Original Article
DOI: https://doi.org/10.70749/ijbr.v3i3.869

INDUS JOURNAL OF BIOSCIENCE RESEARCH
https://induspublishers.com/IJBR
ISSN: 2960-2793/ 2960-2807

Diet, Dyslipidemia and Breast Cancer: Macronutrients Imbalance as Dietary Risk of Breast Cancer among the Pakhtun Women of Khyber Pakhtunkhwa, Pakistan

Hira Ayub[1], Fazia Ghaffar[1]

[1]Department of Food & Nutrition Sciences, College of Home Economics, University of Peshawar, KP, Pakistan.

ARTICLE INFO

Keywords

Breast Cancer, Macronutrients, Dietary Fats, Body Composition, Anthropometry, Dyslipidemia.

Corresponding Author: Fazia Ghaffar, Department of Food & Nutrition Sciences, College of Home Economics, University of Peshawar, KP, Pakistan.
Email: faziaghaffar@uop.edu.pk

Declaration

Authors' Contribution: All authors equally contributed to the study and approved the final manuscript.

Conflict of Interest: No conflict of interest.

Funding: No funding received by the authors.

Article History

Received: 07-10-2024, Revised: 12-01-2025
Accepted: 01-03-2025, Published: 21-03-2025

ABSTRACT

Breast cancer (BC) is the most prevalent cancer in women and the second foremost reason for cancer-related deaths in after lung cancer. The current study analyzed dietary intake patterns and health indicators of 328 newly diagnosed breast cancer females of Pathan ethnicity at Peshawar district, KP Pakistan. The objectives were to analyze the dietary macronutrient intake patterns and its subsequent effects on the prevalence of dyslipidemia among these breast cancer patients. Participants, selected from Khyber Teaching Hospital, provided data on demographics, anthropometrics and biochemical tests covered random blood glucose and lipid profile. Key findings include a predominantly married sample (98%), with 18.2% from peri-urban areas and 48.2% having laborer husbands. The majority (76.4%) lived in joint family systems with a monthly income below 30 thousand. The mean BMI was 28.368 ± 4.9890, indicating an overweight tendency. Family history revealed conditions like diabetes, hypertension, elevated blood lipids, obesity, and overweight. Blood test results indicated high cholesterol, triglycerides, HDL, and LDL, suggesting generalized body then contribution to overweight and linked to the disease or diet. This study suggests that total dietary fat and its subtypes may increase the risk of breast cancer among Pathan women. A direct association was found between fat intake and BC development. Cautious fat consumption is recommended to reduce risk. Further research is needed, and nutrition education should be prioritized, especially for Pakhtun women, to promote dietary improvements.

INTRODUCTION

The most common disease in women worldwide is breast cancer, which also contributes significantly to the high percentage of cancer-related deaths globally. One out of every eight female patients worldwide are estimated to have breast cancer at some point in her life [1,2]. A combination of genetic predispositions, inadequate or restricted access to healthcare, and modifiable risk factors including nutrition and lifestyle can account for the increased prevalence of breast cancer in low- to middle-income nations like these, including Pakistan. Because of these factors, prevention methods are crucial for the development, progression, prognosis, and causation of breast cancer [3].

Among the risks that can be altered, nutrition is one critical element in causation and carcinogenesis of the breast. Intake of diets characterized by high saturated fat intake, higher red meat intake, and especially refined sugars in combination with low fruit and vegetable intake with whole grains has been linked to a higher incidence of breast cancers [4]. Obesity, which can be due to high-calorie intake and physical inactivity, further increases the risk during menopause, especially in women, where weight gain has been found to appreciably contribute to breast cancer [2]. In contrast, a diet rich in whole grains, fruits, vegetables, nuts, and olive oil with moderate amounts of processed foods was found to have a high survival rate in patients with breast cancer [3].

Dyslipidemia, defined as abnormal lipid profiles with higher triglyceride and LDL cholesterol levels, has also been associated with visceral fat and a high body mass index**.** Dyslipidemia, which was previously believed to be a sign of cardiovascular disease, has also been linked to an increased risk of breast cancer, demonstrating the complex relationship between metabolic health and cancer susceptibility. This has contributed to the region's elevated incidence of breast cancer [6,7].

Copyright © 2024. IJBR Published by Indus Publishers
This work is licensed under a Creative Common Attribution 4.0 International License.

