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Dietary Patterns and Risk of Stomach Cancer Mortality: The Japan Collaborative Cohort Study

TRUONG-MINH PHAM, MD, PHD, YOSHIHISA FUJINO, MD, PHD, SHOGO KIKUCHI, MD, PHD, AKIKO TAMAKOSHI, MD, PHD, SHINYA MATSUDA, MD, PHD, AND TAKESUMI YOSHIMURA, MD, PHD

PURPOSE: We sought to examine associations between dietary patterns and the risk of stomach cancer mortality in a cohort study in Japan.
METHODS: Factor analysis on food frequency questionnaire was conducted among 25,730 males and 37,673 females in a cohort study in Japan; we identified three dietary patterns, termed "vegetable"; "animal food"; and "dairy product". The Cox proportional hazards model was used to estimate the hazard ratio (HR) with stomach cancer mortality.
RESULTS: The "vegetable" pattern showed no association with stomach cancer mortality in either sex. The "dairy product" pattern was significantly associated with a decreased risk of stomach cancer in males, with multivariate HRs of 0.82 (95% confidence interval [CI]: 0.61–1.10), 0.74 (95% CI: 0.54–1.01), and 0.72 (95% CI: 0.52–0.99) for the second, third, and fourth quartiles, respectively. In addition, the "animal food" pattern tended to be associated with an increased risk in females, but non-significant, with HRs for respective quartiles of 1.45 (95% CI: 0.92–2.29), 1.32 (95% CI: 0.81–2.16), and 1.51 (95% CI: 0.78–2.21).
CONCLUSIONS: A diet high in dairy products may be associated with a decreased risk of stomach cancer mortality in males. We did not observe any significant association of this condition with other dietary patterns in either sex.
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KEY WORDS: Cohort Study, Dietary Pattern, Factor Analysis, JACC Study, Stomach Cancer.

INTRODUCTION

Although the incidence and mortality of stomach cancer in Japan have decreased over the past 50 years, it remains a leading cause of cancer mortality (1). This decline may be attributable, at least in part, to changes in diet, as well as in food storage practices, such as refrigeration. While the etiology of this condition is multifactorial, with increasing age, male gender, and infection with *Helicobacter pylori* strongly implicated as causes, the potential influence of dietary factors has also attracted considerable attention (2, 3).

Epidemiological studies of diet and stomach cancer have usually focused on individual foods or food groups. For instance, vegetable or fruit intake has been linked with a decreased risk of this condition (4–6), whereas that of fresh or processed meats has been implicated with an increased risk (7, 8). However, because the human diet consists of a complex variety of foods and nutrients which tend to be closely correlated, approaches that focus on specific foods might be confounded by a complex of food components. In recognition of this, many investigators have focused on the use of factor analysis to investigate dietary patterns in cancer, including colorectal (9–11), breast (12, 13), and lung cancer (14). With regard to stomach cancer, while a number of studies have used this methodology to investigate the risk of this condition with dietary patterns (15–18), results have been inconsistent. Two case-control studies (15, 16) in Sweden and Canada, for instance, suggested an association with diet highly loaded for meats, whereas other cohort studies in Japan (17, 18) did not. Nevertheless, diet rich in vegetables tended to decrease the risk of this condition in most of these studies, albeit that the associations were generally weak, statistically insignificant (15, 16), or limited to females (17).

To clarify the association of dietary pattern with stomach cancer among Japanese populations, we attempted to identify major dietary patterns in the Japan Collaborative Cohort Study (the JACC Study), and then evaluated the

