Association of Empirically Derived Food-based Inflammatory Potential of the Diet and Breast Cancer: A Hospital Based Case-control Study

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Research

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Abstract

Background: Diet may be a modifiable factor in the prevention of breast cancer (BC) by modulating inflammation. We used a food-based empirical dietary inflammatory index (FDII) to evaluate the association between FDII and odds of breast cancer in Iranian women.

Methods: The present case-control study carried out on 150 age-matched women with newly diagnosed breast cancer and controls. Data for dietary intake and anthropometric measures were collected. FDII score was developed according to participants dietary intakes of 21 pre-defined food groups. Multivariate odds ratios (OR) with 95% confidence intervals (CI) were used to investigate the association of empirically derived food-based inflammatory potential of the diet and breast cancer.

Results: Our finding indicated that participants in the top tertile of FDII score had a higher odds of breast cancer (OR: 1.73; 95% CI: 1.14 - 2.53, P=0.01) compared with those in the first tertile. . After controlling confounders, multivariate logistic regressions showed in those at the third tertile of FDII chance of breast cancer was 1.7 times higher than those in the first terile (OR: 1.72; 95% CI: 1.12- 2.58, P=0.01).

Conclusions: The results of our study suggested that more pro-inflammatory diets (higher FDII scores) are associated with increased breast cancer risk. These findings suggest that developing an effective dietary modification based on FDII may reduce risk of breast cancer.

Introduction

Currently, cancer is the main reason of death and the most important cause for the decline in life expectancy in all countries of the world (1). In the meantime, breast cancer (BC) ranks as the second most common cancer globally (2) and in women is regarded the most common diagnosed malignancy, that affect all countries at all levels of modernization (3). The global prevalence of female BC is predicted to reach 3.2 million new cases per year by 2050.(4)

The association between inflammation and breast cancer risk has been reported in several studies. For instance, it has been found that the high level of several inflammatory cytokines such as tumor necrosis factor alpha (TNF-α), interleukin 6 (IL-6) and C-reactive protein (CRP) are correlated with the increased incidence, progression and prognosis of BC (5–7). In addition, elevated serum CRP and amyloid A levels are associated with low survival in patients with BC (8). On the other hand, according to the available evidence, diet has a potential to modulate inflammation and serum levels of inflammatory cytokines (9–12). The evaluation of the inflammatory potential of the diet and its modifying and regulating may help to control and modify the concentration of inflammatory biomarkers. To assessment the inflammatory potential of the diet, dietary inflammatory index (DII) based on nutrients has been established (13). However, people consume nutrients together in the form of food group, and then the total quality of the diet should be considered. Tabung et al. created a food-based empirically derived dietary inflammatory index (FDII) (14). Studies based on nutrients do not involve complex intrinsic interactions in diets (15). In other words, there are interactions or a synergistic impact between nutrients affects their absorption.

Additionally, changes in the consumption of certain nutrients or foods are correlated with changes in the consumption of other foods or nutrients. Likewise, following dietary recommendation should be according to food or food groups, not nutrients. Therefore, the whole diet is a more effective approach to appreciation the association between diet and cancer. Therefore, we investigated the association between FDII and BC in a case-control study for the first time in Iranian women.

Methods

Study population

The current case–control study was performed on 150 women 24–73 years old who had been recently diagnosed with BC and 150 seemingly healthy women in cancer research center, Imam Khomeini hospital between September 23, 2017 and June 21, 2018. Cases were referred to us by a pathologist. Through poster installation, seemingly healthy individuals had chosen from other wards of Imam Khomeini Hospital, including dermatology, urology, orthopedic, etc., which had no family relationship with cases. For members of the control group, based on age, one-to-one matching with the case group was performed. In order to decreasing the impact of awareness of breast cancer on patients' dietary reports, only women who were diagnosed with breast cancer in the past 3 months were included in our study. Likewise, we excluded cases and controls if they had medical history or existence of other cancers and controls that had breast cancer history. Prior to participate in the study an informed consent form was signed by all participants. The study was conducted in accordance with the ethical committee of the Tehran University of Medical Sciences (Ethic Number: IR.TUMS.VCR.REC.1396.2880).