There is interplay between diet, obesity, and breast cancer that calls for more targeted intervention such as nutrition education, weight management programs, and lifestyle modification. In addition to lowering the risk of cancer, this is also enhancing the quality of life and chances of survival for cancer-affected women. Physiologically, breast cancer has high impacts on psychological health, family functioning, and activities generally during the period of treatment for it, thus requiring a multidisciplinary approach to care [8]. The complex relationship between diet and obesity and breast cancer can be comprehended and treated with a focus on the psychological effects on Pakistani women in order to create prevention and management plans that will enhance long-term results.

One of the risk variables that can be changed is food, which is crucial to the development and genesis of breast cancer. Breast cancer risk is linked to poor nutrition and diet, which are heavy in red meat, saturated fats, and added sugars and frequently deficient in fruits, vegetables, and whole grains [4]. According to studies, postmenopausal women who gain weight have a markedly increased risk of breast cancer. This risk is exacerbated by obesity, which is brought on by a diet heavy in calories and poor in physical activity [2]. However, a diet low in processed foods and high in whole grains, fruits, vegetables, nuts, and olive oil has been linked to improved survival rates for breast cancer patients [3].

OBJECTIVES

- To examine the association between dietary patterns and macronutrient-related imbalances and the risk of breast cancer.
- To assess the association of lipid profiles, anthropometric indices and risk of breast cancer.

METHODOLOGY

Study Design & Sampling

The current study was a prospective analytical cross-sectional study which investigated the socio demographic, dietary intake and macronutrient among newly diagnosed breast cancer Pushtun females' patients of KP, Pakistan. A sample of 328 newly diagnosed non-invasive breast cancer were selected randomly based on written consent. Patients were investigated for the ABCD method of nutritional assessment. This study was conducted in the surgical B ward, Khyber Teaching Hospital Peshawar, from October 2022 to January 2023 and the Oncology department of Hayatabad Medical Complex Peshawar. The study was approved by the Institutional Ethical Approval Committee of the College of Home Economics, University of Peshawar (No. 486/H.ECO).

Inclusion Criteria

i. Newly diagnosed breast cancer females.
ii. Women with no comorbidities and recent history of infections
iii. Women age > 18 and <70

Mode of Data Collection

A Self-constructed questionnaire and standardized semi quantitative FFQ were developed to attain required data.

Demographic Data

Demographic section included: marital status, occupation of the patient or spouse or parents, no. of children, residential area, family income, family system, source of income and medical and meditational history of patients.

Anthropometric Measurement

Age

The age of all the respondents was taken in years.

Height

Height was measured by the height board or measuring scales. The patient stood straight against the height board touching her heels near to the board. Height was measured without shoes.

Weight

Weights of all the respondents were taken in kilograms through a weighing machine. The respondents were asked to remove any heavy clothing and respondents were asked to stand still barefooted, with weight disturbed evenly on both feet.

BMI

It is pronounced as Body Mass Index. BMI was calculated through weight and height.
The formula to discover the BMI is:
BMI- weight in (kg)/ (height in inches)

Skin Fold Thickness

With the help of skin fold caliper triceps of patient was calculated.

Mid Upper Arm Circumference

MUAC was determined by measuring the mid upper arm of all the respondents through inch tape.

Waist -to- Hip Ratio

Waist to hip ratio was taken by measuring the hip then waist and then both the values are divided together to determine wait to hip ratio of all the respondents. Formula WHR= Waist Circumference/ Hip Circumference

Body Fat Percentage

The body fat percentage was calculated through the biochemical impedance analyzer (Omron Body Composition Monitor)

Biochemical Analysis

Biochemical data was collected aimed to assess the different values including blood glucose level, lipid

Copyright © 2024. IJBR Published by Indus Publishers
This work is licensed under a Creative Common Attribution 4.0 International License.

profile (High density lipoprotein (HDL), Low density lipoprotein (LDL), and cholesterol, triglyceride).

Dietary Assessment/Food Frequency Questionnaire

In order analyze family and individual dietary intake patterns and determine the inflammatory potential of the diet as the food were divided eight food groups comparing for food frequency was recorded on daily and weekly basis.