From the Department of Preventive Medicine and Community Health, School of Medicine, University of Occupational and Environmental Health, Kitakyushu, Japan (T-.M.P., Y.F., S.M.); Department of Public Health, Aichi Medical University School of Medicine, Nagakute, Aichi, Japan (S.K.); Department of Preventive Medicine/Biostatistics and Medical Decision Making, Nagoya University Graduate School of Medicine, Nagoya, Japan (A.T.); and Fukuoka Institute of Health and Environmental Sciences, Fukuoka, Japan (T.Y.).
Address correspondence to: Truong-Minh Pham, MD, PhD, Department of Preventive Medicine and Community Health, School of Medicine, University of Occupational and Environmental Health, 1-1 Iseigaoka, Yahatanishi-ku, Kitakyushu-shi, 807-8555, Japan. Tel: (+)81-93-691-7244; Fax: (+)81-93-603-4307. E-mail: ptrminh@med.uoeh-u.ac.jp.
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360 Park Avenue South, New York, NY 10010
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Selected Abbreviations and Acronyms

JACC = Japan Collaborative Cohort (study)
HR = hazard ratio

association between these patterns and the risk of stomach cancer mortality in this study population.

MATERIAL AND METHODS

Study Population

The JACC Study is a large-scale cohort study designed to evaluate the effects of various risks or protective factors on cancer. Details of the JACC Study have been described elsewhere (19, 20). Briefly, the cohort consisted of 110,792 subjects aged 40 to 79 years living in 45 areas throughout Japan. The baseline survey was conducted from 1988 through 1990 using a self-administered questionnaire. All subjects were asked to provide information on health-related factors, including smoking, alcohol intake, diet, disease history, and others.

We then followed up these 110,792 subjects for vital status until December 31, 2003. Causes and dates of death among study subjects were determined by reviewing all death certificates in each study area with the permission of the Director-General of the Prime Minister's Office (Ministry of Public Management, Home Affairs, Post and Telecommunications) until 2003. Participants who had moved out of their study area at baseline were also identified in each area by review of the population-register sheets of cohort members. Cause of death was recorded and coded using the *International Classification of Diseases and Injuries*, 9th Revision (ICD-9), from the baseline survey to the end of 1994, and the 10th revision (ICD-10) from 1995. Stomach cancer was coded from 151.0 to 151.9 (ICD-9) or from C16.0 to C16.9 (ICD-10). All ICD-9 codes were then converted into the ICD-10 codes for analysis.

The overall study design was approved by the Ethics Board of Nagoya University School of Medicine, where the central office of JACC Study was located.

Dietary Assessment

Average intake of 38 food items during the year preceding the start of the study was assessed with a self-administered questionnaire. Most food items were assessed by using the five frequency categories of "seldom or never", "1–2 times per month", "1–2 times per week", "3–4 times per week", and "daily intake". As exceptions, rice and miso soup (soy paste) intake was assessed using the number of bowls consumed daily; for current drinkers, alcohol consumption was ascertained using the four frequency categories of "less than once per week", "1–2 times per week", "3–4 times per week", and "5 times per week or more"; and for consumption of four non-alcoholic beverages (green tea, black tea, Chinese tea, and coffee), five categories were assessed as "almost never," "1–2 cups/month," "1–2 cups/week," "3–4 cups/week," and "almost daily intake". For analysis, average intake was estimated by converting the data to frequency intake or number of bowls/cups per week for each food item. The daily intake of total energy (kilojoules per day) was also estimated based on the fourth version of the Japan Food Table.

The food frequency questionnaire used in our study was previously validated (21). In brief, 85 volunteers recruited from among the cohort completed a food frequency questionnaire having the same food item structure as that used in the JACC Study on two occasions at an interval of 1 year. During this 1-year period, the volunteers also provided four consecutive 3-day weighed dietary records: one every 3 months (spring, summer, autumn, and winter), or, in other words, 12 days of weighed dietary records within 1 year. Reproducibility was estimated by calculating the Spearman rank correlation coefficients between the two food frequency questionnaires for each food item, which showed a mean value of 0.60 (range: from 0.86 to 0.42). Validity was estimated by using the Spearman rank correlation coefficients between the second food frequency questionnaire and 12-day weighed dietary record, which showed a mean value of 0.39 (ranged from 0.81 to 0.07).

