Research Square

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Validation of Dietary Antioxidant Index (DAI) and investigating the relationship between DAI and the odds of Gastric Cancer

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Abstract

Background Gastric Cancer (GC) incidence and mortality are rapidly growing. The necessity of the design and validation of the Dietary Antioxidant Index (DAI) was to examine the total antioxidant content of the diet. The present study examined the validity of DAI and its association with the odds of GC.

Methods In this hospital-based case-control study, 82 patients with GC and 95 healthy controls were examined. We have used a 168 item FFQ to assess dietary intakes. The DAI was calculated based on the intake of vitamin A, C, E, and selenium, manganese, and zinc. To calculate DAI, we standardized each of the six vitamins and minerals by subtracting the global mean and dividing by the global standard deviation. We then calculated the DAI by summing the standardized intakes of these vitamins and minerals with equal weight.

Results We observed a significant and acceptable correlation between DAI and TAC after controlling for age, BMI, energy intake, and smoking and FBS, education, total fat intake, H.pylori infection, total cholesterol, and SFA intakes. Results obtained from modeling DAI as a continuous variable in relation to GC showed a negative association after adjustment for age and in the multivariable analysis (OR=0.64, CI=0.43-0.95).

Conclusion DAI is a valid indicator of dietary antioxidants assessments, and it can be used as a predictor of antioxidant status due to its correlation with serum antioxidants levels. The results of this study showed that dietary antioxidants have a significant relationship with GC, which indicates the importance of antioxidants in preventing this cancer.

Introduction

Diet plays an important role in health and disease. Dietary composition, habits, and patterns discriminate inviolability or affliction to communicable diseases such as cardiovascular disease, diabetes, fatty liver, cancers and high blood pressure [1–6]. Several studies have shown that some foods and micro-nutrients have antioxidant or/and anti-inflammatory properties [3–5, 7]. In addition to the characteristics of the satiety of foods, a comprehensive and complete view is necessary on food properties for preventing, treating and controlling diseases, especially non-communicable diseases [8–10]. Hence, the antioxidants properties of some foods and micronutrients in recent centuries are taken into consideration due to an increase in the incidence and prevalence of various types of cancers [9]. Several studies have examined the association between food and micro-nutrients that have antioxidant properties with the incidence and prevalence of various diseases [8–10]. These studies have also done well in cancer patients [9, 11–13]. But it is noteworthy that most studies have investigated the relationship between foods or micronutrients with antioxidant properties individually or in a limited way. On the other hand, they do not take the whole diet together. It is clear that dietary antioxidants can improve the effects of each other and may have a different or better effect in combination. Therefore, the necessity of the Dietary Antioxidant Index (DAI) design was to examine the total antioxidant content of the diet. This index has been used in some studies

and significant results have been observed [14–16]. Based on the DAI, people's diets can be divided into two major groups including main antioxidants or mainly oxidative diets [14]. However, further investigation and validation are needed to determine its sensitivity and specificity [14]. Nonetheless, it can be used to study the nutritional status in a wide range of outcomes. Therefore, one of the main goals of this study is to investigate its correlation with the antioxidant level in blood and survey its validity.

Moreover, cancer incidence and mortality are rapidly growing worldwide [17]. Actually, Gastric Cancer (GC) is one of the most common and pernicious malignancies in the world [18]. According to estimates, every year more than 1,033,701 new cases of GC are diagnosed and more than 782,685 people lose their lives due to GC [17]. The lifetime risk of GC to age 74 remains between 5–20% in some parts of Asia [17, 19]. Given that the therapies for GC are limited and the survival of patients is low, prevention can be a very effective strategy to reduce mortality from GC [20–22]. Several studies have found a link between the incidence of GC and unhealthy diets [23, 24]. On the other hand, the association between dietary antioxidants and the reduction of the incidence and prevalence of GC has been observed [25–27]. Therefore, the total antioxidant capacity of the diet can provide a comprehensive overview of the relationship between dietary antioxidants and the incidence and/or risk of GC [28]. Differences in GC subgroups and their relationship with the DAI can be a response to how the antioxidant system might influence the mechanisms for preventing or treating this cancer [25, 29, 30]. The possible mechanisms for how dietary antioxidants can prevent or even in some cases eliminate cancer cells are very limited. But there are several suggested hypotheses for these mechanisms. Antioxidants may inhibit or limit the formation of potential carcinogens (e.g., N-nitroso compounds) associated with GC [25]. A diet high in lipids causes oxidative and inflammatory stress, mediated by cytokines such as tumor necrosis factor-a (TNF-a) and interleukin (IL)–6 and oxidized lipids. The presence of antioxidants-rich foods during a high-fat diet might provide a depot of extrinsic antioxidants, able to slake radical species produced at the gastric level, synergizing with esoteric antioxidants and providing more efficient protection against oxidative stress [31].