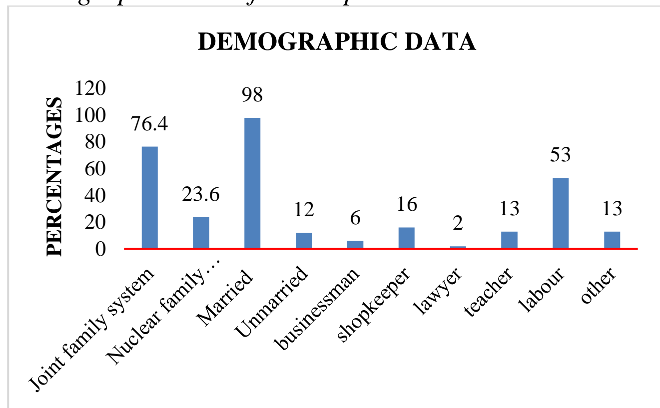
Statistical Analysis

Data was analyzed by using Statistical Package for Social Sciences (SPSS) version 20 for entering and analysis of collected data.

RESULTS

Figure 1

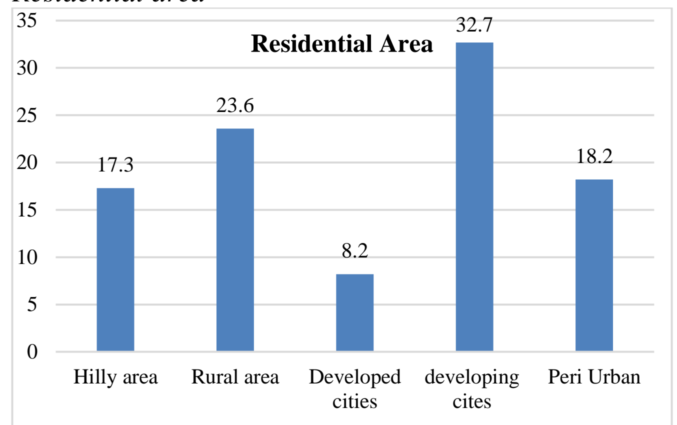
Demographic data of the respondent



The socio-demographic characteristics of participants (Figure – 1), revealed that 76.4% lived in joint/extended families, while 23.6% lived in nuclear families. Marital status indicated 98% of women were married, and 12% were unmarried. The occupation of husbands varied, with 53% being laborers, 16% shopkeepers, 13% in teaching, 6% businessmen, 2% lawyers, and 13% in low-paid jobs. These findings suggest a predominance of participants from extended families with lower monthly income. The socio-demographic characteristics of this study align with findings from similar research. For example [9] reported 75% of breast cancer patients in Qatar lived in extended families, comparable to 76.4% in this study. Marital status also showed similarity, with 92% married in Bener's study versus 98% here. Occupational data were consistent [10], where 50% of husbands were laborers, reflecting socio-economic challenges common in low-income families in these regions.

Figure 2

Residential area



The residential background (Figure -2) showed that 32.7% women belonged toperi urban developing townships and 23.6% belonged to rural areas, 17.3% belonged to hilly areas of KP while 18.2% were from the peri urban developed towns. These findings align [9], who also reported significant socio-economic and geographical influences on health outcomes, with lower-income and rural residents facing greater health challenges.

Table 1

Anthropometric Profiles of the Patients

Parameters	RANGE	Mean±Std. Deviation	P value	Reference Values
Patient age (years)	18 -65	42.7 ± 12.75	---------	----------------
Height of patient (cm)	150.00 - 175.00	159.1027±5.33	.000	159 cm
Weight of patient (kg)	50.00 - 108.00	78.6 ±13.988	.004	59 kg
Body Mass Index	19.5 - 41.7	28.8 ± 4.98	.000	18.5-24.9
Mid Upper Arm Circumference (cm)	7.00 - 38.00	21.18 ± 8.53	.002	12.5 - 13.5 cm
Waist to Hip Measurement	.20 - 1.40	0.919 ± .164	.001	0.9 or lower
Skin Fold Thickness	16.00 - 40.00	26.3300 ± 6.75364	.000	16.5
General Body Fat Percentage	28.00 - 55.00	39.32 ±7.954	.000	21-33 %
Visceral Body Fat Percentage	4 – 15	9.05 ±2.734	.001	1-9

The anthropometric data of breast cancer patients reveals a mean age of 42.7 years (range: 18-65), average height of 159.1027 cm (range: 150.00-175.00 cm), average weight of 78.6 kg (range: 50.00-108.00 kg), and average BMI of 28.8 kg/m2 (range: 19.5-41.7 kg/m2), indicating a prevalence of overweight/obesity in the study population. Additionally, the mean MUAC was 21.18 (range: 7.00-38.00), mean WTH ratio was .0919 (.20-1.40), and average skin fold thickness was 26.3300 (range: 16.00-40.00). The participants had an average general body fat percent of 39.32 (range: 28.00-55.00) and an average visceral body fat percent of 9.05 (range:

Copyright © 2024. IJBR Published by Indus Publishers
This work is licensed under a Creative Common Attribution 4.0 International License.