Exclusions

Among the 110,792 subjects of the baseline study, we excluded 1,094 subjects with any cancer diagnosed before the study baseline; 1,219 with a history of stroke; 2,215 with a history of cardiovascular disease; and 3,770 with diabetes mellitus, on the basis that patients with these diseases may have changed their diet. We also excluded deaths within the first 3 years of follow-up ($n = 1{,}792$), and subjects who left blank responses for five or more of the 38 food items ($n = 37{,}299$) on the food frequency questionnaire. For subjects who left blank four items or fewer, we assumed the missing value was the median value of the respective food item. Analysis was thus finally performed in 25,730 males and 37,673 females, or a total of 63,403 subjects.

Assessment of Dietary Patterns

We used factor analysis (principal component analysis) to generate dietary patterns in the present study. Factor loadings represent the correlation coefficients between food items and a particular pattern. A positive (negative) loading means that the food item is positively (inversely) correlated with the dietary pattern. We then used an orthogonal rotation procedure (Varimax rotation) to attempt to make the

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original variables load as highly as possible on one factor and low on the rest. For this, the number of factors to be retained was determined by using the eigenvalue (>1.0), scree test, and interpretability. This procedure was performed separately for males and females. The results suggested three major patterns for both, which were labeled according to the most significant food items associated with them, namely "vegetable", "animal food", and "dairy product" patterns. Factor scores were then calculated for each subject and for each factor extracted, and standardized to a mean value of zero and a standard deviation of one. A high score for a given dietary pattern indicated a high intake of the food group constituting that pattern.

Statistical Analysis

We counted the number of person-years of follow-up for each subject from baseline until the date of death, date of migration from the study area, or end of follow-up, whichever occurred first. Cox proportional hazards regression was used to estimate the hazard ratios (HR) and their 95% confidence intervals (95% CI) of stomach cancer mortality according to factor score quartiles, with the first quartile used as the reference. A test for trend was performed to assess statistical significance across score quartiles by including ordinal terms for each score quartile and entering the variable as a continuous term in the model. Patterns in Schoenfeld residuals with time were considered to identify possible violation of the proportional hazards model, and found to be valid in our analysis (22). Confounding factors used in the model were age at baseline, tobacco smoking status, history of gastric ulcer, participation in mass screening for stomach cancer, body mass index, educational level, and total energy intake.

All p values and confidence intervals presented were based on two-sided tests. All statistical analyses were performed using the Stata version 9.0 software package (Stata Corporation, College Station, TX).

RESULTS

A total of 327,630 person-years of follow-up were counted in 25,730 male subjects and 506,766 in 37,673 female subjects. During these periods, deaths due to stomach cancer were recorded in 320 males and 157 females.

Using factor analysis, we identified three dietary patterns in our study. The first pattern, which was particularly loaded on vegetables and fruits, was named the "vegetable" pattern; the second, which was loaded on animal meats and fish, was named the "animal food" pattern; and the third, which was loaded on milk and dairy products, was named the "dairy product" pattern. These three derived patterns explained about 25.2% of total variance for males and 24.1% for females. Factor loadings between the food items and these three dietary patterns are shown in Table 1.

Subject characteristics according to factor score for each pattern are shown by sex in Table 2 (males) and Table 3 (females). Subjects with a high versus a low score tended to be older for the "vegetable" pattern for both sexes, but younger for the "animal food" and "dairy product" patterns. Means of body mass index did not statistically differ between the four quartiles for any of the three patterns, except for "dairy product" in females. Distribution of other variables, tobacco smoking habit, mass screening for stomach cancer, and education status were substantially different between score quartiles of the three major dietary patterns ($p < 0.01$), except for a history of gastric ulcer for the "vegetable" pattern in both males and females. Subjects reporting in the "vegetable" and "animal food" patterns with high factor scores tended to have higher values for daily energy, compared to those with lower factor score in both sexes. For the dairy product pattern, in contrast, energy intake was lower in subjects with higher factor scores.