Therefore, considering the limited resources and studies on validating the DAI, the present study examined the validity of this index and its association with the odds of GC.

Method And Materials

Participant

The full protocol of this study has already been published elsewhere [23, 24]. In sum, this hospital-based case-control study was conducted from December 2014 to May 2016. Eighty-two patients with GC and ninety-five healthy controls were examined. The mean age was 48.33±10.74 and 51.36±11.81 in the case and the control groups, respectively. The cases were patients with GC who were diagnosed by a gastroenterologist within the previous month. Controls were randomly selected from among other patients' caregivers attending the same clinics. Controls were frequency-matched on sex and age (±5 year). Data on cases and controls were collected at the same time and interviewed in the same setting.

Informed consent was received from all participants. The study protocol was approved by the local Ethics Review Committee at Shahid Beheshti University of Medical Sciences, Tehran, Iran.

Inclusion and exclusion criteria

Inclusion criteria

a) in control group the absence of malignancy, pregnancy, lactation or a history of cancer, neurological, gastrointestinal, hepatic, endocrine, immune, kidney and heart disorders and diseases b) in case and control group not following special diets such as vegetarian, or the diets resulted in the weight reduction or increase during the year prior to the interview, c) in case group the absence of conditions such as pregnancy, lactation, neurological, gastrointestinal, hepatic, endocrine, immune, kidney and heart disorders and diseases, d) in both group to be in the age range of 20-80 years and e) willingness to cooperate in the study.

Exclusion criteria

a) not to adhere to the study protocol, b) major diet changes during the study, including diets aimed at weight increase or decrease, c) reported intake energy report >5500 or less than 800 kcal/day.

Assessment of antioxidants markers and blood samples

Participant Preparation

The case and controls should not be on any corticosteroids, anti-inflammatory medications or pain killers, for at least 48 hours prior to collection of specimen.

Blood tests

After fasting for 10–12 hours, venous blood samples (10 ml) were taken in vacationer tubes under sterile conditions from participants between 08:30–10:30 am. Serum was obtained from freshly drawn, rapidly centrifuged. The serum was quickly frozen at −70°C and stored until processed [23, 24].

The serum levels of antioxidants markers including total antioxidant capacity (TAC), and Malone dialdehyde (MDA) for all participants was measured using Ferric-reducing antioxidant power (FRAP) and Thiobarbituric acid assay (TBA) methods.

Assessment of dietary intake

We have used a 168 item FFQ to assess dietary intakes of the case and controls over the past year. Case and controls were asked to report the frequency of consumption of each food item in the last year according to the standard size units (standard serving size) in the questionnaire.

Then, the information obtained from the questionnaires was analyzed using Nutritionist IV (First Databank, Hearst Corp., SanBruno, CA, USA) to calculate the average daily intake of energy and nutrients.

To calculate the DAI we use the daily intake of food items affecting the index of antioxidants.

Calculation of DAI Scores

We used two previously published methods to derive dietary antioxidant indices. The first method, the dietary antioxidant quality score (DAQS), was adapted from Rivas et al. [32]. The DAQS was calculated based on the intake of six antioxidant vitamins and minerals (vitamin A, vitamin C, vitamin E, selenium, manganese, and zinc) derived from the FFQ. The DAI was used to calculate antioxidant-nutrient intake. The score refers to the intake of certain vitamins and minerals that have been proven to act as dietary antioxidants: selenium, zinc, vitamin A, vitamin C, and vitamin E. Daily nutrient intake was compared to that of the daily recommended intake (RDI). The intake of each of the five antioxidant nutrients evaluated was assessed separately by assigning a value of 0 or 1 to each nutrient. When the intake was below 2/3 of the RDI, it was assigned a value of 0. Similarly, when the intake was higher than 2/3 of the RDI, it was assigned a value of 1. Thus, the DAQS ranged from 0 (pro-oxidative diet) to 5 (anti-oxidative diet)

The second method, the DAI, was developed by Wright et al. [14]. To estimate DAI, we standardized each of the same six dietary vitamins and minerals by subtracting the global mean and dividing by the global standard deviation. We then calculated the DAI by summing the standardized intakes of these vitamins and minerals with equal weight, as described next [14, 15, 32]:

[Due to technical limitations, the formula could not be displayed here. Please see the supplementary files to access the formula.]