Assessment of non-dietary exposures

Two trained interviewers obtained information from individuals by a 45-min structured face to face interview. They administered to cases and controls a structured questionnaire, including information on age (year), BMI (kg/m^2), education (≤ high school or ≥ university degree), marital status (married or single/divorced/widowed), menopause status (yes or no), socioeconomic status (low or high/average), alcohol use (yes or no), smoking (yes or no), vitamin supplements and medication (lipid lowering and anti-hypertensive medications) uses (yes or no), medical history (diabetes, hypertension and hyperlipidemia) (yes or no), history of hormone replacement therapy (HRT) (yes or no) and time of oral contraceptive (OCP) use (year), age at first menarche (year), time since menopause in post-menopausal women (year), weight at age 18 years old (kg), number of child (n), length of breast feeding (year) and family history of BC (yes or no).

Body weight of women was measured with light clothes on, by using a digital weighing scale (Seca725 GmbH & Co. Hamburg, Germany) to the nearest 0.1 kg. Height was measured in a standing position to the nearest 0.5 cm while women wearing no shoes. BMI was calculated by dividing the weight in kilograms by the square of height in meters (kg/m2). Blood pressure was measured by a digital barometer (BC 08, Beurer, Germany) after 10-15-minute seated-rest. Blood pressure was measured twice, and the average blood pressure was reported. Physical activity was determined by a short from International Physical

Activity Questionnaire (IPAQ) to calculate the metabolic equivalent (MET) minute per week (16). MET minute per week (MET/min/wk), the duration and frequency of physical activity days were multiplied by the MET value of the activity. Then, sum of the scores was calculated as the total exercise minute per week.

Assessment of dietary intake

Participants' dietary intake was determined by a semi-quantitative 147-item food frequency questionnaire (FFQ) which previously validated in Iran for energy and nutrient intake (17). The participants reported their frequency of consumption of each food item during the previous year on a daily, weekly, or monthly basis.

Development of FDII

To construct FDII, we applied previous datasets in which foods and food groups associated with systemic inflammation were reported (18). In that study, systemic inflammation was evaluated by assessing serum high sensitive CRP (hs-CRP) status. The foods and food groups in the healthy dietary pattern and the western dietary pattern in that study are considered as anti-inflammatory and pro-inflammatory, respectively. The reason for this division was due to the reverse correlation between a healthy dietary pattern and inflammation and the positive correlation between the western dietary pattern and inflammation. The purpose was to empirically construct a score for overall inflammatory potential of whole diets using food groups. The FDII score includes 21 food groups that evaluate the inflammatory potential of the diet from the lower scores indicate anti-inflammatory diets and higher scores indicate pro-inflammatory diets. 7 anti-inflammatory food including fruits, vegetables, fish, canned fish, poultry, olive, legumes, 14 pro-inflammatory including processed meat, organ meat, egg, snack, mayonnaise, salt, grains, high-fat dairy, boiled potato, oil and butter, coffee, pickles, sweet dessert and fried potato. Then, mean daily intakes were multiplied by their given factor loadings. The overall FDII score for each participant was then computed by summing up the scores of each food and food groups. Finally, the FDII score was divided by 100 to reduce the magnitude of the scores. Similar approaches were used in previous publications on FDII. In the current study, the FDII score ranged from − 8.07 to + 25. The FDII score is the total weight of 21 food groups that higher scores (more positive) indicate pro-inflammatory diets and lower scores (more negative) indicate anti-inflammatory diets.

