Original Article

Dietary patterns and breast cancer risk in a prospective Japanese study

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Abstract

Background The association between dietary patterns and breast cancer has been inconsistent.

Methods This study examined associations between dietary patterns and risk of developing breast cancer among 23,172 women from the Japan Collaborative Cohort Study, including 119 incidences of breast cancer diagnosed during a median 16.9-year follow-up period. Factor analysis was conducted to obtain dietary patterns, and Cox proportional models were used to estimate hazard ratios (HR) and 95% confidence intervals (95% CI) for breast cancer morbidity.

Results Three dietary patterns were identified: ‘‘vegetable pattern’’ (vegetables, potatoes, seaweed, tofu, fruits, fresh fish, eggs, and miso soup); ‘‘animal food pattern’’ (meat, deep-fried foods, fried vegetables, fish paste and salt-preserved fish); and “dairy product pattern’’ (milk, dairy products, fruits, coffee and tea). After adjusting for potential confounders, the vegetable and dairy product patterns were not significantly associated with risk of breast cancer. However, the animal food pattern was significantly associated with a decreased risk of breast cancer morbidity among premenopausal women by HR 0.47 for the 2nd tertile (95% CI: 0.22–1.00) and HR 0.42 for the 3rd tertile (95% CI: 0.18–0.93), compared with the bottom tertile (*p* for trend 0.04).

Conclusion We found no significant association between the vegetable and dairy product dietary patterns and breast cancer risk; however, an animal product diet may reduce risk of breast cancer among premenopausal Japanese women.

Key words: dietary pattern, cohort study, Japanese, breast cancer

Abbreviations: BC: breast cancer; BMI: body mass index; CI: confidence interval; FFQ: food frequency questionnaire; HR: hazard ratio; JACC: Japan Collaborative Cohort (study).

Introduction

Breast cancer (BC) incidence has been increasing worldwide [1]. Although its rate in most Asian countries is much lower than that in Western countries [2, 3], BC rates in Asia have markedly increased in recent years [4]. Migration studies imply that differences in dietary habits might be the major factor for international variations in BC incidence [5].

Many nutritional studies have evaluated the associations between individual foods or nutrients and BC, with inconsistent results [6]. This approach, however, does not consider the complexity of human diet, such as the variety of foods consumed and interactions among dietary components [7].

Factor analysis aggregates interrelated variables into a few dietary patterns. It is an increasingly common alternative approach to examining the relationship between diet and disease risk, and could be important in determining public health recommendations [8, 9]. Although several epidemiologic studies have investigated associations between dietary patterns and BC risk [7, 10, 11], those dietary patterns may represent eating habits in a particular study population that are not applicable across other populations. Moreover, individual food preferences are modified by cultural, social, environmental, lifestyle and economic determinants [12]. Asian dietary habits differ from those of Western populations; for example, Asian populations eat much less meat, generally speaking, than do Western populations [13, 14]. Analysis of associations between dietary patterns and BC among Japanese women could offer new insight into this field. However, almost all prospective studies of dietary patterns and BC have been undertaken in Western countries [15–23]. Only one prospective study has evaluated dietary patterns and BC risk among Asian women to date [24]. One case-control study [25], but no prospective studies, has evaluated the association specifically among Japanese women.

The present study examined the association between dietary pattern and BC risk among Japanese women, using data from the Japan Collaborative Cohort Study (JACC Study).

Materials and Methods

Study population

The JACC Study is a large-scale cohort study, started in 1988–90, which has been described in detail elsewhere [26, 27]. Briefly, the cohort consisted of 110,585 individuals, 46,395 men and 64,190 women aged 40–79 years, living in 45 areas across Japan. At the baseline survey, all participants were asked to provide information about their lifestyle including dietary habits, smoking and drinking, physical activity, medical history, education, family history of cancer, height and weight, and female reproductive factors, using a self-administered questionnaire.

