-6 time/week and 1 time/day	6 (3%)	24 (7%)	
>= 2 times/day	0 (0%)	2 (1%)	
Olive oil			$P<10^{-3}$
never/rarely/1 time/month	136 (56%)	133 (37%)	
1-4 times/week	66 (27%)	75 (21%)	
5-6 time/week and 1 time/day	36 (15%)	105 (29%)	
>= 2 times/day	7 (3%)	47 (13%)	
Vegetables			$P<10^{-3}$
never/rarely/1 time/month	22 (9%)	21 (6%)	
1-4 times/week	205 (86%)	172 (48%)	
5-6 time/week and 1 time/day	9 (4%)	127 (35%)	
>= 2 times/day	2 (1%)	42 (12%)	
Potatoes (fries/chips)			***P= 0.002***
never/rarely/1 time/month	72 (30%)	153 (42%)	
1-4 times/week	169 (70%)	202 (56%)	
5-6 time/week and 1 time/day	2 (1%)	7 (2%)	
>= 2 times/day			
Fruits			$P<10^{-3}$
never/rarely/1 time/month	13 (5%)	20 (6%)	
1-4 times/week	167 (70%)	153 (43%)	
5-6 time/week and 1 time/day	47 (20%)	117 (33%)	
>= 2 times/day	12 (5%)	69 (19%)	

The statistics demonstrate that patients consume **all types of bread** at a considerably higher rate than controls. Indeed, 86% of patients ate bread at least twice daily, compared to only 63% of controls. The change was statistically significant ($P < 0.05$). In addition, 68% of patients ate **flour bread** at least twice a day, compared to 44% for controls. This difference was also statistically significant ($P<0.05$).

Wheat cakes were consumed once to four times a week by 43% of controls and 31% of cases, respectively. However, 51% of patients ate wheat cakes occasionally or rarely, compared to 42% of controls. Furthermore, 10% of patients ate wheat cake twice or more each day, compared to 6% of controls. The difference was statistically significant ($P=0.01$).

As for **wheat pasta**, 67% of controls rarely or never ate it, compared to 50% of cases. In contrast,

an equal number of patients and controls (50%) consumed it one to four times each week. These disparities imply that food choices might play a role in the differences seen between the studied groups, potentially impacting the findings on risk or protective variables associated with specific health disorders. . Furthermore, cases had a lower frequency of wheat pasta consumption compared to controls. A substantially higher proportion of controls (67%) reported eating pasta 1-4 times per week, compared to 50% of patients who indicated they ate itrarely or never. None of the groups ate them five to six times a week or once a day. The association between consuming this food and developing BC is statistically significant (P=0.0001).

For all types of pastry, the differences were statistically significant between cases and controls (P=0.001). We note that 27% of patients reported less frequent consumption than controls, going from never, rarely or once a month, versus 40% of controls. On the other hand, a higher proportion of controls (50%) consumed pastries 1 to 4 times a week, compared with 56% of cases. Controls also show a higher consumption of pastries on a regular basis (5-6 times/week and once a day), while this category is almost absent among cases.

Regarding **rice consumption**, 72% of patients reported regular consumption (1-4 times/week), compared to 61% of controls; 27% of cases consumed rice less frequently (never, rarely, or once a month), as did 38% of controls. The study found a statistically significant difference in rice consumption between the two groups.

In terms of **white sugar consumpti**on, the vast majority of patients (72%) indicated frequent intake (>= 2 times per day), while only 45% of controls reported moderate to low consumption (22% never/rarely/once a month). At P<10-3, statistically significant differences indicate a link between this food and the probability of developing BC.

In regard to **chocolate**, more cases (56%) reported rarely or monthly intake than controls (54%), despite the fact that controls consumed chocolate more frequently on a daily basis. There is a significantly significant difference between the groups of women tested and their intake of all varieties of chocolate (P=0.001).