Statistical analyses

Statistical analysis of data was carried out using SPSS Statistics software version 25. We categorized all individuals based on tertile cut-off points of FDII score. Characteristic and dietary intakes of participants were tested between case and control by Student t tests. Chi-square tests also were performed for comparing qualitative variables. General characteristics of study participants across tertiles of FDII score were presented as means ± SDs for continuous variables and percentages for categorical variables. To examine the differences across tertiles, we used one-way analysis of variance (ANOVA) for continuous variables and chi-square test for categorical variables. Logistic regression was carried out to examine ORs and 95% CIs for Breast Cancer across tertiles of FDII score in the crude and multivariable-adjusted

models. In all these analyses age, physical activity, marital status, smoking status, and energy intake were included in the regression model as confounding variables. P values less than 0.05 was define, a priori, to indicate statistical significant.

Results

The general and sociodemographic characteristics of the study participants between apparently healthy controls and cases with BC are presented in ***Table 1***. The mean age of the women in current study was 46±10.74 years. The mean energy intake was significantly higher in healthy women (2914.16±1159.02) compared to women with breast cancer in case group (2660.3 ± 799.6) (P_{value}= 0.02). Compared to controls (45.90±5.22), cases (48.38±4.60 (at the onset of menopause were older (P_{value}= 0.008) and the family history of breast cancer was significantly higher in the case group (P_{value}= 0.01). The number of children, the years of breastfeeding, in the case subjects were lower than in the control subjects, but statistically this difference was not significant.

Data for general characteristics of the study participants across tertiles of FDII score is shown in ***Table 2***. It was observed that through tertiles of FDII, the dietary intake of energy was significantly increased (P_{value}= 0.008). Likewise, participants in the highest tertile had lower dietary supplement intake than those in the lower tertile (P_{value}= 0.01). There was no significant across tertiles of FDII scores in terms of other variables.

Table 3 presents Mean intakes of foods and food groups between apparently healthy controls and cases with BC. The mean consumption of canned fish, boiled potatoes was significantly lower in the cases than in the controls subjects (P_{value}= 0.04). In the mean consumption of other foods and food groups, no statistically significant difference was observed between the two groups.

Table 4 reported distribution of dietary characteristics across tertiles of FDII score. Participants in the highest tertile of this score had significantly higher intakes of eggs (P_{value}= 0.01), high fat dairy, grain, coffee, sweet dessert, mayonnaises, salt, oil and butter (P_{value}= 0.00), pickles (P_{value}= 0.02) and lower intakes of fruits (P_{value}= 0.00). Indeed a higher FDII score was significantly associated with higher intakes of eggs, high fat dairy, grain, coffee, sweet and dessert, mayonnaises, salt, pickles, oil and butter and lower intakes of fruits.

The multivariate-adjusted odds ratios (OR) of BC according to tertiles of FDII by multivariate logistic regression models are provided in ***Table 5***. We observed that either in crude or in adjusted models, there was significant association between FDII score and odds of BC. In the crude model, participants in the highest tertile of FDII score had greater odds for breast cancer (OR: 1.73; 95% CI: 1.14 – 2.53, P=0.01) compared with participants in the lowest tertile. After adjustment for controlling for potential confounders including age, energy, education, marital status, occupation and income status, alcohol use, smoking, vitamin supplements, history of HRT and OCP use, first menstruation age, medical history and menopause status in first model, individuals in the top tertile of FDII score had higher odds of BC (OR:

1.71; 95% CI: 1.11- 2.55, P=0.01). This correlation remained significant even after adjustment for BMI (OR: 1.72; 95% CI: 1.12- 2.58, P=0.01).

Discussion

We carried out a case-control study, utilizing a food-based dietary inflammatory index to determine the inflammatory potential of diet and clarify its role in BC. This study provides evidence that more pro-inflammatory diet (higher tertile of the FDII) is statistically significant associated with BC risk.