Informed consent was obtained individually from each participant prior to completion of the questionnaire, except in a few study areas where informed consent was obtained at the group level after the purpose of the study and confidentiality of the data had been explained to community leaders. The Ethical Board of the Nagoya University School of Medicine, where the central office of JACC Study was located, approved the protocol of this present study.

Dietary assessment

A validated self-administered questionnaire was used, which included a 39-item food frequency questionnaire (FFQ) [28]. Most food items were assessed by using the five frequency categories of “rarely,” “1–2 times per month,” “1–2 times per week,” “3–4 times per week,” and “almost daily.” As exceptions, for rice and miso (fermented soybean paste) soup, the questionnaire inquired about the number of bowls consumed daily. Four non-alcoholic beverages were assessed for five frequency categories of “rarely,” ”1–2 cups per month,” ”1–2 per week,” ”3–4 cups per week,” and “almost daily.” Total energy and nutrient intakes were estimated based on the fifth edition of the Japan Food Table. For participants who left blank four items or fewer of the 38 food items on the FFQ, the missing information of these participants was replaced with the median value of the respective food item in their study areas, as done previously [29, 30].

Exclusions

Potential participants for the present analysis were restricted to 37,412 women who lived in 23 study areas where information on cancer incidence and FFQs (to estimate food and nutrient intake at baseline) were available.

Among the 37,412 potential subjects, we excluded 755 subjects in whom any cancer had been diagnosed before the study baseline; 374 with histories of stroke; 1,213 with histories of cardiovascular disease; and 1,414 with diabetes mellitus, because patients with these diseases may have changed their dietary patterns. We also excluded subjects who left blank responses for five or more of the 38 food items on the FFQ (n = 7,373), and who had an implausibly high or low intake of total energy (< 500 or > 3500 kcal/day, n = 2,069) or died within the first 5 years of follow-up (n = 1,043). Finally, 23,172 subjects were analyzed.

Follow-up

We used population registries in the municipalities to determine the vital and residential status of the participants. Registration of death is required by the Family Registration Law in Japan, and is adhered to nationwide. For logistical reasons, we discontinued the follow-up of those who had moved out of their given study areas. We ascertained the incidence of cancer by linking to records of population-based cancer registries, supplemented by a systematic review of death certificates. In some study areas, medical records in major local hospitals were also reviewed. We counted the woman-years of follow-up for each participant from the date of filling out the baseline questionnaire to the date of diagnosis of BC, the date of death, the date of migration from the study area, or the end of follow-up, whichever came first. For cases identified only with a death certificate, the date of death was assumed to be that of diagnosis. Those who died from causes other than BC or who moved out of their study areas were treated as censored cases.

Statistical analysis

Factor analysis with varimax rotation was conducted to identify dietary patterns based on the various food items. To determine the number of factors to be retained, we considered components with eigenvalues (>1.0), scree test results, and interpretability of the factors. Factor scores were calculated for each of the participants, standardized to a mean value of zero and a standard deviation of one, and each participant was assigned a factor score for every identified pattern. Participants were divided into three categories based on tertiles of factor scores for dietary patterns.

The hazard ratios (HRs) with 95% confidence intervals (CI) morbidity risk related to BC by menopausal status were estimated based on dietary patterns tertiles compared to those in the first tertile using the Cox proportional hazard model, adjusted for age and other potential confounders. Participants were asked their age at menopause in the self-administered questionnaire at the baseline survey. For subjects who did not respond to this question, we designated those aged 55 years or older at the baseline survey to be postmenopausal, and those younger than 55 years to be premenopausal. The following variables were included in the multivariate models: age (continuous variable), education duration (<15, 16–18, ≥19 years, or unknown), area (Hokkaido and Tohoku, Kanto, Chubu, Kinki, or Kyushu), age at menarche (≤ 13, 14–15, 16–17, or ≥18 years), parity (0, 1, 2, 3, or ≥ 4, or unknown), age at first birth (≤ 24, 25–29, or ≥ 30 years, or unknown), body mass index (BMI; <18.5, 18.5–24.9, or ≥25.0 kg/m^2, or unknown), family history of BC in mother or sisters (yes or no), use of exogenous female hormones (nonuser, user or unknown), daily walking habits (seldom or never, or approximately 30, 30–59, or ≥ 60 min/day or unknown), alcohol drinking status (never, former, current alcohol drinker, or unknown), smoking status (never, former, current smoker or unknown), and total daily energy intake (categorized into tertiles; 500–1,261, 1,262–1,533, or 1,534–3,500 kcal/day). The SAS statistical package for Windows (version 9.4, SAS) was used for all statistical analyses. $P < 0.05$ was considered significant.