4-15), highlighting a significant issue of overweight and obesity in this population.

According to Pacholczak's, study the upper body fat, broad shoulders and narrow hips were linked to higher breast cancer risk, especially in premenopausal women with a high waist-to-hip ratio. Postmenopausal women with higher hip-to-shoulder and trunk-to- height ratios had lower risk [10].

Table 2

Biochemical Profiles of the Sample

Tests	Range	Mean± Std. Deviation	P value	Reference Values
Age (years)	18 -70	45.95 ± 12.755	------------	---------------
Lipid Profile				
Cholesterol (mg/dl)	101- 322	222.19±**42.852**	.007	<200
Triglycerides (mmol/L)	70 - 350	232.36 ±58.806	.006	<200
High density protein (mg/dl)	55 - 146	88.61 ± 23.08	.625	35-65
Low density protein (mg/dl)	42 - 208	106.51± 40.433	.682	<150

The biochemical data in the table presents a sample aged 18-73, with a mean of 45.95 ± 12.755. The lipid profile indicates elevated levels, with cholesterol mean and standard deviation of 222.19±42.852, triglycerides at 232.36 ±58.806, and HDL lower than LDL, with means of 88.61 ± 23.08and 106.51± 40.433, respectively. Although the mean and standard deviation fall within the normal range, there is notable variability in range values, likely influenced by some patients with low intake.

The findings of the current study highlight the intricate interplay between lipid profiles, particularly high-density lipoprotein (HDL) and low-density lipoprotein (LDL) levels, and their connection to breast cancer risk, along with their association with obesity, emphasizes the complex relationship between metabolic factors and cancer development. Researches indicated that elevated LDL cholesterol levels may heighten the risk of breast cancer, while higher HDL cholesterol levels may confer a protective effect. The relationship between obesity and altered lipid metabolism further underscores the nuanced connection between metabolic health and cancer susceptibility [11-16]. However, it is crucial to recognize that our understanding of these relationships is still evolving, necessitating additional research to uncover underlying mechanisms and establish causation. Individual variations in genetics, lifestyle, and environmental factors also play a role, highlighting the importance of personalized approaches in cancer prevention.

In the context of breast cancer prevention, addressing lipid profiles and metabolic health becomes paramount alongside traditional risk factors. Lifestyle modifications, such as dietary changes, regular physical activity, and weight management, may potentially influence lipid levels and reduce breast cancer risk. This holistic approach underscores the significance of considering both established and emerging risk factors to enhance our understanding and develop effective strategies for breast cancer prevention.

Dietary Intake

Table 3

Macronutrient Intake of the Sample

Nutrients	Range	Mean ±SD	P-value	Difference	RDA
Calories	1089-4015	2426.99 ±678.850	.079	226	2,200kcal/day
Protein	18.00 - 119	49.99 ±21.73	.004	-5.01	50-60mg/day
Fats	70-214	91.56± 31.71	.027	31.63	45-75gm/day
saturated fatty acids	15- 99	46.63 ±30.76	.908	31.63	<15g/day)
poly unsaturated fatty acids	16.30-87	50.94 ± 24.83	.074	28.94	<22g/day)
monounsaturated fatty acid	22- 134	88.436±44.116	.101	44.44	<44g/day
Carbohydrate	124.8-646.8	370.04±112.48	.094	95.04	225-325gm/day

The table shows that calories intake of higher than recommended daily allowance (RDA) but protein intake was less than the recommended. Fat consumption, including saturated, polyunsaturated, and monounsaturated fatty acids, were well beyond the RDA, suggesting the diet is fat-rich and it is likely to increase health risks such as cardiovascular diseases. Carbohydrate intake was also above the recommended range, suggesting excessive consumption of energy-dense foods. Significant deviations in the dietary consumption of fats and proteins indicate an imbalanced diet, which suggests a need for a change toward nutritional requirements for a healthy diet [11, 17-20].