In the case of **dried fruit**, 65% of patients indicated never, rarely, or once a month consumption, compared to 49% of controls, which was statistically significant (P=0.0002). On the other hand, a greater number of controls (44%) reported regular eating (1-4 times/week) of dried fruit than cases (33%). A P=0.0002 indicates a statistically significant relationship between dried fruit consumption and the categories of women interviewed.

In the case of **coffee**, 43% of patients reported drinking it rarely or once a month, compared to 28% of controls. Conversely, 38% of cases consumed press coffee 5-6 times a week or more, compared

to 42% of controls. This difference could indicate that the two groups consume coffee in different ways, which could have an impact on their health. The difference in coffee intake between the two study groups was statistically significant ($P < 10^{-3}$).

In terms of **green tea** drinking, the majority of patients (92%) indicated infrequent consumption (never, seldom, or once a month), whereas 71% of controls had similar habits. On the other hand, 29% of controls consumed green tea on a regular basis (1-4 times a week or more), compared to only 8% of cases. The variation in green tea intake between the interviewed women was statistically significant ($P < 10^{-3}$).

Olive oil consumption showed significant differences between the two groups studied ($P < 10^{-3}$). Cases had a higher prevalence of occasional (never/rarely/once/month) olive oil consumption (56%) than controls (37%). On the other hand, frequent consumption (5-6 times/week and 1 time/day) is higher in controls (29%) than in cases (15%).

The results show marked differences **in vegetable consumption** between the two studied groups ($P < 10^{-3}$). 86% of patients consumed vegetables regularly (1-4 times/week), compared with 48% of controls. On the other hand, more frequent consumption (5-6 times/week and 1 time/day) is higher in controls (35%) than in cases (4%).

The consumption of potatoes in the form of French fries or potato chips differed significantly between cases and controls (P=0.002). 70% of patients reported regular consumption (1–4times per week), compared to 56% of healthy women. On the other hand, controls had greater rates of occasional intake (never/rarely/once/month) than women with BC (30%).

Fruit intake habits differed significantly between patients and controls ($P < 10^{-3}$). Cases had a higher prevalence of regular (1-4 times per week) fruit eating (70%) than controls (43%). In contrast, controls (33%) consumed more frequently (5-6 times per week and once per day) than patients (20%).

4. DISCUSSION

The economy and food supply of Algeria are significantly influenced by cereals. Around 205kg of cereal products were consumed annually per capita in 2007 (Chehat, 2007). The primary ingredients used to make foods like bread and pasta are wheat and wheat flour (Talamali, 2000; Benbelkacem., *et al*, 1995). Technological developments in the handling and processing of wheat grains have allowed for the development of methods for isolating and discarding the bran and germ, which are vital components that would be lost during the refining process. The traditional human diet consists of bread and pasta, however, some scientists suggest that wheat and flour are

hazardous to our health due to their high carbohydrate content. Indeed, carbohydrates tend to raise our blood sugar levels, which can lead to health problems such as metabolic diseases like diabetes and cancers (EUFIC., 2009 ; Gaskins, AJ *et al*., 2012 ; Mulholland, HG *et al*., 2018).

The findings demonstrate a highly significant ($P<0.05$) consumption of soft wheat cereals (flour bread, semolina cake, and pasta). All types of bread, flour bread, and wheat galette are among the food classes that are consumed more frequently than or equal to two pieces per day; in the cases, this frequency is higher (86%, 68%, and 10%, respectively), compared to the controls (63%, 44%, and 6%, respectively). Regarding the consumption of the relevant foods, there were notable disparities between the two studied groups.

In addition, consumption of wheat pasta (vermicelli, mhamsa pasta, etc.) at a frequency of one to four average plates per week was observed in 50% of cases and 33% of controls. These results conflict with research by Karimi *et al*., 2014 and Ahmadnia *et al*., 2016), which found that eating bread and cereals is a preventive factor that would reduce the risk of contracting this disease to 66%. According Farvid et *al.*, (2016), a significant association between patients and healthy women ($P<0.05$) confirms that eating bread and pasta made with white flour as well as wheat cake increases the risk of BC. On the other hand, consuming white bread is linked to a highly elevated risk of BC.

