Prevalence and Predictive Factors of Irritable Bowel Syndrome in a Community-dwelling Population in Japan

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Abstract

Objective Irritable bowel syndrome (IBS) is a common functional gastrointestinal disorder characterized by chronic, relapsing abdominal pain or discomfort and is associated with disturbed defecation. The pathogenesis of IBS is multifactorial. The aim of this study was to investigate the prevalence of IBS using the Rome III criteria and to assess the effects of mental and lifestyle factors on IBS in a community-dwelling population in Japan.

Methods The diagnosis of irritable bowel syndrome was based on the Japanese version of the Rome III Questionnaire. The questionnaire was administered to 993 volunteers who participated in the Iwaki Health Promotion Project 2013. Diet was assessed with a validated brief-type self-administered diet history questionnaire. Dietary patterns based on 52 predefined food groups [energy-adjusted food (g/dl)] were extracted using a principal component analysis. The Center for Epidemiologic Studies Depression Scale with a cut-off point of 16 was used to assess the prevalence of depression.

Results A total of 61 subjects (6.1%) were classified as having IBS. Three dietary patterns were identified: “Healthy”, “Western” and “Alcohol and accompanying” dietary patterns. After adjusting for potential confounders, the “Alcohol and accompanying” dietary pattern and depression were related to the risk of IBS.

Conclusion We found that an “Alcohol and accompanying” dietary pattern and depression were related to the risk of IBS in a Japanese community population. However, we could not rule out the possibility of some selection bias. Further studies with longitudinal observations are therefore warranted.

Key words: cross-sectional studies, dietary patterns, Japanese, irritable bowel syndrome, depression

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Introduction

Irritable bowel syndrome (IBS) is a common functional gastrointestinal disorder characterized by chronic, relapsing abdominal pain or discomfort and is associated with disturbed defecation (1). The prevalence of IBS is estimated to be in the range from 3 to 20% based on the Rome III criteria (2-5). Although the symptoms of IBS often impair the patient’s quality of life (QOL) (6), many individuals with IBS ignore their symptoms and tend not to seek medical care (7).

Although the pathogenesis of IBS is still largely unknown, several factors, including psychiatric disorders (2), stressful experiences (8), infection (9) and inflammation (10), have been suggested to play a role in the development of IBS. In particular, psychological stress has been recognized to be a causative factor (11) because of the high prevalence of psychiatric comorbidities (2).

Individuals with IBS believe that diet may play a role in triggering their gastrointestinal symptoms and may therefore avoid certain foods with changes in their dietary intake (12-14). Previous studies (15-17) have primarily focused on the effects of individual nutrients or foods but have rarely examined dietary patterns. However, nutrients and/or foods are consumed in dietary combinations and may...
have interactive or synergistic effects. Surveys examining single foods or single nutrients within foods may not adequately assess the complex effects on human health. Dietary patterns that represent a combination of foods may be more strongly associated with disease risk than individual foods or nutrients.

To date, there is limited evidence concerning the associations between predictive factors and IBS in community-dwelling populations. In the present study, we aimed to investigate the prevalence of IBS in a community-dwelling population using the Rome III criteria and to assess the effects of mental and lifestyle factors that affect IBS. We hypothesized that dietary patterns and/or mental distress would be associated with the risk of IBS.

**Materials and Methods**

**Participants**

The subjects included 993 volunteers (382 men and 611 women) who participated in the Iwaki Health Promotion Project in 2013. The data collection for this study was approved by the ethics committee of the Hirosaki University School of Medicine, and all subjects provided their written informed consent before participating in the project. Demographic data (age, sex, level of education and marital status), smoking, exercise habits (defined as 4 or more times of exercise per week) and medical history were obtained from self-reported questionnaires and interviews. Marital status was evaluated on the basis of the response (“yes”or “no”) to the following question: “Do you have a spouse?” As to exercise habits, the respondents were asked to answer a question regarding their frequency of exercise. Those answering “4 or 5 times per week” or “everyday” were included in the “having exercise habits” group, while those answering “not at all,” “once a week” or “2 or 3 times per week” were assigned to the “not having exercise habits” group. The subject’s height and weight were measured, and the body mass index (BMI) was calculated.

**Assessment of IBS**

The Japanese version of the Rome III Questionnaire was used to screen for IBS (18). All subjects were asked to complete self-reported ROME III diagnostic questionnaires. Screening for IBS requires that the subject have abdominal discomfort or pain lasting at least three days per month, not necessarily consecutive, during the previous three months, associated with two or more of the following: relief by defecation; onset associated with a change in stool frequency; onset associated with a change in the form (appearance) of stools.