Results

We extracted three dietary patterns using factor analysis. Table 1 shows the factor-loading matrix for the dietary patterns. Positive loading indicates positive association with the factor, and vice versa for negative loading. The first pattern—the vegetable pattern—had a higher loading of vegetables, potatoes, seaweed, tofu, fruits, fresh fish, egg, and miso soup. The second pattern—the animal food pattern—had a higher loading of meat, deep-fried foods, fried vegetables, fish paste and salt-preserved fish. The third pattern—the dairy product pattern—had a higher loading of milk, dairy products, fruits, coffee and tea. The total variances of these three dietary patterns were 23.8%.

Table 2 shows the baseline characteristics of participants according to the three dietary patterns by score tertile. Participants in a high tertile for the vegetable pattern were likely to be older, well-educated, have been older at menarche and at first births and to be current drinkers, and less likely to be current smokers. Persons with the animal food pattern were likely to be younger, and less likely to be nulliparous and current smokers. Participants in the higher dairy product tertile were younger, younger at menarche, had higher educational levels, more likely to be exogenous female hormone users and current smokers and less likely to be current drinkers, than those in the lower tertile.

The median follow-up period was 16.9 years. During 327,031 woman-years, 119 women were affected with BC. Table 3 shows HRs between three dietary pattern and BC morbidity by menopausal status. In premenopausal women, multivariate HRs for the animal food pattern were significantly associated with decreased risk of BC morbidity (2nd tertile, HR: 0.47, 95% CI: 0.22–1.00; and 3rd tertile, HR: 0.42, 95% CI: 0.18–0.93, *p* for trend 0.04). However, this association with BC was not observed among postmenopausal women. The vegetable and dairy product patterns showed no significant association with BC morbidity among either premenopausal or postmenopausal women in multivariate analysis.

Discussion

Our study identified three major dietary patterns: vegetable, animal food, and dairy product. Our results significantly associated the animal food pattern with decreased BC risk among premenopausal, but not postmenopausal, women, whereas the vegetable and dairy product patterns showed no significant association with BC morbidity.

We found that the animal food pattern was a protective factor against BC among premenopausal women. This result appears to contradict previous studies results which regarded the Western or meat patterns as BC risk [7, 10, 11]. However, we need to interpret our results with caution; the “animal food pattern” and Western dietary patterns differ in several regards. Western dietary patterns are characterized by relatively high intake of red and processed meats [7, 10, 11], which may contain pro-carcinogenic factors such as heterocyclic amines, N-nitroso compounds and polycyclic aromatic hydrocarbons when cooked in high heat [31]. In comparison, the major components of the “animal food pattern” in our study were beef, pork, chicken and processed meats, but fish paste and salt-preserved fish were also loaded positively. Although the association between fish consumption and BC risk has not been fully established in epidemiological studies, n-3 fatty acids from fish could have beneficial effects [31–34]. The JACC study previously showed an inverse association between intake of fish fat or long-chain n-3 fatty acids and BC risk among Japanese women [33]. Therefore, a beneficial effect from fish intake might offset the risk from “unhealthy” foods in the animal food pattern in our study. Moreover, red meat intake by Japanese people (a corrected median value of 36 g/day, by weighed dietary records among JACC sub-samples) is much lower than that of Western populations; for example, the US population, whose mean intake is 69.8 g/day [13, 28]. Narrow meat exposure could attenuate its BC-promoting effect. Thus, differences in components or intake quantities could have caused these inconsistent results. Mannisto et al. reported an inverse association between the Western dietary pattern and BC, and pointed out the type of fat might explain the result; butter loaded negatively on the Western pattern, but substituting low-fat margarine (which is rich in unsaturated fatty acids and is consequently healthier) loaded positively in their study [19]. A recent systematic review regarding BC risk from Western dietary patterns also showed inconsistent results [7]; that of 10 cohort studies, only one study positively associated the Western dietary pattern with BC [35], one study reported an inverse association [19], and eight found no significant association [15–18, 20–23]. Moreover, another systematic review and meta-analysis found no evidence of an association between Western dietary patterns and BC risk (OR: 1.09; 95% CI: 0.98–1.22; P = 0.12) [10]. Heterogeneity in components of dietary patterns and cooking methods between studies could have accounted for these inconsistent results [10].