Table 4

Regression Statistics of the dietary macronutrients as predictors of Dyslipidemia

Coefficients[a]				
Dietary macronutrients	Unstandardized Coefficients	Standardized Coefficients	t	Sig.

Copyright © 2024. IJBR Published by Indus Publishers
This work is licensed under a Creative Common Attribution 4.0 International License.

	B	Std. Error	Beta		
High Density Protein					
1. Carbohydrate	80.716	6.147	.999	13.131	.000
2. Energy	82.669	4.431	.099	18.657	.000
3. Fats	88.424	4.085	-.051	21.645	.000
4. Saturated fatty acid	86.665	2.449	-00.6	35.384	.000
5. Poly unsaturated fatty acid	84.068	3.246	.103	25.895	.000
6. Mono unsaturated fatty acid	81.623	3.158	.206	25.843	.000
Low Density Protein					
1. Energy	102.301	7.784	.060	13.142	
2. Fats	98.140	7.099	.135	13.825	.000
3. Saturated fatty acid	106.538	4.289	-.001	24.837	.000
4. Poly unsaturated fatty acid	100.544	5.661	.138	17.760	.000
5. Mono unsaturated fatty acid	101.284	5.609	.123	18.057	.000
Cholesterol					
1. Energy	170.492	8.261	-.029	20.638	.000
2. Fats	169.246	7.592	-.014	22.294	.000
3. Saturated fats	171.249	4.496	-.147	38.086	.000
4. Poly unsaturated fatty acids	162.188	6.003	.134	27.017	.000
5. Mono unsaturated fatty acids	166.607	5.986	.038	27.833	.000
Triglycerides					
1. Energy	168.415	11.321	-.060	14.876	.000
2. Carbohydrate	172.564	10.352	-.113	16.669	.000
3. Fats	163.479	6.233	-.041	26.227	.000
4. Poly unsaturated fatty acids	159.241	8.303	.049	19.179	.000
5. Mono unsaturated fatty acids	162.756	8.220	-.006	19.799	.000

The regression of dietary micronutrients imbalance (energy, carbohydrates, proteins and fats) with blood lipid profiles of the patients is given in the Table – 4. Health indicators like high-density protein, low-density protein, cholesterol, and triglycerides. Carbohydrates and monounsaturated fats have a substantial positive relationship with high-density protein, while polyunsaturated fats contribute positively to most parameters. Saturated fats are often associated with unfavorable outcomes, particularly cholesterol and triglycerides, where they have strong predictors. Energy consumption has a mixed effect, with good connections for proteins and small negative effects on cholesterol and triglycerides. Overall, the data highlight the distinct and varying impact of various macronutrients on health markers.

Many studies investigated the relationship between dietary macronutrients and serum lipid profiles relating eating more saturated fatty acids (SFAs) was linked to higher levels of low-density lipoprotein cholesterol (LDL-C), but polyunsaturated fatty acids (PUFAs) were linked to reduced triglyceride levels. Furthermore, eating free sugar was linked to higher triglycerides and lower HDL-C levels. These findings suggest that the amount and quality of macronutrients consumed can have a significant impact on lipid profiles, which is consistent with your earlier work on the effects of different fats and carbohydrates on health markers [12, 21-26].

Table 5

Dietary macro nutrients as predictors of anthropometric measurements of the sample

Coefficients[a]						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
Energy						
1.	Weight	945.293	282.892	.009	3.342	.001
2.	BMI	798.267	309.605	.054	2.578	.000
3.	MUAC	972.376	136.896	-.002	7.103	.000
4.	Body fat percentage	1144.604	311.350	-.055	3.676	
5.	Visceral fats	861.866	214.491	.050	4.018	.000
Carbohydrate						
1.	Weight	107.350	22.145	.027	4.848	.000
2.	BMI	93.228	24.199	.081	3.853	.000
3.	MUAC	102.226	10.655	.110	9.594	.000
4.	Body fat percentage	120.060	24.409	-.206	4.919	.000
5.	Visceral fats	91.497	16.675	.130	5.487	.000
Fats						
1.	Weight	61.568	22.576	.030	2.727	.007
2.	BMI	69.600	24.754	-.004	2.812	.006
3.	MUAC	62.872	10.914	.054	5.761	.000
4.	Body fat percentage	58.594	24.876	.039	2.355	.020
5.	Visceral fats	58.605	17.118	.057	3.424	.001

Copyright © 2024. IJBR Published by Indus Publishers
This work is licensed under a Creative Common Attribution 4.0 International License.