**Assessment of depression**

The Japanese version of the Center for Epidemiologic Studies Depression Scale (CES-D) (19) was administered to all of the participants to measure their depressive symptoms. The CES-D is a 20-item self-reported measurement that focuses on depressive symptoms during the week prior to administering the questionnaire. The maximum score on this scale is 60, and depression (CES-D 16 depression) was considered to be present when the subject had a CES-D scale of 16 or more.

**Assessment of dietary intake**

The subjects were instructed to complete a brief self-administered diet history questionnaire (BDHQ) that included questions on the consumption frequency of 56 foods and beverages and nine dishes commonly consumed in the general Japanese population. For each food item, the subjects indicated their mean frequency of consumption of the food over the past month. The mean daily consumption of nutrients was calculated using an ad hoc computer program developed to analyze the questionnaire. The Japanese food composition tables, 5th edition, (20) and others (21) were used as the nutrient database. The reproducibility and validity of the BDHQ have previously described in detail elsewhere (22).

**Statistical analysis**

We derived dietary patterns through a principal component analysis of the energy-adjusted intake. The analysis used a density method for the 52 food and beverage items (excluding four items that overlapped with other items). We used eigenvalues, scree plots and the interpretability of the factors to determine the number of factors to retain. The selected factors each had eigenvalues greater than 1. The scree plots dropped substantially after the second factor (from 2.63 to 2.19) and remained similar after the third factor (2.19 for the third and 2.12 for the fourth factor); thus, we decided to retain three factors. The factor scores for each dietary pattern and each individual were calculated by summing the food item intake weighted by their factor loading. The factor scores were categorized into tertiles. Student’s unpaired t-test (for continuous variables) or the Chi-square test (for categorical variables) were used to compare the subjects with and without IBS. Trend associations across the tertile categories of each dietary pattern were assessed using a linear regression analysis for continuous variables, with ordinal values from 0 to 2 assigned to the tertile categories of each dietary pattern.

A logistic regression analysis was used to assess the relationships between the dietary patterns and IBS. A comparison between the high tertile group and others was conducted for each dietary pattern. The adjusted model was adjusted for age, gender, level of education, marital status, exercise habits, body mass index, smoking status and a positive history of diabetes, hypertension and dyslipidemia. A p value of <0.05 was considered to be statistically significant. The data were analyzed using the PASW Statistics PC software program for Windows, Version 18.0.0 (SPSS, Chicago, USA).
Characteristics of the participants

Among the 993 subjects who were available to be analyzed, 61 (6.1%) had self-reported IBS, and 187 (18.8%) had CES-D 16 depression. The characteristics of the study subjects with and without IBS are shown in Table 1.

Dietary patterns identified in the principal component analysis

We identified three dietary patterns using a principal component analysis (Table 2). The first factor, which loaded heavily on Carrots/pumpkin, Cabbage/Chinese cabbage, Green leafy vegetables, Other root vegetables, Seaweed, Mushrooms, Japanese radish/turnip, Tofu/atsuage and Potatoes, was labeled the “Healthy” dietary pattern. The second factor, which had high loading for Ham/sausage/bacon, Pork/beef, Chicken, Eggs, Lettuces/cabbage (raw), Coffee, Mayonnaise dressing, Ice cream and other root vegetables, Cabbage/Chinese cabbage and Spaghetti and macaroni, was labeled the “Western” dietary pattern. The third factor was characterized by a high intake of Beer, Oily fish, Squid/octopus/shrimp/shellfish, Shochu, Lean fish, Chicken and Small fish with bones and thus termed the “Alcohol and accompanying” dietary pattern. These three dietary patterns explained 10.5%, 5.1% and 4.2%, respectively, of the variance in food intake.