Table 4 shows the age-adjusted and multivariate HRs for stomach cancer mortality according to quartile scores of the three major dietary patterns by sex. In males, the highest quartile score of the "dairy product" pattern was significantly associated with a decreased risk of stomach cancer mortality, with multivariate HRs of 0.82 (95% CI: 0.61–1.10), 0.74 (95% CI: 0.54–1.01), and 0.72 (95% CI: 0.52–0.99) for the second, third, and fourth quartiles, respectively; p for trend was 0.03. However, the "vegetable" and "animal food" patterns showed no significant association with stomach cancer mortality. In females, the "vegetable" and "dairy product" patterns showed no significant association with stomach cancer mortality, whereas the "animal food" pattern was associated with a slightly increased risk, with HRs of 1.45 (95% CI: 0.92–2.29), 1.32 (95% CI: 0.81–2.16), and 1.31 (95% CI: 0.78–2.21) for the second, third, and fourth quartiles, respectively; however, these results were statistically non-significant.

DISCUSSION

Data from this prospective study in 25,730 male and 37,673 female subjects identified three major dietary patterns, termed "vegetable", "animal food", and "dairy product". The "dairy products" showed an inverse association among males, whereas the "animal food" pattern showed a borderline increased risk among females, but without significance. The "vegetable" pattern was not associated with the risk of stomach cancer mortality in either males or females.

The "vegetable" pattern was primarily characterized by a high intake of all kinds of fresh vegetables and fruits and is comparable to the "vegetable and fruit" and "prudent" patterns described in previous studies (15–18). Results

TABLE 1. Factor loading* matrix for the three major dietary patterns in males and females

	Males			Females		
Food item	Vegetable	Animal food	Dairy product	Vegetable	Animal food	Dairy product
Rice	—	0.20	–0.21	—	0.22	–0.24
Miso soup	0.31	—	–0.25	0.33	—	–0.29
Beef	—	0.35	0.22	—	0.38	0.25
Pork (excluding ham, sausage)	—	0.47	—	—	0.56	—
Processed meat (ham, sausage)	—	0.52	0.23	—	0.57	0.21
Chicken	—	0.56	—	—	0.56	—
Liver	—	0.51	—	—	0.40	—
Egg	0.32	0.24	—	0.32	0.30	—
Fresh fish	0.40	0.26	—	0.42	—	—
Fish paste	—	0.48	—	—	0.45	—
Salt-preserved fish	0.27	0.39	—	0.27	0.35	–0.20
Milk	0.25	—	0.31	0.25	—	0.34
Yogurt	—	—	0.38	—	—	0.37
Cheese	—	0.22	0.50	—	0.24	0.49
Butter	—	0.23	0.56	—	0.30	0.48
Plant margarine	—	—	0.59	—	—	0.61
Deep-fried foods (tempura)	0.21	0.49	—	—	0.54	—
Spinach	0.59	—	—	0.59	—	—
Carrot and/or pumpkin	0.64	—	—	0.64	—	—
Tomato	0.42	—	—	0.40	—	—
Cabbage	0.61	—	—	0.57	—	—
Chinese cabbage	0.60	—	—	0.53	—	—
Edible wild plants	0.26	—	—	0.25	0.23	—
Mushroom	0.52	—	—	0.51	—	—
Potato	0.65	—	—	0.62	—	—
Seaweeds	0.62	—	—	0.61	—	—
Pickled vegetables	0.35	—	—	0.25	—	—
Boiled beans	0.37	—	—	0.38	—	—
Bean curd (tofu)	0.52	—	—	0.54	—	—
Mandarin orange	0.54	—	0.26	0.43	—	—
Fruit juice	0.28	—	0.20	—	—	—
Fruit	0.58	—	0.30	0.49	—	0.32
Sweet cake	0.28	—	—	—	0.23	—
Coffee	—	–0.21	0.41	—	—	0.26
Black tea	—	—	0.34	—	—	0.37
Green tea	—	—	—	—	—	—
Chinese tea	—	—	0.21	—	—	0.27
Alcohol	—	—	—	—	—	—
Eigenvalue	5.6	2.1	1.8	5.1	2.2	1.9
Factor variance explained (%)	12.6	6.7	5.9	11.3	6.6	6.2
Factor variance cumulative (%)	12.7	19.3	25.2	11.3	17.9	24.1