Proteins						
1.	Weight	61.619	31.620	-.046	1.949	.054
2.	BMI	43.223	34.691	.102	1.246	.215
3.	MUAC	57.791	15.273	-.076	3.784	.000
4.	Body fat percentage	36.318	34.874	.029	1.041	.300
5.	Visceral fats	42.728	24.026	.017	1.778	.078

The Table – 5 shows how dietary macronutrients (energy, carbs, fats, and proteins) affect anthropometric variables such as weight, BMI, MUAC (mid-upper arm circumference), body fat percentage, and visceral fat. The uncorrected data show that carbs are the strongest predictor of these indicators, similar to their impact in blood lipid profiles such as HDL, LDL, cholesterol, and triglycerides. Carbohydrates frequently exhibit strong positive relationships, notably with MUAC and visceral fat, indicating a major influence on body composition. Fats and proteins have weaker or mixed effects, with proteins exerting the least influence. These findings are consistent with the existing understanding of macronutrient impacts on body composition and blood lipids. Many studies investigated the link between food consumption, inflammation, and cancer development. These studies has shown that Women in the highest quintile of saturated fat intake had a statistically significantly greater risk of BC than those in the lowest quintile. Increases in total and monounsaturated fat intake had also been shown to be associated with greater BC risk. It was postulated that excess dietary fat is more strongly associated with hormone-sensitive than receptor-negative disease. The evidence from prospective epidemiological studies was inconsistent, while case-control studies indicated a statistically significant positive association between fat intake and breast cancer [13, 27-32].

CONCLUSION

The current study can be concluded on the facts that Total dietary fat and its subtypes might increase the risk of BC. We found a direct association between total dietary fat and subtypes of fat intake being a risk of BC development among the pathan women. This initial study provides a strong support for the importance of dietary fat intake in increasing the risk of breast cancer. Therefore, the amount of dietary total fat as well as fatty acids should be recommended with caution to reduce the risk of BC. More intervention and cohort studies are needed considering the effect of dietary fats on cell growth considering different subgroups of BC. The study also highlights the urgent need for nutrition education at all levels and dietary improvements especially among the Pakhtun women of the region.

REFERENCES

1. Hauner, D., Janni, W., Rack, B., & Hauner, H. (2011). The effect of overweight and nutrition on prognosis in breast cancer. *Deutsches Ärzteblatt international*, *108*(47), 795. https://doi.org/10.3238/arztebl.2011.0795
2. Ferrini, K. (2015). Lifestyle, nutrition and breast cancer: Facts and presumptions for consideration. *ecancermedicalscience*, *9*. https://doi.org/10.3332/ecancer.2015.557
3. De Cicco, P., Catani, M. V., Gasperi, V., Sibilano, M., Quaglietta, M., & Savini, I. (2019). Nutrition and breast cancer: A literature review on prevention, treatment and recurrence. *Nutrients*, *11*(7), 1514. https://doi.org/10.3390/nu11071514
4. Rock, C. L., & Demark-Wahnefried, W. (2002). Nutrition and survival after the diagnosis of breast cancer: A review of the evidence. *Journal of Clinical Oncology*, *20*(15), 3302-3316. https://doi.org/10.1200/jco.2002.03.008
5. Kopin, L., & Lowenstein, C. J. (2017). Dyslipidemia. *Annals of Internal Medicine*, *167*(11), ITC81-ITC96. https://doi.org/10.7326/aitc201712050
6. Tall, A. R., Thomas, D. G., Gonzalez-Cabodevilla, A. G., & Goldberg, I. J. (2022). Addressing dyslipidemic risk beyond LDL-cholesterol. *Journal of Clinical Investigation*, *132*(1). https://doi.org/10.1172/jci148559
7. Van Wyk, J., & Carbonatto, C. (2016). The social functioning of women with breast cancer in the context of the life world: A social work perspective. *Social Work/Maatskaplike Werk*, *52*(3). https://doi.org/10.15270/52-3-518
8. Bener, A., Ayoubi, H. R., Ali, A. I., Al-Kubaisi, A., & Al-Sulaiti, H. (2010). Does consanguinity lead to decreased incidence of breast cancer? *Cancer Epidemiology*, *34*(4), 413-418. https://doi.org/10.1016/j.canep.2010.04.004
9. Xiao, Y., Zhao, N., Wang, H., Zhang, J., He, Q., Su, D., Zhao, M., Wang, L., Zhang, X., Gong, W., Hu, R., Yu, M., Ding, G., Cong, L., & Ye, Z. (2013). Association between socioeconomic status and obesity in a Chinese adult population. *BMC Public Health*, *13*(1). https://doi.org/10.1186/1471-

Copyright © 2024. IJBR Published by Indus Publishers
This work is licensed under a Creative Common Attribution 4.0 International License.