We observed a significant inverse association between the animal food pattern and BC risk only among premenopausal women. We conducted the analyses by menopausal status because premenopausal women have higher estrogen levels than do postmenopausal women. A migration study of Asian-American women suggested that diet in early adult life may have a stronger effect on BC risk; first-generation immigrants had low risk for BC, but their second-generation immigrants, who had spent their childhoods in countries with high BC prevalence, were in higher risk of BC [5]. And a mathematical model of the etiology of BC from the Nurse Health Study also identified exposures during the years before the first birth of a child as the most relevant to future BC risk [36]. However, most prospective studies found significant associations between some dietary patterns with BC risk among postmenopausal [18, 23], but not premenopausal, women, although the mechanism of modification by menopausal status is unclear. Further studies are required to draw firm conclusions regarding differences in menopausal status.

We found no significant association between our vegetable pattern and BC risk. The vegetable pattern, or prudent dietary patterns characterized by vegetables and fruit intake, have been considered to decrease BC risk through anti-oxidative effects [37], although many studies of the association between vegetables or fruit intake and BC risk have had inconsistent results. A prospective study from the Japan Public Health Center showed null association between total fruit and vegetable intake and BC risk among Japanese women [38]. Moreover, a comprehensive review [31] by the World Cancer Research Fund (WCRF) reported no firm association between vegetables or fruit and BC, which accords with our result. Differences exist among components of the vegetable or prudent dietary patterns among each study, which might be the reason for inconsistent results. However a recent systematic review with regard to vegetable or prudent dietary patterns showed decreased BC risk with prudent dietary pattern [11]. Further studies of the vegetable pattern and BC risk are required to draw firm conclusions.

In the present study, the dairy product pattern, which is characterized by milk, yogurt, cheese, butter and plant margarine, also showed no significant association with BC. To our knowledge, this study is the first prospective study to investigate the association between the “dairy product pattern” and BC risk. Epidemiological studies have been inconsistent in their results regarding BC risk and each dairy product. Accordingly, WCRF reported no conclusive association between dairy product pattern and BC [31], which supports our results, whereas a pooled analysis of eight large cohort studies showed association between high intake of dairy products and decreased BC risk [39]. Further studies are also needed to elucidate the association between dairy product dietary pattern and BC risk.

Our present study is the first large prospective study to evaluate the association between dietary patterns and BC risk using factor analysis in Japanese women. Moreover, the median follow-up period of 16.9 years would be sufficient for potential disease occurrence.