Risk of IBS in relationship to depressive symptoms and dietary pattern scores

The crude and adjusted odds ratios (with 95% confidence intervals) with regard to depressive symptoms and dietary pattern scores are shown in Table 3. Individuals with high depressive symptoms (CES-D score) had a higher risk of IBS, and those with the “Healthy” dietary pattern had a lower risk of IBS than those with the “Western” dietary pattern.
Table 2. Factor Loading Matrix for Major Dietary Patterns Identified by Principal Component Analysisa.

| Food Item                                      | Healthy dietary pattern | Western dietary pattern | Alcohol and accompanying dietary pattern |
|------------------------------------------------|-------------------------|-------------------------|------------------------------------------|
| Reduced fat milk and yogurt                    | -0.197                  | 0.244                   |                                          |
| Chicken                                        | 0.408                   | 0.544                   | 0.549                                    |
| Pork/beef                                      | 0.544                   | 0.549                   |                                          |
| Liver                                          | 0.151                   | 0.312                   |                                          |
| Squid/octopus/shrimp/shellfish                 | 0.208                   | 0.324                   |                                          |
| Small fish with bones                          | 0.249                   | -0.274                  | 0.209                                    |
| Canned tuna                                    | 0.173                   | 0.172                   |                                          |
| Dried fish/salted fish                         | 0.308                   | -0.187                  | 0.194                                    |
| Oily fish                                      | 0.344                   | -0.263                  | 0.317                                    |
| Lean fish                                      | 0.292                   | -0.185                  | 0.281                                    |
| Egg                                            | 0.374                   |                         |                                          |
| Tofu/atsuage b                                 | 0.525                   |                         |                                          |
| Natto c                                        | 0.259                   | -0.207                  |                                          |
| Potatoes                                       | 0.511                   |                         |                                          |
| Pickled green leaves vegetables                | 0.390                   | -0.287                  |                                          |
| Other pickled vegetables                       | 0.307                   | -0.276                  | -0.166                                   |
| Lettuces/cabbage (raw)                        | 0.480                   | 0.295                   |                                          |
| Green leaves vegetables                        | 0.610                   | 0.171                   |                                          |
| Cabbage/Chinese cabbage                        | 0.679                   | 0.213                   |                                          |
| Carrots/pumpkin                                | 0.695                   | 0.181                   |                                          |
| Japanese radish/turnip                         | 0.570                   |                         |                                          |
| Other root vegetables                          | 0.581                   | 0.229                   |                                          |
| Tomatoes                                       | 0.491                   |                         |                                          |
| Mushrooms                                      | 0.576                   |                         |                                          |
| Seaweeds                                       | 0.578                   |                         | -0.541                                   |
| Western-type confectionneries                  |                         |                         | -0.405                                   |
| Japanese-type confectionneries                 | 0.188                   | -0.242                  | -0.495                                   |
| Rice crackers/rice cake/okonomiyaki            |                         | -0.159                  | -0.191                                   |
| Ice cream                                      |                         | 0.248                   |                                          |
| Citrus fruit                                   | 0.359                   | -0.173                  |                                          |
| Persimmons/strawberries/kiwifruit              |                         |                         | 0.325                                    |
| Other fruit                                    | 0.428                   | -0.302                  | -0.265                                   |
| Mayonnaise dressing                            | 0.173                   | 0.250                   | -0.244                                   |
| Bread                                          |                         |                         | -0.453                                   |
| Buckwheat noodles                              |                         |                         | -0.228                                   |
| Japanese wheat noodles                         |                         |                         | -0.214                                   |
| Chinese noodles                                | -0.323                  | 0.196                   |                                          |
| Spaghetti and macaroni                         |                         | 0.211                   |                                          |
| Green tea                                      | 0.233                   | -0.226                  |                                          |
| Black tea/oolong tea                           |                         |                         | -0.189                                   |
| Coffee                                         |                         |                         |                                         |
| Cola drink/soft drink                          | -0.306                  | 0.188                   |                                          |
| 100% fruit and vegetable juice                 |                         |                         | -0.176                                   |
| Rice                                           | -0.327                  | -0.377                  | 0.157                                    |
| Miso soup                                      |                         |                         | -0.299                                   |
| Sake                                           |                         |                         | 0.188                                    |
| Beer                                           | -0.219                  | 0.331                   |                                          |
| Shochu                                         | -0.192                  | 0.286                   |                                          |

a Factor loading less than ±0.15 represented by a dash for simplicity. Omitted in the table were food items with factor loadings less than ±0.15 for all dietary patterns (milk and yogurt, Whisky, Wine).
b Deep fried tofu.
c Fermented soybeans.