Indeed, the incidence of BC has increased (19, 20). Therefore, finding prevention approaches is so important. Among the factors that can play a role in the development of BC, diet is recognized as a modifiable risk factor for BC. So that reported nearly one-third of BC can be prevented by dietary rectification (21). Various studies have been conducted on diverse aspects of diet and its association with BC. Several previous studies have been performed on the impact inflammatory potential of the diet by nutrient-based DII and breast cancer (22–24). In this regard, Haung et al., in a case-control study of a total of 867 cases and 824 controls proposed that higher DII scores, corresponding to more pro-inflammatory diets, were positively associated with BC risk among Chinese women (25). In a Swedish cohort of 49,258 women, among whom 1895 incident BC positive association were observed between DII and breast cancer, with somewhat stronger associations in postmenopausal women (26). Additionally, in another cohort of 34,700 women, aged 55–69 years showed positive associations between DII scores and BC risk (24). The outcomes of a recent meta-analysis including seven observational studies involving 319,993 participants suggested more pro-inflammatory diets (higher DII scores) are related with 25% increased BC incidence (27). In contrast, Tabung et al., in a large prospective investigation of pre-diagnosis dietary inflammatory potential in postmenopausal women observed a more pro-inflammatory diet was not associated with higher risk of BC incidence. However, there was a significantly higher risk of BC death with higher baseline DII scores (28). In a German population-based case-control study, 2887 postmenopausal BC patients aged 50–74 years and 5,512 healthy age-matched controls suggested no significant between the energy-adjusted-DII and postmenopausal BC (29). Likewise, Gardeazabal et al., among 10,713 middle-aged Spanish female university graduates from the SUN cohort observed no statistically significant association between a more pro-inflammatory diet and overall risk of BC (30). Contradictory results in association between DII and BC in various studies may be due to inconsistencies in breast cancer biology, differences in socio-demographic characteristic, ethnicity, study design type, or study population.

The outcomes of most researches supports that the inflammatory potential of diet is an influential factor in systemic inflammation. However, all of these investigates have centralized on the association between nutrient-based DII and BC. There is no previous study that examined the association of food-based DII and odds of BC. Both indicators estimate the inflammatory potential of the diet; however vary in notion and design. Studies based on nutrient-based DII provide valuable data, but the food-based DII score and other dietary patterns according to food groups are more practical for adherence to dietary recommendation to achieve optimal health, and are more relevant to dietary guidelines for health

promotion and disease prevention.. Based on the findings of the present study, to reduce the incidence of BC, people are recommended to consume anti-inflammatory food groups including fruits, vegetables, fish, canned fish, poultry, olive, legumes and restrict the use of pro-inflammatory food groups including processed meat, organ meat, egg, snack, mayonnaise, salt, grains, high-fat dairy, boiled potato, oil and butter, coffee, pickles, sweet dessert and fried potato.

Several biological mechanisms may elucidate the higher BC incidence among women with higher pro-inflammatory diet consumption. A large body of existing literature reports the positive correlation between inflammatory potential of diet and cytokine levels including IL-6, CRP and TNF-α (31–34). High levels of several cytokines, including CRP, IL-1β, IL-6 and TNF-α, have been shown to play a substantial role in greater risk of BC (8, 35–37). Cytokines are involved in cell growth, angiogenesis, proliferation, metastasis and apoptosis prevention (5, 38–40). It has also been proposed that immunosuppressive properties and up-regulation of oncoproteins due to chronic inflammation may contribute to the development of BC (41, 42).

Strengths And Limitations

This is the first study looking at the association between FDII and BC.We use of a validated and reliable FFQ. The questionnaire, containing 147 items, has been developed especially to estimate the food items consumed in Iran (17). Additionally, reduced the potential for residual confounding by collecting comprehensive data on diet and important variables. Also, we adjusted for several known confounder which may impression breast cancer. However, our study is not without limitations. We cannot totally intercept confounding by unmeasured variables, although adjusted for some potential confounding variables. Due to the design of the control case, it is not possible to distinguish the right temporal association between the inflammatory potential of the diet and BC risk. Additionally, recall bias was inevitable, but applying reliable FFQs by trained interviewers setting might have further decreased the recall bias.

