

ORIGINAL ARTICLE

DIETARY PATTERNS AND RISK OF BREAST CANCER AMONG WOMEN: A CASE-CONTROL STUDY

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Background: Epidemiological studies have shown the robust link between breast cancer and dietary pattern. This study aims to examine the association of breast cancer with dietary patterns among Pakistani women. **Method:** This case-control study was carried out in multiple tertiary care facilities. Newly diagnosed primary breast cancer patients were recruited as cases (n=408); age matched controls (n=408) were randomly selected from the general population. Data on required parameters were systematically collected using subjective and objective tools. Factor and Principal Component Analysis (PCA) techniques were used to extract women's dietary patterns. **Results:** Four dietary patterns were identified based on eigenvalue >1; (i) veg-ovo-fish, (ii) meat-fat-sweet, (iii) mix (milk and its products, and gourds vegetables), and (iv) lentils-spices. Results of the multiple regressions were displayed as adjusted odds ratio (Adj. OR) and their respective confidence intervals (95% CI). After adjusted for potential confounders, veg-ovo-fish dietary pattern was found to be robustly associated with a lower risk of breast cancer among women (Adj. OR: 0.68, 95% CI: (0.46–0.99, $p < 0.01$). **Conclusion:** Attachment to the diets majorly composed of fresh vegetables, and high quality protein sources may contribute in lowering the risk of breast cancer among women.

Keywords: Breast cancer, dietary pattern, women, principal component analysis

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INTRODUCTION

A tumour or lump in the breast resulting from abnormal cell division leads to cancer; its incidence has elevated over the last few decades.¹ A grave public health concern is posed by breast cancer (BC), which is the 2nd highest contributor to the cancer disease load around the world.² Globally, around 2 million women were the victim of BC in 2020, out of whom 0.7 million mortalities took place.³ The rate of BC is expected to be increased worldwide by 46% up to 2040, and thus will be major cause for mortalities among women 2040.⁴ Increasing trend in the BC has also been observed among all age women in Pakistan; every one in nine women falling into the disease at some point, have 2.5 times higher incidence than its neighbour and becoming Asia's country with the highest BC incidence.⁵ Shaukat *et al*⁶ reported that of all the cancers, 34.6% is contributed by BC. They suggested multiple attributable factors for the incidence of BC in different geographical settings.⁶ Commonly reported factors include a broad list of socioeconomic and lifestyle related correlates of BC in different population and sites. In the recent past, behavioural modifications in dietary habits and practices have been observed in association with multiple non-infectious health disorders including BC. The most commonly reported diet related factors for BC incidence include straying away from traditional diets, intake of high animal-sourced foods, vegetable oils, refined sweeteners, and carbohydrates.⁷

Multiple observational studies on dietary characteristics and BC incidence among women have yielded inconsistent outcomes.⁸ There has been negligible research in this area, specifically focused on dietary pattern among women with breast cancer, in the North-west region of Pakistan. This study aims to examine the association of BC with dietary pattern among Pakistani women to explore the women's attachment with different dietary patterns and the risk of BC in the North-west region of Pakistan.

MATERIAL AND METHODS

This case-control study was conducted at Out Patients Department (OPD) of Oncology Units after seeking ethical permission from the concerned bodies. Based on gender, oncologist-confirmed histology, and the presence of initial breast cancer, newly diagnosed (in the last one month) women were selected randomly. Same area residence, age-match (± 2 years) were the prerequisites of the hospital and visitor-based controls. Both cases and controls were exposed to the same risk factors, and the controls were remarkably similar to cases in every aspect except for the presence of the disease. Samples from areas of diversified geography were selected with a sample size of 816 (408 each from cases and controls). Consent from the subjects was obtained. A structured questionnaire was developed on which interviews were conducted with the respondents, to collect data on multiple parameters and dietary characteristics. Women's anthropometric measurements including weight, height, waist and hip circumferences

were taken using standardized tools.⁹ Body mass index (BMI) and waist to hip ratio were calculated.^{10,11}

Data on usual dietary intake was collected using standardized food frequency questionnaire (FFQ). Dietary intake data was used to extract women’s dietary patterns by Principal Component Analysis (PCA) and Factor Analysis (FA).

Data were entered into and analysed on SPSS-20. Data was checked for normality, and entry errors using descriptive statistics such as histogram, mean, frequency, mode, median etc. before analysis. Frequencies and percentages were calculated for categorical variables. Student’s *t*-tests and Chi-square tests were used for the comparisons of means and percentages between the groups. Logistic regression models were used to identify dietary patterns in association with BC. Results of the regression models were expressed as odds ratio (OR) with 95% confidence intervals (CI) adjusted for potential confounders, and $p \leq 0.05$ was taken as statistically significant.