Discussion

The present study investigated the prevalence of IBS in a community-dwelling population using the Rome III Questionnaire and assessed mental and lifestyle factors that affect IBS using a cross-sectional design. In this study, the prevalence of IBS (based on the Rome III Questionnaire) was 6.1%. The prevalence of IBS in our study was within the
### Table 3. Characteristics According to Tertile Categories of Dietary Pattern Scores.

|                     | Healthy dietary pattern | Western dietary pattern | Alcohol and accompanying dietary pattern |
|---------------------|-------------------------|-------------------------|-----------------------------------------|
|                     | Low tertile             | Middle tertile          | High tertile                            |
|                     | Mean    | SD     | Mean    | SD     | Mean    | SD     | Mean    | SD     | Mean    | SD     | Mean    | SD     | Mean    | SD     | Mean    | SD     | Mean    | SD     | Mean    | SD     | Mean    | SD     | Mean     | SD     |
| Energy (kcal)       | 2,014   | 65.3   | 1,867   | 52.3   | 1,916   | 60.0   | 0.034   | 1,976   | 61.8   | 1,975   | 58.5   | 1,847   | 57.9   | 0.005   | 1,873.04| 587.2  | 1,936.59| 588.3  | 1,987.25| 641.2  | 0.014   |
| Protein (g/1,000 kcal) | 32.2   | 4.6    | 37.1    | 4.8    | 42.9    | 7.2    | <0.001  | 37.6    | 7.6    | 36.7    | 6.4    | 37.8    | 7.3    | 0.689   | 35.5    | 5.2    | 37.0    | 6.3    | 39.7    | 8.8    | <0.001  |
| Carbohydrate (g/1,000 kcal) | 143.4 | 19.6   | 139.5   | 16.8   | 134.7   | 18.3   | <0.001  | 148.3   | 17.4   | 140.8   | 15.8   | 128.6   | 16.9   | <0.001  | 145.9   | 14.5   | 142.2   | 17.0   | 129.6   | 19.8   | <0.001  |
| Fat (g/1,000 kcal)  | 24.8    | 6.1    | 27.4    | 5.3    | 29.4    | 5.5    | <0.001  | 23.9    | 5.1    | 26.7    | 5.1    | 31.0    | 5.2    | <0.001  | 28.3    | 5.3    | 27.1    | 5.8    | 26.2    | 6.5    | <0.001  |
| n-3 polyunsaturated fatty acids (g/1,000 kcal) | 1.1    | 0.3    | 1.5     | 0.3    | 1.8     | 0.5    | <0.001  | 1.5     | 0.5    | 1.4     | 0.4    | 1.5     | 0.4    | 0.334   | 1.3     | 0.4    | 1.4     | 0.4    | 1.6     | 0.6    | <0.001  |
| n-6 polyunsaturated fatty acids (g/1,000 kcal) | 4.9    | 1.2    | 5.5     | 1.1    | 5.9     | 1.3    | <0.001  | 4.8     | 1.1    | 5.3     | 1.1    | 6.2     | 1.2    | <0.001  | 5.5     | 1.1    | 5.5     | 1.3    | 5.3     | 1.4    | 0.022   |
| Folate (µg/1,000 kcal) | 113.9  | 27.3   | 156.1   | 30.8   | 219.8   | 61.4   | <0.001  | 164.2   | 54.1   | 154.4   | 57.0   | 171.3   | 69.6   | 0.133   | 162.1   | 60.7   | 159.0   | 58.0   | 168.8   | 63.7   | 0.156   |
| Riboflavin (Vitamin B2) (mg/1,000 kcal) | 0.5    | 0.1    | 0.7     | 0.1    | 0.8     | 0.2    | <0.001  | 0.7     | 0.2    | 0.6     | 0.2    | 0.7     | 0.2    | 0.001   | 0.7     | 0.1    | 0.6     | 0.2    | 0.7     | 0.2    | 0.046   |
| Pyridoxine (Vitamin B6) (mg/1,000 kcal) | 0.5    | 0.1    | 0.6     | 0.1    | 0.8     | 0.2    | <0.001  | 0.6     | 0.2    | 0.6     | 0.2    | 0.7     | 0.2    | 0.063   | 0.6     | 0.2    | 0.6     | 0.2    | 0.7     | 0.2    | <0.001  |
| Cobalamin (Vitamin B12) (µg/1,000 kcal) | 4.0    | 1.9    | 5.4     | 2.3    | 7.1     | 3.6    | <0.001  | 6.3     | 3.6    | 5.3     | 2.5    | 4.9     | 2.6    | <0.001  | 4.4     | 2.1    | 5.3     | 2.6    | 6.8     | 3.6    | <0.001  |
| Ascorbic acid (Vitamin C) (mg/1,000 kcal) | 28.8   | 11.7   | 45.2    | 12.5   | 73.1    | 25.1   | <0.001  | 50.1    | 25.3   | 45.5    | 24.1   | 51.5    | 26.2   | 0.486   | 52.3    | 28.3   | 48.5    | 23.5   | 46.3    | 23.6   | 0.002   |
| Soluble dietary fibre (g/1,000 kcal) | 1.1    | 0.3    | 1.5     | 0.3    | 2.0     | 0.5    | <0.001  | 1.6     | 0.5    | 1.5     | 0.5    | 1.5     | 0.6    | 0.561   | 1.6     | 0.6    | 1.5     | 0.5    | 1.5     | 0.6    | <0.001  |
| Insoluble dietary fibre (g/1,000 kcal) | 3.3    | 0.6    | 4.4     | 0.6    | 5.8     | 1.3    | <0.001  | 4.7     | 1.3    | 4.4     | 1.4    | 4.4     | 1.5    | 0.001   | 4.7     | 1.5    | 4.5     | 1.3    | 4.3     | 1.3    | <0.001  |
| Total dietary fibre (g/1,000 kcal) | 4.5    | 0.9    | 6.0     | 0.9    | 8.2     | 1.9    | <0.001  | 6.5     | 1.9    | 6.1     | 2.0    | 6.1     | 2.1    | 0.007   | 6.6     | 2.1    | 6.2     | 1.9    | 6.0     | 1.9    | <0.001  |
| Alcohol (g/1,000 kcal) | 7.8    | 9.9    | 4.5     | 7.6    | 2.2     | 5.1    | <0.001  | 3.7     | 6.7    | 4.9     | 8.2    | 5.8     | 9.2    | 0.001   | 1.3     | 3.0    | 3.3     | 5.9    | 9.9     | 10.7   | <0.001  |