Conclusion

In summary, a pro-inflammatory diet, as indicated by higher FDII scores was positively associated with BC. Longitudinal studies are needed for confirm our findings.

A List Of Abbreviations

FDII: Empirically derived Dietary Inflammation Index; BC: Breast Cancer; TNF-α: Tumor Necrosis Factor Alpha; IL-6: Interleukin 6; CRP: C- reactive protein; hs-CRP: High Sensitive CRP; DII: Dietary Inflammatory Index; OR: Odds Ration; CI: Confidence Interval; FFQ: Food Frequency Questionnaire; BMI: Body Mass Index

Declarations

Ethics approval and consent to participate

The study was conducted in accordance with the ethical committee of the Tehran University of Medical Sciences (Ethic Number: IR.TUMS.VCR.REC.1396.2880).

Consent for publication

All authors agree to publish this article.

Availability of data and materials

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Competing interests

The authors declare that they have no competing interests.

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Authors' contributions

Mahtab Ghanbari and Sakineh Shab-Bidar contributed to conception/design of the research; Mahtab Ghanbari and Hossein Shahinfar contributed to acquisition, analysis, or interpretation of the data; Mahtab Ghanbari drafted the manuscript; Sakineh Shab-Bidar and Hossein Imani critically revised the manuscript; and Sakineh Shab-Bidar agree to be fully accountable for ensuring the integrity and accuracy of the work. All authors read and approved the final manuscript.

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Author disclosure statement

None of the authors had any personal or financial and publication conflicts of interest.

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Tables

Table1. Characteristics of study participants between apparently healthy controls and cases with breast cancer

	cases	controls	P_{value}
BMI (kg/m^2)	28.19±4.61	28.17±5.26	0.97
Weight (kg)	72.51±12.32	72.04±13.46	0.75
Systolic blood pressure (mm/Hg)	122.66±17.17	124.53±18.59	0.36
Diastolic blood pressure (mm/Hg)	82.73±10.35	83.90±13.42	0.40
Education (%)			0.69
Illiterate	9.3%	13.3%	
Under diploma	42.7%	45.3%	
Diploma	29.3%	27.3%	
Educated	18.7%	14%	
Marital Status (%)			0.06
Married	86.0%	90.7%	
Single, divorced or widowed	14%	9.3%	
Occupation and Income status (%)			0.46
Employee/ Housekeeper	86%	84%	
University student/ Retired	1.3%	2.7%	
Low	2.7%	2.7%	
Average/High	10.7%	10%	
Lifestyle, With someone (%)	98%	96.7%	0.61
Menopause status, yes (%)	36%	41.3%	0.34
First menstruation age (year)	13.44±1.65	13.64±1.63	0.3
Menopause age (year)	48.38±4.60	45.90±5.22	0.008
Weight at 18 years old (kg)	52.04±8.92	51.42±9.1	0.55
Number of child, (n)	2.42±2.11	2.67±2.14	0.3
Length of breastfeeding (year)	3.55±2.74	4.24±3.50	0.05
Family history of breast cancer, yes, (%)	26%	20%	0.01
HRT, yes (%)	5.3%	8%	0.35
Smoking, never smoked (%)	96%	98%	0.36
Alcohol, never used (%)	98.7%	99.3%	0.6

Dietary supplement use, yes, (%)	56%	53.3%	0.09
Comorbidities, yes, (%)	41.3%	54%	0.14
Medication use, yes (%)	41.3%	42.7%	0.44
Energy intake (kcal/d)	2660.3 ± 799.6	2914.16±1159.02	0.02
Physical activity, yes (%)	41.3%	35.3%	0.1

BMI: Body mass index; Kg/m2, kilogram/meter; mm/Hg, millimeter of mercury; HRT, hormone replacement therapy;

P values result from Student t test for continuous variables, Chi-square test for categorical variables.