Assessment of other variables

For all participants, the required information about age, sex, place of birth (rural/urban), smoking, alcohol consumption, aspirin/NSAID use, regular physical activity, education, family history of cancer were collected through general information questionnaire during the interviews.

The weights of participants were measured with the least clothes using a SECA digital scale. The height was measured without shoes in standing position, leaning against the wall and shoulder blades under normal circumstances. Body Mass Index (BMI) was calculated by dividing weight (in kilograms) by the square of height (square meters).

Statistical Analyses

Descriptive analyses were carried out using paired t-test for continuous variables and $\chi 2$-square test for categorical variables. DAQS (as dichotomous) was examined across the following characteristics: age, sex, BMI, education, smoking, alcohol, H.*pylori* infection, physical activity, aspirin/NSAID use and family history of cancer. Analyses focusing on the association of DAI scores and antioxidant markers were carried out using DAI as a continuous variable. For analyses focusing on GC as an outcome, the DAI was analyzed both as a continuous variable and as a dichotomous variable, categorized based on the median

value of the DAI for the controls (-0.19). Beta estimates and 95% confidence intervals (CI) for the antioxidant markers were estimated using linear regression and odds ratios (OR) and 95% CI for GC as outcome was estimated using logistic regression models, adjusting only for age and then fitting a model with additional adjustment for alcohol consumption, marital status, physical activity, cancer history in the first-degree family, total antioxidant capacity, vitamin E, manganese, and salt intake. The partial correlation was used to estimate coefficients between DAI and serum levels of antioxidant factors in the subjects. Statistical tests were performed using SPSS 21; all p values were based on two-sided tests.

Results

Table 1 shows the distribution of 82 cases of GC and 95 controls according to the selected variable [23, 24]. Cases were older, had higher BMI, DAI score compared to controls. The mean DAI value among cases was 0.17 (SD = 1.18); among controls it was −0.21 (SD = 0.68), indicating a more antioxidant diet for controls (p-value = <0.001). The distribution of characteristics and dietary intakes across DAQS categories were shown in table 2. Control characteristics by DAI categories are provided in Table 3.

Partial correlation coefficients between DAI and serum levels of antioxidant factors in the subjects are shown in Table 4. According to this table, in model 1 controlling for age, BMI, energy intake, and smoking acceptable correlation was seen between the DAI and TAC. However, the results were not good for MDA and there was no acceptable correlation. In model 2 after multivariable adjustments, the results were for TAC were improved and the correlation observed was stronger and more significant. But there was still no acceptable and significant correlation for MDA.

Beta estimates and 95% confidence intervals for DAI and antioxidant markers are shown in table 4. According to this table, were observed significant and acceptable correlation between DAI and TAC after controlling for age, BMI, energy intake, and smoking (model 1) and Additionally controlling for fasting blood sugar, education, total fat intake, H.pylori infection, total cholesterol, and saturated fatty acid intakes (model 2). But there was a non-significant and unacceptable correlation between DAI and MDA (in both models).

ORs and 95% CIs for the odds of GC according to dichotomized DAI scores are shown in Table 5. Results obtained from modeling DAI as a continuous variable in relation to odds of GC showed a negative association after adjustment for age (OR = 0.65; 95% CI = 0.45–0.93) and in the multivariable analysis (OR = 0.64, CI = 0.43–0.95). When the analysis was carried out with DAI expressed as a dichotomous variable, and adjusting for age, subjects with DAI score $-0.19 \leq$ were at higher but not significant odds of having GC compared to subjects with DAI $-0.19 >$ ($OR_{DAI} > -0.19 / \leq -0.19 = 0.68$; 95% CI = 0.37–1.24). Also, after multivariable adjustment, it was a seen higher odd of having GC (This association was not significant). When the analysis was carried out with DAQS and adjusting for age and multivariable adjustment, no significant association was seen.