*Based on linear regression analysis for continuous variables; ordinal numbers 0–2 were assigned to the tertile categories of each dietary pattern.*
range of previous results (2-4). The participants with depression (CES-D 16 depression) had a greater risk of having IBS than those without depression. In addition, three dietary patterns were identified using a principal component analysis. After adjusting for potential confounders, the “Alcohol and accompanying” dietary pattern and depression were found to be related to the risk of IBS.

Previous studies have indicated that individual nutrients play a role in the symptoms of IBS. A study in a US population (23) showed that the studied individuals with IBS consumed a significantly smaller proportion of energy as carbohydrates and a greater proportion of energy as fat. In another study (24, 25), conducted among IBS patients with lactose malabsorption, a lactose-restricted diet significantly improved symptoms, both over the short and long term. In addition, a mixture of fructose and sorbitol is known to be absorbed more poorly and to cause more symptoms than either sugar alone, both in control and IBS patients (26). Several studies (27-29) with double blind testing have shown that individual foods sometimes cause IBS symptoms. In particular, among IBS patients, wheat, corn, dairy products, coffee, tea, citrus fruits, eggs and peas are found to provoke symptoms of IBS.

Recently, there has been growing awareness of the importance of dietary patterns in epidemiological studies concerning health issues with complex etiologies (30-32). Okubo and colleagues (33) reported that the “Japanese traditional” dietary pattern with high loading of rice, miso soup and soy products together with low (negative) loading of bread and confectionaries is associated with a significantly lower prevalence of functional constipation in young women (18-20 years of age). However, Guo and colleagues (3) did not find any associations between IBS and dietary patterns among healthy middle-aged Japanese working individuals. In our results, the subjects within the high tertile of the “Alcohol and accompanying” dietary pattern had a significantly lower risk of having IBS than the other groups. The “Alcohol and accompanying” dietary pattern was also associated with the intake of alcohol. Although alcohol consumption was not found to be significantly associated with IBS in several community-based studies (23, 34, 35), up to 21% of individuals with IBS report intolerance to various alcoholic beverages and up to 12% of individuals limit or avoid these drinks (36, 37). Another possible explanation for our results is selection bias. Because all participants were volunteers with an interest in their health, they may have been healthier than the general population. Those with a higher prevalence of IBS related to heavy drinking are not expected to have participated in this study, leaving a cohort of remaining individuals with the “Alcohol and accompanying” dietary pattern.