On the other hand, the same study (Farvid *et al*., 2016) suggests that a high intake of whole grains may be associated with a lower risk of premenopausal breast cancer, as barley grains are an excellent source of dietary fiber, the most common components of which are beta-glucans (CCG, 2009). Barley is a cereal rich in antioxidants that help fight cancer. It also has numerous health benefits, including the prevention of several diseases, such as lowering plasma cholesterol and glycemic index, and boosting the immune system. It is also rich in fiber and contains numerous minerals such as magnesium and zinc (Zhang *et al*., 2016; Crascì *et al*., 2018). In addition, it has been shown by the GCC (2009) that after adding a fibrous fraction of barley to wheat-based bread, this could give the bread additional health benefits thanks to beta- glucans**.**

The study revealed that patients consumed a significantly lower amount of barley (barley cake) than the controls (6% vs. 1%). Between the two groups of women surveyed, there was, in fact,a significant difference ($P<0.05$). This is completely consistent with research that shows barley is a protective factor against breast cancer, as reported by Aune *et al*. (2012), Tayyem *et al*. (2016), Kubatka *et al*. (2016) and Zhang *et al*. (2017).

Compared to controls, patients consumed more white rice. Compared to 61% of healthy women, 72% of patients consumed rice one to four times per week. Several results support our study's data and show a correlation between eating white rice and the risk of breast cancer in obese postmenopausal women (Yun *et al*., 2010; Sanchez *et al*., 2020). Furthermore, improper cooking of rice may increase the risk of cancer since it is a crop that absorbs a significant amount of arsenic

from the soil (Hojsak *et al*., 2015). This suggests that rice consumption may contribute to the development of BC.

In our study, the difference between cases and controls was statistically significant (P<0.05) with regard to rice consumption. This suggests that rice is associated with the development of breast cancer.

Despite concerns about its long-term consumption, research among American men and women found no link between white rice and cancer risk (Zhang *et al*., 2016). Also, the results of a review of 23 articles, showed no conclusive evidence suggesting a correlation between cancer development and rice consumption (Lai *et al*., 2022).

Sweets, such as all varieties of pastry, all varieties of chocolate, and primarily white sugar, are consumed in greater proportions in cases (4%, 5%, and 72%, respectively) than in controls (1%, 2%, and 45%), and with a frequency greater than or equal to twice daily. This suggests that consumption of all varieties of pastry, white sugar, and all varieties of chocolate is linked to an increased risk of breast cancer, with a significant difference between the two groups studied (P<0.05). This aligns with the research conducted by Debras *et al*. (2020) and Marzbani *et al*. (2019) which have shown that consumption of sweet products has a detrimental impact on health. This includes the development of various diseases such as diabetes and cancer.

Moreover, 35% of cases in the same frequency group consumed dried fruit weekly, whereas 51% of control women did so 1-4 times. Data from our study show significant differences in the consumption patterns of these nuts among the various groups investigated (P<0.05), suggesting a possible correlation between this consumption and the incidence of breast neoplasia. This is consistent with recent research showing a 21% reduction in cancer mortality associated with a daily consumption of total nuts at 28 g/day (Bolling *et al*., 2023). The IVW analyses conducted in the Jin *et al*. study (2022) showed a statistically significant correlation between a one-standard-deviation increase in dried fruit consumption and a 53.07% reduction in the incidence risk of breast cancer.

Globally, coffee and green tea are the most popular drinks. In comparison to cases, the percentages of controls' consumption are higher. The results (Table 01) show that whereas only 10% of cases drink coffee, healthy women drink it more frequently (23%)—at least twice a day. Furthermore, only 3% of breast cancer patients drank green tea, compared to 8% of controls who drank it more frequently than five times per week. P<0.05 indicates that there may be a connection between drinking these drinks and developing breast cancer.