Discussion

The results of our study showed that there is an acceptable and significant correlation between DAI and TAC. Validation of DAI allows researchers to use this proprietary index to examine a comprehensive and more complete aspect of the diet of individuals in nutritional assessments and researches. There is a very limited study of the relationship between the total intake of antioxidants and their serum changes. Most studies on dietary antioxidants and their effect(s) on the serum antioxidant levels, has been considered one or two antioxidants. While the antioxidant levels of the serum are affected by several antioxidants, in combination with each other, they can reduce/increase the effect(s) of each other. Therefore, getting total antioxidants intake from the diet in a coherent formula and designing an index that can predict serum levels of antioxidants is an effective step in assessing nutritional status. Therefore, considering the correlation observed in this study, this indicator can be used in different studies and different outcomes. The correlation between DAI and the TAC was significant and acceptable, while this correlation with MAD was not observed. One of the suggested reasons is that TAC is more susceptible to dietary changes, and it is expected that TAC changes according to dietary antioxidant intake. So, in a study by Wang et. al., in 2012, the researchers came to the conclusion that “TAC is a good predictor of dietary and plasma antioxidant status” [33]. These results were in line with our findings and we reported that the partial correlation between the DAI and the TAC is acceptable and significant after multiple controlling for confounders.

Also, our study showed that DAI is associated with odds of GC. Given the importance of diet and dietary compounds, especially antioxidants, in preventing, treating and controlling various types of cancers, our results confirm the previous findings. It should be noted that GC is directly related to dietary antioxidants, and the design and use of this index in this cancer can be an effective strategy for assessing nutritional status.

On the other hand, the observation of the relationship between dietary antioxidants with the odds of GC in this case-control study is very promising/hopeful. These results are consistent with some studies, so that in a study by Serafini et al., the equivalent of antioxidants was associated with a reduction in the risk of the cardiac and non-cardiac type of GC [31]. But in a study by Terry et. al, they concluded that “Antioxidant intake was not associated with the risk of gastric cardia adenocarcinoma” [34]. According to their findings, the effects of dietary antioxidants are mainly on a group of patients with GC that are under severe stress, such as those who smoke, have gastric reflux or are exposed to air pollution. They stated that intakes of the antioxidants in different types of cancers are not different, except for esophagus cancer [34]. As a result, it can be interpreted that GC etiology is more diverse and a comprehensive diet assessment can be an effective strategy for understanding its roles.

Also, the researchers concluded that there is an association between MDA and GC. They observed that medication could be used as a predictor of GC [35, 36]. Also, in this study, we showed that DAI as a continues variable is associated with odds of GC. These results confirm other studies [35, 36]. Therefore, the association observed in this study between DAI and TAC and GC indicates the importance of their review in nutritional assessments. So, they can even be used as predictive biomarkers of GC. According to the above, and the results of previous studies and our study, there is a strong association between the

serum antioxidant status of the body and the odds of GC. Therefore, the development and validation of a suitable and non-invasive index that is correlated with serum antioxidants can be an option for dietary antioxidants assessment. Also, according to the formula of DAI and considering the total energy intake of the individual, this index provides a comprehensive and universal view on the antioxidant status.

Strengths and Limitations

One of the strengths of this study is the use of a valid FFQ, which allowed us to take complete survey dietary intakes of the subjects being studied. Though recall bias can be a limitation of the FFQ, since it is valid and reliable, and completed by a trained expert, its results are documented and can be trusted.

One of the major strengths of our study was the measurement of the serum TAC and MDA, which allowed us to investigate their association with GC, and to test their correlation with the designed index. This was very important in interpreting the results.

On the other hand, like all other papers, our study also had its own weaknesses and limitations. Like all of the case-control studies, recall bias and select bias (selecting a control group) was a very important challenge in our study. However, due to the hospital-based case-control study and the use of valid questionnaires and the selection of the control group from healthy people, these biases have been minimized.

Another limitation of our study was the relatively low sample size, which could affect the generalization and interpretation of the results; however, considering the outcome of the study, GC, this association appears to be the same in the higher sample size studies. Therefore, it is recommended that studies in the future with an appropriate sample size investigate this association to confirm the results of our study.

Conclusion

Based on the results of this study, DAI is a valid indicator of dietary antioxidants assessments, and it can be used as a predictor of antioxidant status due to its correlation with serum antioxidants levels. On the other hand, the results of this study showed that dietary antioxidants have a significant relationship with GC, which indicates the importance of antioxidants in preventing this cancer. Therefore, the use of dietary antioxidants such as vitamins A, C, E, and minerals such as zinc, manganese, and selenium can be an effective strategy for preventing GC.

Declarations

Conflict of Interest

The authors declare that there is no conflict of interest regarding the publication of this article.

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Author Contributions

FV was responsible for designing the study protocol, writing the paper, and conducting the study, FV and SHD were responsible for analyzing data, and interpreting results.