Table 2. General characteristic of study participants according to tertiles of FDII score

	Tertiles of FDII score			P value
	T1	T2	T3	
BMI (kg/m^2)	27.78±4.91	28.07±5.08	28.69±4.82	0.41
Weight (kg)	71.24±13.23	71.39±12.95	74.19±12.38	0.19
Systolic blood pressure (mm/Hg)	123.70±18.56	122.30±17.74	124.80±17.43	0.61
Diastolic blood pressure (mm/Hg)	82.95±12.37	82.80±11.55	84.20±12.07	0.66
Education (%)				0.66
Illiterate	12%	9%	13%	
Under diploma	42%	42%	48%	
Diploma	26%	33%	26%	
Educated	20%	16%	13%	
Marital Status (%)				0.53
Married	84%	91%	90%	
Single, divorced or widowed	16%	9%	10%	
Occupation and Income status (%)				0.64
Employee/ Housekeeper	87%	83%	85%	
University student/ Retired	0%	2%	4%	
Low	4%	3%	1%	
Average/High	9%	12%	10%	
Lifestyle, With someone (%)	100%	97%	955	0.3
Menopause status, yes (%)	42%	34%	40%	0.48
First menstruation age (year)	13.59±1.62	14.60±11.84	13.68±1.88	0.52
Menopause age (year)	47.23±5.05	46.28±5.48	47.55±4.78	0.54
Weight at 18 years old (kg)	51.59±9.14	52.20±8.37	51.42±9.64	0.81
Number of child, n	2.45±1.78	2.37±2.02	2.82±2.50	0.28
Length of breastfeeding (year)	3.83±3.07	3.76±3.34	4.08±3.08	0.75
Family history of breast cancer, yes, (%)	22%	30%	17%	0.19

HRT, yes (%)	5%	8%	7%	0.68
Smoking, never smoked (%)	98%	96%	97%	0.46
Alcohol, never used (%)	100%	97%	100%	0.19
Dietary supplement use, yes, (%)	64%	54%	46%	0.01
Comorbidities, yes, (%)	45%	46%	52%	0.96
Medication use, yes (%)	44%	42%	40%	0.9
Energy intake (kcal/d)	2373.93±575.30	2629.50±663.30	4077.82±7164.93	0.008
Physical activity, yes (%)	35%	46%	34%	0.24

BMI: Body mass index; Kg/m2, kilogram/meter; mm/Hg, millimeter of mercury; HRT, hormone replacement therapy

P values result from ANOVA test for continuous variables, Chi-square test for categorical variables.

Table 3. Mean intakes of foods and food groups between apparently healthy controls and cases with breast cancer

	cases	controls	P_{value}
Food group			
Grains (g/d)	269.89±184.31	252.38±126.63	0.33
Poultry (g/d)	27.44±28.90	34.97±48.54	0.10
Processed meats (g/d)	14.06±23.88	12.32±40.09	0.17
Red meats (g/d)	19.15±15.13	17.00±13.16	0.18
Fish (g/d)	7.87±9.02	8.90±11.75	0.39
Canned fish	1.75±2.89	3.24±8.76	0.04
Fruits (g/d)	640.41±295.40	646.44±317.19	0.95
Vegetables (g/d)	329.71±142.56	354.84±175.61	0.17
High fat Dairy (g/d)	119.68±145.70	132.64±146.17	0.44
Legumes (g/d)	57.44±42.11	62.56±41.84	0.29
Boiled potatoes (g/d)	16.31±13.84	22.78±23.80	0.04
Fried Potatoes (g/d)	24.03±0.76	25.98±0.65	0.40
Coffee (g/d)	12.26±2.11	13.33±1.14	0.20
Sweet dessert (g/d)	38.08±37.59	50.14±75.85	0.08
Snacks (g/d)	23.83±39.20	19.82±68.73	0.53
Pickles (g/d)	20.31±35.31	18.73±29.11	0.67
Oil and butter (g/d)	27.35±21.73	33.12±30.14	0.30
Olive (g/d)	3.84±5.90	4.08±5.97	0.72
Eggs (g/d)	18.41±16.48	19.81±15.99	0.45
Mayonnaises (g/d)	1.46±2.34	1.24±1.95	0.38
Salt (g/d)	3.85±2.23	4.23±2.62	0.18