Coffee has various biological functions such as antioxidant, anti-inflammatory, anti-mutagenic and anti-carcinogenic activities (Lee *et al*., 2012; Vicente *et al*., 2014). The International Agency for Research on Cancer (IARC., 2016) has established that coffee is not a cancer risk factor. On the other hand, they agree with studies by (Butt and Sultan., 2011; Mirzaei *et al*., 2021; Eldesouki *et al*.,

2022), which confirm that coffee components such as caffestol, kahweol and caffeic acid have anticancer effects due to their antioxidant properties and their ability to inhibit the growth and migration of certain malignant cells. In addition, research by Butt and Sultan (2011) and Kolb *et al*. (2020) concluded that drinking coffee would increase the activation of the Nrf2 factor due to its phytochemical phenolic compounds, thus inhibiting the process of carcinogenesis.

In contrast, a number of epidemiological studies (Folsom *et al*., 1993; Tavani *et al*., 1998; Michels, 2002; Ganmaa *et al*., 2008) have not discovered any correlation between the consumption of coffee or tea and the risk of breast cancer. However, some less recent research (Vatten., 1990; Yang *et al*., 1993), which corroborate our findings, has found that tea's anti- cancer properties are mostly attributed to polyphenols (also known as catechins or flavanols). Furthermore, a recent study (Farvid *et al*., 2021) indicates that while a higher post-diagnosis tea intake may be linked to a longer overall survival; a higher post-diagnosis coffee consumption is associated with improved breast cancer survival.

Olive oil is well known for its health benefits. According to a recent systematic review and meta-analysis, olive oil may have an important role in breast cancer prevention (Markellos *et al*., 2022), which is in perfect agreement with our results, which show a highly significant statistical difference between the two groups of women studied ($P<0.05$).

Indeed, replacing lipids rich in saturated fat with virgin olive oil could reduce the risk of breast cancer (Pelucchi *et al*., 2011; Escrich *et al*., 2011; Demetriou *et al*., 2012).

According to Marzbani *et al*. (2019), fried foods are one of the main dietary risk factors associated with breast cancers. Our results show that consumption of potatoes in the form of French fries and potato chips is significantly more frequent in cases (71%) than in controls (58%), with a frequency of up to four plates per week. Our study reveals a highly significant difference ($P<0.05$), underlining a close relationship between the consumption of French fries or potato chips and the incidence of this breast pathology. These results corroborate several studies (Lee *et al*., 2012; Shi *et al*., 2020) which confirm that consumption of this type of food is an important risk factor for pre-menopausal breast cancer, and exacerbates the risk in post- menopausal women.

Numerous studies confirm the link between prevention of this pathology and regular consumption of fruits and vegetables. Increased consumption of these food groups has been associated with a lower risk of developing various cancers, including breast cancer. According to a number of authors, dietary fibers, vitamins, carotenoids, minerals, and natural antioxidants may have unique or intricate biological actions that prevent the growth of tumors (Baglietto, 2011; Link *et al*., 2013; Sofi *et al*., 2014; Shi *et al*., 2020).

Our study's data indicate a statistically significant difference between the two groups analyzed, indicating a strong correlation between the consumption of these two food types and the occurrence

of BC. This is completely consistent with the literature, which suggests consuming a high intake of these foods to lower the risk of developing this malignant neoplasia (Baglietto., 2011; Link *et al*., 2013; Shi *et al*., 2020; Kazemi *et al*., 2021).

4. CONCLUSION

It is critical to comprehend how dietary variables may affect the risk of BC and to take action to lower that risk and enhance general health. As per the current study's findings, excessive consumption of foods high in saturated and unsaturated fats (such as French fries and chips), wheat-based foods (such as bread, pasta, and cakes), barley cakes, rice, and fiber intake from fruits and vegetables, along with dried fruit, olive oil, coffee, and green tea, are among the nutritional risk factors for breast cancer. Sugar-rich foods, such as all pastries, white sugar, and chocolate in all forms, may also have a role in the development of this malignant breast tumor.

To find additional risk factors and protective factors raising the incidence of BC, more research is required.

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