*Factor loadings less than 0.20 are not shown for reasons of maintaining simplicity of presentation.

from a cohort study in Japan (17) and a case-control study in Canada (15) linked this pattern to a decreased risk of stomach cancer in females only, whereas other studies found no significant association (16, 18). The apparently protective effect of these plant foods and fruits might be attributable to their high concentration of antioxidant substances, vitamin C, and vitamin E compounds. Protective effects for high vegetable and fruit intake have been reported for a number of cancers (4–6) and might be attributable to their high concentrations of these agents. With regard to stomach cancer, however, a recent review article on fruit and vegetable intake reported an overall significant protective effect in case-control studies only, and not in cohort studies (23). Furthermore, while an international review panel (World Cancer Research Fund–American Institute for Cancer Research) concluded in 1997 that there was "convincing" evidence that diets high in vegetables and fruits were associated with a decreased risk of stomach cancer (2), the Panel's 2007 revision downgraded this evidence to indicate rather a "probable" association with decreased risk (3). The protective effect of vegetable and fruit intake on this

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TABLE 2. Selected baseline characteristics of the three major dietary patterns by score quartile in males

Characteristic	Quartile 1 (low)	Quartile 2	Quartile 3	Quartile 4 (high)	*p* Value*
Vegetable pattern					
No. of subjects	6433	6432	6433	6432	
Mean age (SD)	53.8 (9.9)	55.1 (9.7)	56.2 (9.7)	57.7 (9.8)	<0.01
Mean of body mass index (SD)	22.7 (2.7)	22.8 (3.4)	22.7 (2.7)	22.8 (2.6)	0.74
Current smokers (%)	58.9	54.4	49.7	46.2	<0.01
History of gastric ulcer (%)	19.0	19.5	19.2	17.7	0.08
Stomach cancer screening (%)	27.2	30.3	31.1	29.4	<0.01
Schooling <15 years (%)	31.8	32.8	31.3	29.8	<0.01
Mean of total energy (SD)	6120 (1878)	6790 (1827)	7146 (1871)	7683 (1944)	<0.01
Animal food pattern					
No. of subjects	6433	6432	6433	6432	
Mean age (SD)	56.0 (10.3)	55.5 (10.0)	55.4 (9.7)	55.3 (9.6)	0.02
Mean of body mass index (SD)	22.8 (3.0)	22.7 (2.7)	22.8 (2.7)	22.7 (3.1)	0.23
Current smokers (%)	50.5	52.6	53.2	52.8	<0.01
History of gastric ulcer (%)	19.7	19.5	18.8	17.3	<0.01
Stomach cancer screening (%)	22.5	26.7	31.4	37.3	<0.01
Schooling <15 years (%)	28.8	31.3	32.2	33.4	<0.01
Mean of total energy (SD)	5840 (1614)	6547 (1700)	7163 (1732)	8197 (1995)	<0.01
Dairy product pattern					
No. of subjects	6433	6432	6433	6432	
Mean age (SD)	57.1 (9.2)	55.5 (9.8)	54.6 (10.0)	55.5 (10.3)	<0.01
Mean of body mass index (SD)	22.8 (3.4)	22.7 (2.7)	22.8 (2.7)	22.6 (2.8)	0.16
Current smokers (%)	53.9	53.5	51.9	49.8	<0.01
History of gastric ulcer (%)	16.9	17.6	19.3	21.6	<0.01
Stomach cancer screening (%)	37.9	31.0	25.8	23.1	<0.01
Schooling <15 years (%)	42.4	33.2	28.0	22.1	<0.01
Mean of total energy (SD)	7675 (1936)	6792 (1877)	6493 (1914)	6721 (1911)	<0.01

SD = standard deviation.
*p Value: based on the chi-square test for categorical variables and analysis of variance for continuous variables.

cancer might therefore be weaker than previously thought. In the present study, moreover, we identified no association between this "vegetable" pattern and the risk of stomach cancer in either male or female subjects.