g/d :gram/day

Values are means ± SD used Student t test.

Table 4**.** Mean intakes of foods and food groups according to tertiles of FDII score

	Tertiles of FDII score			P value
	T1	T2	T3	
Food Groups				
Grains (g/d)	209.20±92.55	248.55±113.25	325.65±216.83	0.00
Poultry (g/d)	23.79±20.41	21.52±52.42	24.31±39.33	0.42
Processed meats (g/d)	12.73±47.19	11.53±25.95	12.31±10.40	0.96
Red meats (g/d)	17.08±11.37	17.65±13.00	19.50±17.53	0.45
Fish (g/d)	7.49±8.64	8.03±8.25	9.65±13.64	0.31
Canned fish	1.94±3.68	1.88±3.24	3.68±10.18	0.08
Fruits (g/d)	791.82±339.55	589.61±265.31	560.84±255.08	0.00
Vegetables (g/d)	261.47±139.04	253.22±141.29	260.23±180.33	0.93
High fat Dairy (g/d)	78.45±108.66	95.80±110.62	204.22±175.51	0.00
Legumes (g/d)	51.18±31.14	51.06±33.97	51.49±54.31	0.35
Boiled potatoes (g/d)	21.46±0.76	21.16±0.76	19.33±0.76	0.09
Fried Potatoes (g/d)	18.59±16.83	17.99±14.32	22.05±25.97	0.29
Coffee (g/d)	13.28±0.70	15.80±0.65	17.13±0.76	0.00
Sweet dessert (g/d)	27.74±23.69	38.46±36.47	66.13±90.61	0.00
Snacks (g/d)	16.44±23.12	16.93±22.46	32.10±90.74	0.07
Pickles (g/d)	15.80±30.79	16.10±28.40	26.65±36.36	0.02
Oil and butter (g/d)	20.89±19.57	26.97±21.36	38.35±33.74	0.00
Olive (g/d)	5.07±7.84	3.47±4.56	3.34±4.68	0.07
Eggs (g/d)	15.25±12.19	20.61±17.89	21.47±17.43	0.01
Mayonnaises (g/d)	0.85±1.59	1.14±1.31	2.06±2.99	0.00
Salt (g/d)	3.55±1.85	3.75±1.80	4.82±3.21	0.00

g/d :gram/day

Values are means ± SD used ANOVA.

Table5. Odds ratios (ORs) and 95% confidence intervals (95% CIs) for Breast Cancer according to tertiles of FDII

	Tertiles of FDII			P_{trend}
	T1	T2	T3	
Crude	1.00	0.77 (0.43-1.34)	1.73 (1.13-3.04)	0.01
Model 1	1.00	0.72 (0.40-1.29)	1.71 (1.09- 3.05)	0.01
Model 2	1.00	0.73 (0.40-1.30)	1.72 (1.10-3.08)	0.01
Model 3	1.00	0.74 (0.41-1.32)	1.72 (1.10-3.07)	0.01

Data are OR (95% CI)

Model 1: adjusted for age, energy

Model 2: additionally, adjusted for Education, Marital status, Occupation, Physical activity, Alcohol use, Smoking, Vitamin supplements, History of HRT and OCP use, First menstruation age, Medical history, number of child and Menopause status.

Model 3: additionally, adjusted for BMI.