2458-13-355

10. Pacholczak, R., Klimek-Piotrowska, W., & Kuszmiersz, P. (2016). Associations of anthropometric measures on breast cancer risk in pre- and postmenopausal women—a case-control study. *Journal of Physiological Anthropology*, *35*(1). https://doi.org/10.1186/s40101-016-0090-x
11. Kelly, R. K., Watling, C. Z., Tong, T. Y., Piernas, C., Carter, J. L., Papier, K., Key, T. J., & Perez-Cornago, A. (2021). Associations between macronutrients from different dietary sources and serum lipids in 24 639 UK Biobank study participants. *Arteriosclerosis, Thrombosis, and Vascular Biology*, *41*(7), 2190-2200. https://doi.org/10.1161/atvbaha.120.315628
12. Lodi, M., Kiehl, A., Qu, F. L., Gabriele, V., Tomasetto, C., & Mathelin, C. (2022). Lipid intake and breast cancer risk: Is there a link? A new focus and meta-analysis. *European Journal of Breast Health*, *18*(2), 108-126. https://doi.org/10.4274/ejbh.galenos.2021.2021-11-2
13. Chajes, V., Thiebaut, A. C., Rotival, M., Gauthier, E., Maillard, V., Boutron-Ruault, M., Joulin, V., Lenoir, G. M., & Clavel-Chapelon, F. (2008). Association between serum trans-monounsaturated fatty acids and breast cancer risk in the E3N-EPIC study. *American Journal of Epidemiology*, *167*(11), 1312-1320. https://doi.org/10.1093/aje/kwn069
14. Cowen, S., McLaughlin, S., Hobbs, G., Coad, J., Martin, K., Olfert, I., & Vona-Davis, L. (2015). High-fat, high-calorie diet enhances mammary carcinogenesis and local inflammation in MMTV-pymt mouse model of breast cancer. *Cancers*, *7*(3), 1125-1142. https://doi.org/10.3390/cancers7030828
15. Cao, Y., Hou, L., & Wang, W. (2015). Dietary total fat and fatty acids intake, serum fatty acids and risk of breast cancer: A meta-analysis of prospective cohort studies. *International Journal of Cancer*, *138*(8), 1894-1904. https://doi.org/10.1002/ijc.29938
16. Hunter, D. J., Spiegelman, D., Adami, H., Beeson, L., Van den Brandt, P. A., Folsom, A. R., Fraser, G. E., Goldbohm, R. A., Graham, S., Howe, G. R., Kushi, L. H., Marshall, J. R., McDermott, A., Miller, A. B., Speizer, F. E., Wolk, A., Yaun, S., & Willett, W. (1996). Cohort studies of fat intake and the risk of breast cancer — A pooled analysis. *New England Journal of Medicine*, *334*(6), 356-361. https://doi.org/10.1056/nejm199602083340603
17. Boyd, N., Martin, L., Noffel, M., Lockwood, G., & Trichler, D. (1993). A meta-analysis of studies of dietary fat and breast cancer risk. *British Journal of Cancer*, *68*(3), 627-636. https://doi.org/10.1038/bjc.1993.398
18. DANDAMUDI, A., TOMMIE, J., NOMMSEN-RIVERS, L., & COUCH, S. (2018). Dietary patterns and breast cancer risk: A systematic review. *Anticancer Research*, *38*(6), 3209-3222. https://doi.org/10.21873/anticanres.12586
19. VEER, P. V., KOK, F. J., BRANTS, H. A., OCKHUIZEN, T., STURMANS, F., & HERMUS, R. J. (1990). Dietary fat and the risk of breast cancer. *International Journal of Epidemiology*, *19*(1), 12-18. https://doi.org/10.1093/ije/19.1.12
20. Gerber, M., & Cenée, S. (1991). The role of fat, animal protein and some vitamin consumption in breast cancer: A case control study in southern France. *International Journal of Cancer*, *48*(1), 1-9. https://doi.org/10.1002/ijc.2910480102
21. Franceschi, S., Favero, A., Russo, A., Decarli, A., La Vecchia, C., Ferraroni, M., Decarli, A., Negri, E., La Vecchia, C., Amadori, D., Conti, E., Montella, M., & Giacosa, A. (1996). Intake of macronutrients and risk of breast cancer. *The Lancet*, *347*(9012), 1351-1356. https://doi.org/10.1016/s0140-6736(96)91008-9
22. Do, M. H., Lee, S. S., Jung, P. J., & Lee, M. H. (2003). Intake of dietary fat and vitamin in relation to breast cancer risk in Korean women: A case-control study. *Journal of Korean Medical Science*, *18*(4), 534. https://doi.org/10.3346/jkms.2003.18.4.534
23. Al Othaimeen, A., Ezzat, A., Mohamed, G., Muammar, T., & Al Madouj, A. (2004). Dietary fat and breast cancer in Saudi Arabia: A case-control study. *Eastern Mediterranean Health Journal*, *10*(6), 879-886. https://doi.org/10.26719/2004.10.6.879
24. Romieu, I., Lazcano-Ponce, E., Sanchez-Zamorano, L. M., Willett, W., & Hernandez-Avila, M. (2004). Carbohydrates and the risk of breast cancer among Mexican women. *Cancer Epidemiology, Biomarkers & Prevention*, *13*(8), 1283-1289. https://doi.org/10.1158/1055-9965.1283.13.8
25. Wang, J., John, E. M., Horn-Ross, P. L., &