The "animal food" pattern was principally characterized by a high intake of all kinds of red meat, processed meat, fresh fish, fish paste, and salt-preserved fish. Results showed a borderline association, but were non-significant, with high quartile scores for this pattern in females only. The "animal food" pattern in the present study is comparable to the "western" or "meat" patterns described previously (15–18, 24), some studies of which (15, 16, 24) showed an association with increased risk, whereas others did not (17, 18). A recent meta-analysis has reported that an increased consumption of processed meat was associated with an increased risk of stomach cancer (8). Processed meat often contains high levels of salt, nitrates or nitrites, and nitrosamine compounds, which may be associated with an increased risk of stomach cancer (2, 7, 25). While there is no evidence to link meat itself with the risk of stomach cancer, an increased risk may relate to cooking methods; in particular, frying or grilling may generate heterocyclic amines or polycyclic aromatic hydrocarbons, which are considered carcinogenic (26).

We identified an inverse association between the "dairy product" pattern and stomach cancer mortality, but in male subjects only. As well as being consumed fresh, milk is also commonly processed into a variety of foods, including cheese, butter, and yogurt. Milk and dairy products are rich sources of calcium, vitamin D, vitamin B_{12}, and riboflavin (2). Several epidemiological studies have shown an inverse association between calcium intake and colon cancer (27, 28); whereas a cluster analysis in a case-control study reported a significant decrease in the risk of esophageal cancer in the highest quartile of dairy products, while the association with stomach cancer was not statistically significant (24).

With regard to the association between dietary patterns and stomach cancer, an analysis based on a cohort study involving more than 40,000 subjects identified three major dietary patterns, termed "healthy", which mainly loaded for vegetables and fruits; "traditional", which mainly loaded for salted foods and alcoholic beverages; and "western", which mainly loaded for meats. The results showed a protective effect for the "healthy" pattern in females only and an increased risk with the "traditional" pattern in both sexes (17). The second analysis, based on a cohort of 5,765 Japanese male workers, derived four major dietary patterns, named "vegetables and fruit," "western breakfast," "meat",

TABLE 3. Selected baseline characteristics of the three major dietary patterns by score quartile in females

Characteristic	Quartile 1 (low)	Quartile 2	Quartile 3	Quartile 4 (high)	*p* Value*
Vegetable pattern					
No. of subjects	9419	9418	9418	9418	
Mean age (SD)	55.2 (10.2)	55.5 (9.8)	56.2 (9.7)	57.8 (9.4)	<0.01
Mean of body mass index (SD)	22.9 (4.1)	22.8 (3.0)	22.9 (3.0)	23.0 (3.3)	0.06
Current smokers (%)	7.5	4.4	3.5	3.1	<0.01
History of gastric ulcer (%)	9.5	9.1	8.9	9.4	0.43
Stomach cancer screening (%)	30.4	33.4	33.2	35.1	<0.01
Schooling <15 years (%)	38.5	33.4	31.2	29.7	<0.01
Mean of total energy (SD)	4946 (1427)	5414 (1332)	5741 (1310)	6181 (1365)	<0.01
Animal food pattern					
No. of subjects	9419	9418	9418	9418	
Mean age (SD)	58.0 (10.0)	56.4 (9.8)	55.3 (9.7)	54.9 (9.5)	<0.01
Mean of body mass index (SD)	22.9 (3.0)	22.8 (2.9)	22.9 (3.0)	23.0 (4.3)	0.09
Current smokers (%)	5.8	4.7	4.3	3.6	<0.01
History of gastric ulcer (%)	10.2	9.6	9.0	8.0	<0.01
Stomach cancer screening (%)	28.3	31.4	33.8	38.6	<0.01
Schooling <15 years (%)	34.8	34.2	32.3	31.4	<0.01
Mean of total energy (SD)	4633 (1092)	5270 (1130)	5758 (1185)	6677 (1454)	<0.01
Dairy product pattern					
No. of subjects	9419	9418	9418	9418	
Mean age (SD)	58.6 (9.2)	56.6 (9.9)	54.8 (9.8)	54.7 (9.8)	<0.01
Mean of body mass index (SD)	23.1 (3.2)	23.0 (4.4)	22.9 (2.9)	22.6 (2.8)	<0.01
Current smokers (%)	2.9	4.2	5.6	5.9	<0.01
History of gastric ulcer (%)	7.5	8.7	9.6	11.1	<0.01
Stomach cancer screening (%)	42.5	35.6	29.4	24.7	<0.01
Schooling <15 years (%)	47.5	38.1	27.9	19.3	<0.01
Mean of total energy (SD)	5904 (1504)	5397 (1345)	5356 (1380)	5644 (1421)	<0.01