In this study, we found a significant association between depression (CES-D 16 depression) and IBS. Depressed or distressed psychological conditions have long been thought to play a major role in IBS, although how they relate to IBS or which disorder (psychological condition or IBS) comes first still remains to be identified. Recently, a conceptual model of IBS was developed suggesting bidirectional communication between the central nervous system and gastrointestinal tract. Visceral symptoms arising from the gastrointestinal tract secondarily influence the brain function (bottom-up model). Conversely, psychological factors themselves influence physiological factors, such as the motor, sensory, secretory and immune functions of the gastrointestinal tract (top-down model) (38). Previous studies have shown that early life stressors, such as sexual abuse and maternal separation, are related to the development of IBS (39-41). Understanding the psychological problems of IBS patients might contribute to the development of effective treatments.

There are several limitations to our study. First, the cross-sectional nature of this study does not allow for assessments regarding causal assumptions relating depression to the onset of IBS. Future studies with a longitudinal design are needed to investigate these associations. Second, the diagnosis of depression was established using the CES-D rather

| Number of | Crude OR | 95% CI | p value | Adjusted OR | 95% CI | p value |
|-----------|----------|--------|---------|-------------|--------|---------|
| Healthy dietary pattern | Others | 42 | reference | reference | 2.62 | 1.51 - 4.54 | 0.001 | 5.14 | 1.44 - 4.46 | 0.001 |
| Western dietary pattern | Others | 25 | reference | reference | 0.90 | 0.51 - 1.57 | 0.709 | 0.90 | 0.54 - 1.38 | 0.987 |
| Alcohol and accompanying dietary pattern | Others | 49 | reference | reference | 0.90 | 0.51 - 1.57 | 0.709 | 0.90 | 0.54 - 1.38 | 0.987 |
| High | 19 | 0.90 | 0.51 - 1.57 | 0.709 | 1.00 | 0.54 - 1.38 | 0.987 |
| High | 36 | 1.41 | 0.83 - 2.40 | 0.199 | 1.20 | 0.67 - 2.16 | 0.538 |
| High | 42 | 2.62 | 1.51 - 4.54 | 0.001 | 2.54 | 1.44 - 4.46 | 0.001 |
| High | 22 | 0.90 | 0.51 - 1.57 | 0.709 | 1.00 | 0.54 - 1.38 | 0.987 |
| High | 49 | 0.90 | 0.51 - 1.57 | 0.709 | 1.00 | 0.54 - 1.38 | 0.987 |
| High | 12 | 0.47 | 0.25 - 0.90 | 0.022 | 0.47 | 0.24 - 0.90 | 0.024 |
| High | 19 | 0.90 | 0.51 - 1.57 | 0.709 | 1.00 | 0.54 - 1.38 | 0.987 |
| High | 36 | 1.41 | 0.83 - 2.40 | 0.199 | 1.20 | 0.67 - 2.16 | 0.538 |
| High | 42 | 2.62 | 1.51 - 4.54 | 0.001 | 2.54 | 1.44 - 4.46 | 0.001 |
| High | 22 | 0.90 | 0.51 - 1.57 | 0.709 | 1.00 | 0.54 - 1.38 | 0.987 |
| High | 49 | 0.90 | 0.51 - 1.57 | 0.709 | 1.00 | 0.54 - 1.38 | 0.987 |
| High | 12 | 0.47 | 0.25 - 0.90 | 0.022 | 0.47 | 0.24 - 0.90 | 0.024 |

OR: odds ratio, CI: confidence interval, CES-D: Center for Epidemiologic Studies Depression Scale

a Logistic regression model was adjusted for age, gender, amount of education, marital status, exercise habit, body mass index, smoking status, positive history of diabetes, hypertension, and dyslipidemia. Comparison between high tertile group and the others was conducted in each dietary pattern.
than a clinician-administered structured diagnostic interview. Third, the dietary data were obtained using the brief-type self-administered diet history questionnaire (BDHQ). Although the validity and reliability of our dietary questionnaire have been evaluated (22), potential misclassification of the dietary patterns may have affected our results. Fourth, several potential confounding factors, such as the employment physical activity level and interpersonal relationships among families, were not assessed in our study. Employment physical activity may be a particularly important factor, and high employment physical activity may have confounded the results. Stratification by the employment physical activity level should be a feature of future studies. Finally, as our sample size was relatively small, we were not able to subcategorize the IBS subjects.

In conclusion, we found that an “Alcohol and accompanying” dietary pattern and depression were related to the risk of IBS in a Japanese community population. However, we could not rule out the possibility of some. Further studies with longitudinal observations are therefore warranted.

The authors state that they have no Conflict of Interest (COI).

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