Copyright © 2024. IJBR Published by Indus Publishers
This work is licensed under a Creative Common Attribution 4.0 International License.

Ingles, S. A. (2008). Dietary fat, cooking fat, and breast cancer risk in a multiethnic population. *Nutrition and Cancer*, *60*(4), 492-504. https://doi.org/10.1080/01635580801956485
26. Sulaiman, S., Shahril, M. R., Shaharudin, S. H., Emran, N. A., Muhammad, R., Ismail, F., & Husain, S. N. (2011). Fat intake and its relationship with pre-and postmenopausal breast cancer risk: a case-control study in Malaysia. *Asian Pac J Cancer Prev*, *12*(9), 2167-78.
27. Zhang, C., Ho, S. C., Lin, F., Chen, Y., Cheng, S., & Fu, J. (2011). Dietary fat intake and risk of breast cancer. *European Journal of Cancer Prevention*, *20*(3), 199-206. https://doi.org/10.1097/cej.0b013e32834572bb
28. Tayyem, R. F., Mahmoud, R. I., Shareef, M. H., & Marei, L. S. (2019). Nutrient intake patterns and breast cancer risk among Jordanian women: A case-control study. *Epidemiology and Health*, *41*, e2019010. https://doi.org/10.4178/epih.e2019010
29. Howe, G. R., Friedenreich, C. M., Jain, M., & Miller, A. B. (1991). A cohort study of fat intake and risk of breast cancer. *JNCI: Journal of the National Cancer Institute*, *83*(5), 336-340. https://doi.org/10.1093/jnci/83.5.336
30. Byrne, C., Rockett, H., & Holmes, M. D. (2002). Dietary fat, fat subtypes, and breast cancer risk: lack of an association among postmenopausal women with no history of benign breast disease. *Cancer Epidemiology Biomarkers & Prevention*, *11*(3), 261-265.
31. Sieri, S., Chiodini, P., Agnoli, C., Pala, V., Berrino, F., Trichopoulou, A., Benetou, V., Vasilopoulou, E., Sánchez, M.-J., Chirlaque, M.-D., Amiano, P., Quirós, J. R., Ardanaz, E., Buckland, G., Masala, G., Panico, S., Grioni, S., Sacerdote, C., Tumino, R., & Boutron-Ruault, M.-C. (2014). Dietary fat intake and development of specific breast cancer subtypes. *Journal of the National Cancer Institute*, *106*(5), dju068. https://doi.org/10.1093/jnci/dju068
32. Hadmaș, R. M., Popa, A. D., Cherecheș, R. M., & Benedek, A. (2021). The association between food consumption, inflammatory status, and anthropometric development in children aged 6 to 12 years. *Nutrients, 13*(6), 2036.

Copyright © 2024. IJBR Published by Indus Publishers
This work is licensed under a Creative Common Attribution 4.0 International License.