SD = standard deviation.
*p Value: based on the chi-square test for categorical variables and analysis of variance for continuous variables.

and "rice/snack". However, none of these dietary patterns was significantly associated with stomach cancer (18). We also identified a case-control study in Sweden which suggested an increased risk of this cancer for a diet rich in animal foods (western diet) and a slightly decreased risk for a diet rich in vegetables and fruit (16). A recent case-control study in Canada (15) showed that a prudent dietary pattern was associated with a decreased risk of gastric cancer in women, while a western pattern was associated with an increased risk in both sexes. Nevertheless, it is important to note that dietary patterns derived from different studies may not be closely comparable. Different investigators may identify and name the same patterns, but these patterns may differ to a greater or lesser degree in the loading of each food variable, for example, or in the number of variables loaded. Comparison of dietary patterns between studies should therefore be conducted with caution, with careful consideration given to the content of each pattern.

Among the strengths of our study, the use of factor analysis allowed the simultaneous assessment of the effect of all food items and disease; it thus took account of the complexity of the human diet. A further strength was that it was a large-scale prospective cohort study, which enrolled subjects throughout Japan. The assessment of diet in cohort studies may diminish the probability of recall bias, which is inherent to case-control study.

Several limitations also warrant mention. First, the food frequency questionnaires in the present study consisted of only 38 food items, which must be fewer than is usually consumed by Japanese people in daily life. Of grains and cereals, for example, only rice was provided for, while others such as bread and noodles were not. However, Japanese traditionally consume rice as the main staple food, rather than bread or any kind of noodle. Second, information for the food frequency questionnaire was obtained at baseline only, and the study subjects might have changed their food habit during the course of follow-up. However, this issue is common to most long-term cohort studies. Third, factor analysis requires the assessment of all dietary variables at the same time; missing data for many particular food variable resulted in exclusion. A large number of enrolled subjects in the present study were in fact excluded for this reason. Excluded subjects were older than the included subjects (59.4 vs. 56.1 years), but distribution by sex was closely similar (42.8% vs. 40.6% of males). Moreover, we

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TABLE 4. Age-adjusted and multivariate hazard ratios of stomach cancer mortality of the three major dietary patterns by score quartile

	Quartile 1 (low)	Quartile 2	Quartile 3	Quartile 4 (high)	p for trend
Males					
Vegetable pattern					
No. of deaths	65	77	74	104	
Age-adjusted HR	1.00	1.05 (0.76–1.46)	0.94 (0.67–1.31)	1.19 (0.87–1.62)	0.35
Multivariate HR*	1.00	1.03 (0.74–1.43)	0.92 (0.65–1.29)	1.15 (0.83–1.59)	0.47
Animal food pattern					
No. of deaths	68	80	85	87	
Age-adjusted HR	1.00	1.20 (0.87–1.65)	1.29 (0.94–1.78)	1.27 (0.92–1.74)	0.13
Multivariate HR*	1.00	1.12 (0.80–1.54)	1.14 (0.81–1.58)	1.02 (0.73–1.45)	0.90
Dairy product pattern					
No. of deaths	110	78	66	66	
Age-adjusted HR	1.00	0.76 (0.57–1.02)	0.66 (0.48–0.89)	0.63 (0.46–0.85)	<0.01
Multivariate HR*	1.00	0.82 (0.61–1.10)	0.74 (0.54–1.01)	0.72 (0.52–0.99)	0.03
Females					
Vegetable pattern					
No. of deaths	37	38	34	48	
Age-adjusted HR	1.00	1.01 (0.64–1.60)	0.87 (0.54–1.38)	1.08 (0.70–1.67)	0.84
Multivariate HR*	1.00	1.00 (0.63–1.54)	0.83 (0.51–1.34)	0.99 (0.63–1.57)	0.83
Animal food pattern					
No. of deaths	34	45	39	39	
Age-adjusted HR	1.00	1.49 (0.95–2.33)	1.40 (0.88–2.21)	1.44 (0.90–2.28)	0.17
Multivariate HR*	1.00	1.45 (0.92–2.29)	1.32 (0.81–2.16)	1.31 (0.78–2.21)	0.41
Dairy product pattern					
Number of deaths	52	44	30	31	
Age-adjusted HR	1.00	0.93 (0.62–1.39)	0.71 (0.45–1.12)	0.74 (0.47–1.16)	0.10
Multivariate HR*	1.00	0.96 (0.64–1.45)	0.74 (0.47–1.18)	0.77 (0.48–1.23)	0.17