However, our study has some limitations. First, as mentioned in previous papers, factor analysis involves some subjective decisions, such as grouping of foods and labeling of identified patterns, which might lead to uncertainties of study [8, 12]. Nonetheless, we followed factor analysis procedure used in our previous JACC reports [29, 30], which is also common for other epidemiological studies [7]. Second, we evaluated BC risk without considering hormone receptor status in this study, because we had no data on subjects' BC subtypes. Some studies regarding association between dietary pattern and BC risk have suggested that risk factors may differ in their association by tumor receptor status [16–18, 23, 24, 35]. Therefore, further study would be needed for this issue among Japanese women. In addition, we estimated dietary intake only at baseline, and cannot therefore rule out the possibility that some changes occurred in the diet during follow-up. More accurate assessment of long-term diets might be provided by data collection during follow-up. Finally, some premenopausal women in this study reached menopause before BC occurred, which could lead to misclassification of menopausal status, though the method we used is common for other epidemiological studies [15, 16].

In conclusion, our results suggest that a dietary pattern characterized by frequent consumption of meat, dairy products, deep-fried foods, fried vegetables, fish paste and salt-preserved fish is associated with a reduced risk of BC only among premenopausal Japanese women. However, we saw no significant overall association between dietary patterns and breast cancer mortality. Further large-scale prospective studies are needed to draw firm conclusions.

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Ethics approval

This study was approved by the Ethics Board of Nagoya University School of Medicine.

Conflict of interest Statement

All authors declare that there are no conflicts of interests.

Authorship

Akiko Tamakoshi, Hiroyasu Iso, Mitsuru Mori and Kenji Wakai designed and implemented the study. Chigusa Date analyzed the FFQ data. Reiji Kojima analyzed the data and wrote the article. Emiko Okada, Shigekazu Ukawa and all other authors critically revised the article.

Appendix: Members of the Japan Collaborative Cohort Study Group

The present members of the JACC Study Group who coauthored this paper include:

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Tables

Table 1. Factor-loading matrix for the three major dietary patterns.

	Vegetable	Animal food	Dairy product
Beef		0.40	
Pork		0.50	
Processed meat		0.52	
Chicken		0.53	
Liver		0.35	
Egg	0.31		
Milk			0.35
Yogurt			0.43
Cheese			0.46
Butter		0.35	0.42
Plant margarine			0.60
Deep-fried foods (tempura)		0.54	
Fried vegetables	0.34	0.42	
Fresh fish	0.43		
Fish paste		0.44	
Salt-preserved fish	0.30	0.34	
Spinach	0.54		
Carrot or pumpkin	0.62		
Tomato	0.31		
Cabbage	0.51		
Chinese cabbage	0.54		
Edible wild plants			
Mushroom	0.45		
Potato	0.64		
Seaweeds	0.60		
Pickled vegetable	0.31		
Preserved foods using soy sauce		0.33	
Boiled beans	0.37		
Tofu	0.54		
Mandarin orange	0.42		0.36
Fruit juice			
Fruit	0.45		0.41
Sweet cake			
Coffee			0.41
Black tea			0.39
Green tea			
Chinese tea			
Miso soup	0.40		-0.31
Rice			-0.48
Eigen value	5.14	2.18	1.94
Factor variance explained (%)	13.18	5.58	4.99
Factor variance cumulative (%)	13.18	18.76	23.75

Factors that loaded < 0.3% are not shown, to simplify the presentation.

Table 2. Baseline characteristics of the three dietary patterns by score tertile.