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Tables

Table 1. Distribution of 82 gastric cancer cases and 95 controls according to selected variables [a, b (1, 2)]			
Characteristics	Mean±SD or N (%)		P-value
	Controls (n=95)	Cases (n=82)	
Age (years)	51.36±11.81	48.33±10.74	0.07
Body Mass Index (BMI, kg/m^2)	26.36±5.12	24.96±2.71	0.02
Dietary antioxidant Index (DAI)	0.17±1.18	-0.21±0.68	0.00
Sex			0.98
Females	52 (54.74)	45 (54.88)	
Males	43 (45.26)	37 (45.12)	
Education			0.24
Diploma or less	67 (70.53)	51 (62.20)	
Higher than diploma	28 (29.47)	31 (37.80)	
Smoking			0.82
Never smoker	80 (84.21)	68 (82.93)	
Ever smoker	15 (15.79)	14 (17.07)	
Alcohol			0.41
Non drinker	86 (90.53)	71 (86.59)	
Drinker	9 (9.47)	11 (13.41)	
H.*pylori* infection			0.002
Negative	46 (51.58)	21 (25.61)	
Positive	49 (51.58)	61 (74.39)	
Regular Physical Activity			0.03
Yes	30 (31.58)	14 (17.07)	
No	65 (68.42)	68 (82.93)	
Aspirin/NSAID use			0.83
No	86 (90.53)	75 (91.46)	
Yes	9 (9.47)	7 (8.54)	
Cancer history			0.41
Yes	11 (11.58)	13 (15.85)	

No	84 (88.42)	69 (84.15)	

[a] Comparison of mean of case and control groups in case of normal distribution of variables by t-test and in case of abnormal distribution of variables by Mann-Whitney test.

[b] Chi-square was used for categorical variables.

Table2. Distribution of characteristics and dietary intakes across dietary antioxidant quality score (DAQS) categories [a, b] (n=177)

Characteristics	Mean±SD		P-value
	DAI ≤ 3	DAI > 3	
Age (years)	49.59±11.30	50.07±11.45	0.79
Weight (kg)	59.93±7.47	59.10±7.36	0.48
Height (cm)	165.86±8.31	167.74±7.70	0.15
Body Mass Index	25.95±4.21	24.85±3.62	0.09
TNF-a	30.74±26.09	27.51±24.88	0.44
TG	139.40±57.50	136.24±58.63	0.73
HDL	46.66±10.60	47.91±12.37	0.49
LDL	100.05±30.18	104.98±31.35	0.32
Energy intake	3006.24±592.47	2990.36±570.30	0.86
Protein (gr/day)	106.21±37.52	104.24±44.34	0.76
Carbohydrate (gr/day)	378.92±122.43	371.84±101.38	0.70
Fat (gr/day)	111.97±39.12	114.25±36.30	0.71
SFA	45.56±33.90	47.56±31.61	0.71
MUFA	29.31±10.91	30.95±9.44	0.33
PUFA	30.49±19.01	28.49±18.64	0.51
MUFA 18 1	23.25±10.07	24.76±9.40	0.34
PUFA 18 2	25.00±18.30	22.85±18.05	0.47
PUFA 18 3	3.70±2.25	4.14±2.00	0.22
Sodium (mg/day)	4109.37±1664.42	3723.29±1381.93	0.11
Potassium (mg/day)	3910.73±1306.06	3692.42±1276.97	0.30
Vitamin A	565.66±243.72	821.25±375.33	0.000
Beta carotene	5250.19±2197.20	5152.00±2145.91	0.78
Alfa carotene	818.54±446.58	784.44±390.25	0.62
Lutein	2241.78±1006.68	2566.62±1459.05	0.08
Beta cryptox	338.73±160.31	320.51±172.22	0.49

Lycopene	5047.17±2329.06	5333.80±2126.44	0.43
Vitamin C (mg/day)	149.66±62.20	175.31±70.63	0.01
Calcium (mg/day)	1225.30±466.16	1162.47±347.51	0.37
Iron (mg/day)	18.62±5.87	19.80±5.18	0.18
Vitamin D	2.14±1.59	2.30±1.66	0.56
Vitamin E	16.69±6.61	23.89±8.41	0.000
Alfa tocopherol	7.47±4.70	11.36±5.01	0.000
Thiamin	2.20±0.93	2.14±0.80	0.70
Riboflavin	2.12±0.72	2.24±0.79	0.33
Niacin	28.40±9.76	31.65±11.51	0.05
Vitamin B6	2.41±0.93	2.51±0.94	0.48
Folate	692.70±236.78	679.14±238.61	0.72
Vitamin B12	5.54±3.50	5.47±2.78	0.89
Biotin	38.42±12.82	37.65±14.59	0.72
Pantothenic	7.25±2.57	8.24±2.68	0.02
Vitamin K	297.55±152.78	255.96±142.10	0.08

[a] Comparison of mean of case and control groups in case of normal distribution of variables by t-test and in case of abnormal distribution of variables by Mann-Whitney test.