HR = hazard ratio.
*Multivariate HR: adjusted for age, tobacco smoking status, history of gastric ulcer, stomach cancer screening, body mass index, educational level, and total energy intake.

observed only slight differences between them in other baseline characteristics, which may suggest that bias was unlikely in the present study.

In summary, our results suggest that a diet high in milk and dairy products may be associated with a decreased risk of stomach cancer mortality in males. No statistically significant associations were noted between diets high in vegetables or animal food in either sex.

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Member list of the JACC Study Group: The present members of the JACC Study who co-authored this paper together with their affiliations are as follows: Dr. Akiko Tamakoshi (present chairperson of the study group), Aichi Medical University School of Medicine; Drs. Mitsuru Mori & Fumio Sakauchi, Sapporo Medical University School of Medicine; Dr. Yutaka Motohashi, Akita University School of Medicine; Dr. Ichiro Tsuji, Tohoku University Graduate School of Medicine; Dr. Yosikazu Nakamura, Jichi Medical School; Dr. Hiroyasu Iso, Osaka University School of Medicine; Dr. Haruo Mikami, Chiba Cancer Center; Dr. Michiko Kurosawa, Juntendo University School of Medicine; Dr. Yoshiharu Hoshiyama, University of Human Arts and Sciences; Dr. Naohito Tanabe, Niigata University School of Medicine; Dr. Koji Tamakoshi, Nagoya University Graduate School of Health Science; Dr. Kenji Wakai, Nagoya University Graduate School of Medicine; Dr. Shinkan Tokudome, National Institute of Health and Nutrition; Dr. Koji Suzuki, Fujita Health University School of Health Sciences; Dr. Shuji Hashimoto, Fujita Health University School of Medicine; Dr. Shogo Kikuchi, Aichi Medical University School of Medicine; Dr. Yasuhiko Wada, Faculty of Human Life and Environmental Science, Kochi Women's University; Dr. Takashi Kawamura, Kyoto University Center for Student Health; Dr. Yoshiyuki Watanabe, Kyoto Prefectural University of Medicine Graduate School of Medical Science; Dr. Kotaro Ozasa, Radiation Effects Research Foundation; Dr. Tsuneharu Miki, Kyoto Prefectural University of Medicine Graduate School of Medical Science; Dr. Chigusa Date, Faculty of Human Environmental Sciences, Nara Women's University; Dr. Kiyomi Sakata, Iwate Medical University; Dr. Yoichi Kurozawa, Tottori University Faculty of Medicine; Dr. Takesumi Yoshimura, Fukuoka Institute of Health and Environmental Sciences; Dr. Yoshihisa Fujino, University of Occupational and Environmental Health; Dr. Akira Shibata, Kurume University School

of Medicine; Dr. Naoyuki Okamoto, Kanagawa Cancer Center; and Dr. Hideo Shio, Moriyama Municipal Hospital.

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