		Vegetable pattern			Animal food pattern			Dairy product pattern		
		Tert 1	Tert 2	Tert 3	Tert 1	Tert 2	Tert 3	Tert 1	Tert 2	Tert 3
n		7724	7724	7724	7724	7724	7724	7724	7724	7724
Case		32	42	45	49	37	33	33	42	44
Age (y)	Average	54.9	55.5	57.5	57.4	55.5	54.9	57.3	55.5	55.0
	SD	9.9	9.6	9.4	10.0	9.6	9.4	9.4	9.8	9.7
Education (%)	≤15	32.8	28.3	26.6	29.9	29.1	28.8	39.4	30.1	18.3
	16-18	50.3	52.4	49.3	50.3	50.2	51.5	40.1	52.4	59.4
	19≤	9.2	10.6	11.4	10.1	10.7	10.3	5.6	9.6	15.9
	Unknown	7.7	8.7	12.7	9.7	10.0	9.4	14.8	7.9	6.4
Region (%)	Hokkaido	1.7	1.4	1.2	1.3	1.5	1.6	2.1	1.5	0.9
	Tohoku	3.0	4.9	8.2	4.3	6.2	5.7	10.8	3.8	1.6
	Kanto	25.0	36.4	50.2	48.0	35.5	28.0	23.8	44.9	42.9
	Chubu	8.8	7.8	5.4	4.4	7.0	10.6	10.2	6.6	5.2
	Kinki	39.3	27.5	18.5	31.7	29.4	24.2	24.1	24.3	36.9
	Kyushu	22.1	22.0	16.5	10.3	20.4	30.0	29.1	19.0	12.5
Age in years at menarche (%)	≤13	25.7	23.8	20.0	21.7	24.4	23.2	17.9	23.7	27.8
	14–15	44.1	45.0	43.8	43.4	44.8	44.7	43.8	43.2	45.9
	16–17	18.4	20.7	23.7	22.0	19.8	20.8	23.7	21.4	17.6
	18≤	7.0	6.6	8.5	7.4	6.8	7.8	9.7	7.3	5.0
	Unknown	4.9	3.9	4.2	5.4	4.1	3.5	5.0	4.3	3.7
Parity (%)	Nulliparous	3.9	3.7	4.1	5.3	3.8	2.6	3.4	4.1	4.2
	1	7.6	6.8	6.8	8.7	6.7	5.8	5.2	7.0	9.0

	2	38.6	37.8	36.4	37.6	38.5	36.6	31.1	38.1	43.4
	3	29.6	31.7	31.3	27.0	30.6	35.0	33.8	31.2	27.7
	4≤	13.7	14.6	16.5	14.7	14.8	15.3	21.0	14.1	9.8
	Unknown	6.5	5.5	4.9	6.7	5.5	4.7	5.6	5.5	5.9
Age in years at first birth (%)	≤24	44.0	41.0	34.6	38.1	39.6	41.9	41.3	38.7	39.6
	25-29	37.4	39.7	42.0	39.0	39.7	40.5	35.4	41.6	42.2
	30≤	6.3	6.8	7.7	7.7	6.9	6.2	5.5	7.7	7.5
	Unknown	12.2	12.5	15.8	15.3	13.8	11.5	17.8	12.0	10.7
Menopausal status (%)	Having periods	41.7	37.2	29.4	32.8	37.1	38.4	31.1	37.8	39.4
	Menopausal	58.3	62.8	70.6	67.2	62.9	61.6	68.9	62.2	60.6
BMI (%)	< 18.5 kg/m^2	6.1	5.6	5.8	5.9	5.9	5.7	6.0	5.7	5.7
	18.5 to < 25 kg/m^2	69.1	71.7	70.1	69.3	70.6	71.1	67.7	69.8	73.4
	≤ 25 kg/m^2	21.3	19.9	20.8	20.9	20.8	20.2	22.9	21.1	18.0
	Unknown	3.4	2.8	3.3	3.9	2.7	2.9	3.4	3.3	2.8
Family history of breast cancer (%)	No	98.7	98.5	98.4	98.5	98.5	98.6	98.8	98.7	98.2
	Yes	1.3	1.5	1.6	1.5	1.5	1.4	1.2	1.3	1.8
Hormone therapy (%)	Nonuser	88.1	89.6	88.0	87.4	88.6	89.7	89.5	88.8	87.4
	User	4.3	4.4	4.9	5.0	4.6	4.1	3.0	4.6	6.0
	Unknown	7.6	6.0	7.1	7.7	6.8	6.2	7.5	6.6	6.6
Walking each day (%)	Seldom	10.4	8.2	6.7	8.8	7.9	8.6	8.1	8.6	8.6
	<30 min	18.7	16.3	14.9	18.0	16.6	15.3	12.6	17.3	19.9
	30–59 min	19.8	20.4	19.0	20.6	20.1	18.5	16.6	19.5	23.1
	60 min≤	44.8	47.3	48.2	45.3	46.1	48.8	47.6	47.9	44.7
	Unknown	6.4	7.8	11.2	7.3	9.2	8.9	15.1	6.6	3.7