RESULT

Table-1 shows results on socio-demographic characteristics of the groups. Mean differences in age of cases and controls were non-significant. On an average, more cases compared to controls were formally illiterate (59% vs 41%, $p < 0.001$). The occupational status indicates that 53% of BC patients were housewives and 33% were working women. Among healthy individuals, 47% were housewives, and 67% were working. There was a substantially significant ($p < 0.05$) difference in women’s position in occupations. Data regarding marital status showed non-significant differences which indicated that the incidence of breast cancer was also equally prevalent among single/unmarried and married women. Monthly income of the control group was marginally higher in comparison to cases ($p = 0.06$). Results of the current anthropometric status of the groups show that BC patients had higher mean weight (Kg), BMI, waist circumference (WC), and waist-hip ratio (WHR) ($p < 0.05$) as compared to healthy women.

FFQ data was used for identification of dietary patterns using PCA technique. Data suitability for the PCA (was confirmed by Kaiser-Meyer Olkin (KMO) and Bartlett’s Test sampling adequacy measures. Based on a similar nutrient profile, the one hundred and forty-two FFQ food items were classified into 26 food classes. After running the PCA and FA, 4 dietary patterns were extracted based on eigenvalues > 1 . Factors were named according to the food items retained. Figure-1 shows the factor loadings of food items retained in each factors.

Associations of existing dietary patterns with the onset of BC were explored by running adjusted regression models (Table-2). Confounders included

women’s BMI and WC. Women with high attachment (4th quartile) with the Veg-Ovo-Fish patterns were more protective for the onset of BC comparing to their counterparts. These findings remained same in both unadjusted and adjusted analysis (Adj. OR: 0.68, 95% CI: 0.46–0.99, $p < 0.05$). No significant associations of other patterns with the BC were evident ($p > 0.05$).

Table-1: Basic characteristics of the women by case/control status [n(%)]

Characteristics	Mean±SD/n(%)			p
	Total	Cases	Controls	
Age	816	45±6.3	45±2.7	>0.05
Education				
Illiterate	505	297(59)	208(41)	<0.001
<10 years	74	27(37)	47(63)	
10–12 years	141	51(36)	90(64)	
>12 years	96	33(34)	63(66)	
Occupational status				
Housewives	702	370(53)	332(47)	<0.001
Working women	114	38 (33%)	76(67%)	
House hold Income (Rs ×1000) ^a	816	24±1.01	27±1.11	0.06
Marital status				
Single	86	38 (44%)	48 (56%)	0.15
Married	730	370 (51%)	36 (49%)	
Family size ^b	816	7.1±0.21	7.4±0.2	0.19
Anthropometric				
Weight (Kg)	816	64±13	62±12.4	<0.05
Body Mass Index (BMI)	816	24.4±5.0	23.7±4.1	<0.05
Waist Circumference (Cm)	816	82±7.7	80.8±7.7	<0.05
Waist to hip ratio (WHR)	816	0.80±0.0	0.79±0.0	<0.05

^aAverage income in KP (2010–11), i.e., Rs. 20,130, ^bAverage family size in KP, i.e., 7

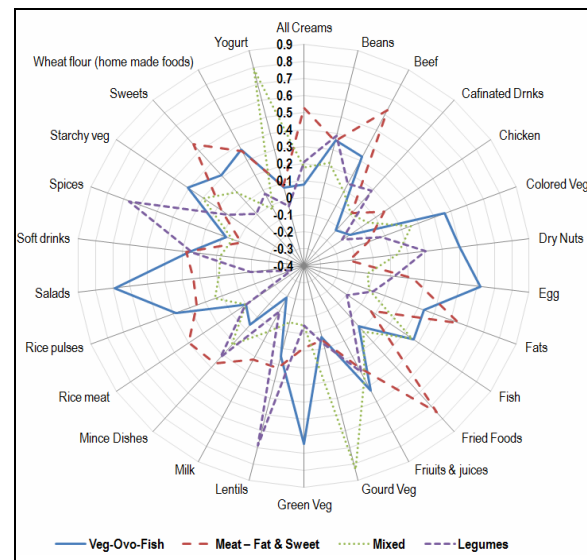


Figure-1: Rotated Factor Loadings of the extracted dietary patterns

a: For simplicity, only classes of foods or averages with absolute values greater than 0.2 were mentioned.

b: Factor scores are the same as a straight line between the food products and the factor. Higher scores mean that the food products have a greater proportion of variation in that factor. The orientation of each food item’s relationship to the element is determined by the sign of the scores.