[b] Chi-square was used for categorical variables.

Table 3. Participant characteristics by level of the dietary antioxidant index (DIA) among controls, Iranian Gastric Cancer case-control study [a, b] (n=95)

Characteristics	Mean±SD or N (%)		P-Value
	DAI ≤ 0.41 (n=48)	DAI > 0.41 (n=47)	
Age, (years)	48.31±11.52	48.36±10.01	0.98
Sex			0.91
Female	26 (54.16)	26 (55.31)	
Male	22 (45.83)	21 (44.69)	
Body Mass Index (kg/m2)	25.36±2.73	24.55±2.65	0.14
Family history of cancer			0.72
Yes	5 (10.41)	6 (12.76)	
No	43 (89.58)	41 (87.23)	
Education			0.33
Less than a high school and diploma	36 (75)	31 (65.95)	
Higher than diploma	12 (25)	16 (34.04)	
Smoking			0.81
Yes		7 (14.89)	
No	8 (16.66)	40 (85.10)	
	40 (83.33)		
Alcohol			0.27
NO	45 (93.75)	41 (87.23)	
Yes	3 (6.25)	6 (12.76)	
Regular Physical Activity			0.60
Yes	14 (29.16)	16 (34.04)	
No	34 (70.83)	31 (65.95)	

H.pylori infection			0.47
Yes	23 (47.91)	26 (55.31)	
No	25 (52.08)	21 (44.68)	
Aspirin/NSAID use			0.70
No	44 (91.66)	42 (89.36)	
Yes	4 (8.33)	5 (10.63)	

[a] Comparison of mean of case and control groups in case of normal distribution of variables by t-test and in case of abnormal distribution of variables by Mann-Whitney test.

[b] Chi-square was used for categorical variables.

Table 4. Partial correlation coefficients between dietary antioxidant index (DIA) and serum levels of antioxidant factors

Model 1	Correlation coefficient	P-Value[a]	Model 2	Correlation coefficient	P-value[b]
TAC	0.25	0.04	TAC	0.41	0.002
MDA	0.10	0.41	MDA	0.09	0.47

[a] Controlling for age, BMI, energy intake, and smoking

[b] Additionally controlling for fasting blood sugar, education, total fat intake, H.pylori infection, total cholesterol, and saturated fatty acid intakes

Table 5. Odds ratios and confidence intervals for the association between dietary antioxidant index (DIA) and gastric cancer.					
DAI	DAI (categorical) OR and 95% CI		P-Value [a]	DAI (continuous) OR and 95% CI	P-Value
	-0.19 ≤	-0.19 >			
	1 (ref.)	0.68 (0.37-1.24)	0.20 [a]	0.65 (0.45-0.93)	0.02 [a]
	1 (ref.)	0.72 (0.36-1.42)	0.34 [b]	0.64 (0.43-0.95)	0.02 [b]
DAQS	DAQS (categorical) OR and 95% CI				
	DAQS ≤ 3	DAQS > 3			
	1 (ref.)	1.32 (0.69-2.53)	0.39 [a]		
	1 (ref.)	1.30 (0.61-2.73)	0.48 [b]		

[a] age-adjusted

[b] additionally adjusted for gender, body mass index, smoking, education, H.pylori infection, alcohol consumption, aspirin/NSAIDs use, physical activity, cancer history in the first-degree family, total energy intake

* Median

1. Vahid F, Shivappa N, Faghfoori Z, Khodabakhshi A, Zayeri F, Hebert JR, et al. Validation of a Dietary Inflammatory Index (DII) and Association with Risk of Gastric Cancer: a Case-Control Study. Asian Pacific journal of cancer prevention: APJCP.19(6):1471-7.
2. Vahid F, Rahmani G, Jafari Naeini A, Falahnejad H, Davoodi SH. The Association Between Index of Nutritional Quality (INQ) and Gastric Cancer and Evaluation of Nutrient Intakes of Gastric Cancer Patients: A Case-Control Study. Int J Cancer Manag. 2018;11(1):e9747.

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