Alcohol use (%)	Never	27.4	23.9	22.3	23.4	25.1	25.2	18.8	24.6	30.2
	Former	1.8	1.4	1.1	1.8	1.2	1.3	1.1	1.6	1.7
	Current	70.7	74.7	76.6	74.8	73.7	73.5	80.1	73.8	68.1
Smoking (%)	Never	84.8	88.7	90.2	86.4	88.0	89.3	89.9	88.2	85.6
	Former	1.6	1.1	1.1	1.5	1.2	1.0	1.0	1.2	1.5
	Current	6.4	4.1	3.0	5.4	4.5	3.6	3.3	4.7	5.5
	Unknown	7.2	6.1	5.7	6.7	6.3	6.1	5.8	5.9	7.4
Total energy intake in kcal/day (%)	500–1,261	52.1	30.5	17.3	55.8	31.7	12.5	29.9	35.8	34.3
	1,262–1,533	28.3	38.0	33.8	32.6	39.1	28.2	32.9	35.0	32.1
	1,534–3,500	19.6	31.5	48.9	11.5	29.2	59.3	37.2	29.2	33.6

Table 3. Hazard ratios and 95% confidence intervals of breast cancer morbidity of three dietary patterns by score tertile among Japanese women by menopausal status.

		Tert 1 (low)	Tert 2		Tert 3 (high)		P for trend
Pre-menopausal							
Vegetable	Woman-years	50669	48323		36975		
	No. of cases	15	20		13		
	Age-adjusted HR	1.00	1.30	0.67–2.55	1.09	0.51–2.29	0.85
	Multivariate HR	1.00	1.21	0.59–2.47	0.81	0.35–1.89	0.61
Animal food	Woman-years	39283	47190		49495		
	No. of cases	20	13		15		
	Age-adjusted HR	1.00	0.55	0.28–1.12	0.62	0.32–1.22	0.16
	Multivariate HR	1.00	0.47	0.22–1.00	0.42	0.18–0.93	0.04
Dairy product	Woman-years	36549	48760		50658		
	No. of cases	10	21		17		
	Age-adjusted HR	1.00	1.55	0.73–3.31	1.29	0.58–2.83	0.63
	Multivariate HR	1.00	1.38	0.62–3.07	1.20	0.52–2.80	0.80
Post-menopausal							
Vegetable	Woman-years	76191	85357		102581		
	No. of cases	17	22		32		
	Age-adjusted HR	1.00	1.01	0.54–1.91	1.10	0.61–1.99	0.73
	Multivariate HR	1.00	0.98	0.51–1.88	0.93	0.48–1.78	0.85
Animal food	Woman-years	91847	86202		86079		
	No. of cases	29	24		18		
	Age-adjusted HR	1.00	0.90	0.52–1.55	0.66	0.37–1.20	0.18
	Multivariate HR	1.00	1.12	0.62–2.02	0.98	0.48–1.99	0.83
Dairy product	Woman-years	99847	87949		76332		
	No. of cases	23	21		27		
	Age-adjusted HR	1.00	1.10	0.61–1.99	1.99	1.14–3.49	0.02
	Multivariate HR	1.00	0.90	0.48–1.67	1.32	0.70–2.49	0.19

HR: hazard ratio

Multivariate HR: adjusted for age, area, tobacco smoking status, drinking status, family history of breast cancer, age at menarche, age at first birth, parity, energy intake, hormone therapy, daily walking, education, and BMI