Table-2: Adjusted OR (95% CI) for breast cancer according to extracted dietary patterns

Dietary Pattern	Quartile	n (%)		OR (95% CI)	
		Cases	Control	Unadjusted	Adjusted*
Veg-Ovo-Fish	1 st quartile	106 (26)	98 (24)	Reference	Reference
	2 nd quartile	113 (28)	91 (22)	1.15 (0.78–1.69)	1.20 (0.81–1.78)
	3 rd quartile	104 (26)	90 (24)	0.96 (0.65–1.42)	1.07 (0.68–1.49)
	4 th quartile	85 (21)	119 (29)	0.66 (0.45–0.98)*	0.68 (0.46–0.99)*
Meat-Fat & Sweet	1 st quartile	86 (21)	118 (29)	Reference	Reference
	2 nd quartile	103 (25)	101 (25)	1.26 (0.51–1.12)	1.28 (0.86–1.89)
	3 rd quartile	108 (27)	96 (23)	1.39 (0.94–2.06)	1.41 (0.95–2.10)
	4 th quartile	111 (27)	93 (23)	1.34 (0.91–1.98)	1.34 (0.90–2.0)
Mixed Pattern	1 st quartile	117 (29)	87 (21)	Reference	Reference
	2 nd quartile	100 (25)	104 (25)	0.75 (0.51–1.12)	0.78 (0.53–1.16)
	3 rd quartile	93 (23)	111 (27)	0.72 (0.47–1.03)	0.73 (0.49–1.08)
	4 th quartile	98 (24)	106 (26)	0.73 (0.49–1.07)	0.73 (0.49–1.08)
Legumes-Spices	1 st quartile	111 (27)	93 (23)	Reference	Reference
	2 nd quartile	110 (27)	94 (23)	1.02 (0.69–1.50)	1.07 (0.72–1.60)
	3 rd quartile	98 (24)	106 (26)	0.80 (0.54–1.18)	0.80 (0.55–1.23)
	4 th quartile	89 (22)	115 (28)	0.70 (0.47–1.03)	0.70 (0.47–1.09)

*adjusted for body mass index, age, family size and total family income

DISCUSSION

Four dietary patterns, namely (i) Ovo-veg-fish, (ii) meat, fat, and sweets, (iii) mixed (gourd, vegetable, and dairy), and (iv) legume and spices, were identified in this study. Women’s anthropometric measurements including BMI, age, family size and total household income were potential confounders for which adjustment were taken in the regression models. Attachment with the dietary pattern ‘Veg-Ovo-Fish’ was found a protective factor for BC in our study. A significant difference in percent women attached with this pattern was evident between the case-control groups. The food items in the current survey were chosen based on their availability and accessibility to the general population living in the study area. A diet constitutes balanced nutrients with diverse food groups such as whole grain (like rice and wheat flour), vegetables/fruits, meat, legumes, milk, and eggs to supply carbohydrates, proteins, fats, and other indispensable nutrients.

There is an association between eating vegetables and having a lower risk of breast cancer as they have anti-carcinogenic compounds like phytochemicals, vitamins C and E, and beta-carotene providing protection by acting as antioxidants on oestrogen metabolism and reducing cell proliferation.^{12,13} The results are statistically at par with a previous study which asserted that eating eggs raises free estradiol levels in the blood, resulting in greater breast cancer prevention.¹⁴ The findings of one study that are similar to our study suggest that the long chain of omega-3 polyunsaturated fatty acids (PUFAs), eicosapentaenoic acid (EPA), and docosahexaenoic acid (DHA), inhibit proliferation by reducing epidermal growth factor receptor and human epidermal growth factor-2 signaling.¹⁵ Dietary heme iron, lipids, and N-glycolylneuraminic acid which is found in red meat are thought to have the potential to boost tumour

growth. Sugar has long been a staple of Pakistani cuisine. This is assumed to be linked to greater insulin sensitivity because of increased sugar consumption leading to higher risk of breast cancer.¹⁶ According to a study, individuals who consume a lot of milk products are more likely to eat a lot of meat or other high-fat foods which can increase their breast cancer risk.¹⁷

Due to a population-based design, a relatively large sample size, together with other strict quality control measures (randomly matching cases and controls, regular evaluation on the quality of collected data, etc.), this study provides reliable evidence on the association of dietary patterns and breast cancer among Pakistani women. Nonetheless, we should keep in mind that the dietary data collected through face-to-face questionnaire interviews might not exactly reflect the real diet due to recall bias.¹⁸ Even though all cases were newly diagnosed; it is possible that subjects will change their dietary habits after being diagnosed with breast cancer. However, women were asked for any modification in the frequency consumption of food items after being diagnosed. Available evidence on the possible mechanism of the observed associations of dietary patterns with breast cancer is still sparse and a potential protective effect of the traditional Pakistani pattern needs to be further studied.

CONCLUSION

Attachment to the diets majorly composed of fresh vegetables, and high quality protein sources may contribute in lowering the risk of breast cancer among women. The vegetable-ovo-fish dietary pattern may protect against breast cancer in women in Pakistan.

LIMITATIONS

The dietary questionnaire did not contain portion size, making it not possible to estimate nutrient consumption.

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