

The association between eating rate and functional dyspepsia in Iranian adults

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Abstract

Objective: This study aimed to investigate the association between eating rate and functional dyspepsia (FD) in a large population of Iranian adults.

Methods: In this cross-sectional study, we assessed eating rate of 4763 Iranian adults using a dietary habit questionnaire. We used a modified validated version of the Rome III questionnaire to assess gastrointestinal health. FD was defined as having one or more of the following characteristics: bothersome postprandial fullness, early satiation and/or epigastric pain or epigastric burning. Needed information on meal frequency, meal regularity, intra-meal fluid drinking as well as on other potential confounders was obtained by using a pre-tested questionnaire.

Results: Functional dyspepsia was prevalent in 15.2% (n=703) of the studied population. Lunch and total eating rate was associated with greater odds of having FD (OR: 1.37; 95% CI: 1.04-1.8) and (OR: 1.45; 95% CI: 1-2.11), respectively). However, this relationship weakened after adjusting for confounding factors. No significant relationship was found between dinner eating rate and FD in both crude and adjusted models (OR: 1.23; 95% CI: 0.83-1.51). There was no significant relation between lunch, dinner or total eating rate and risk of postprandial fullness, early satiation or epigastric pain either in crude or adjusted models. Eating rate was not related to severity or frequency of FD components.

Conclusions: Fast eating was associated with greater odds of FD. However, there was no association between fast eating with postprandial fullness and epigastric pain. Further studies, particularly prospective ones, are required to confirm these relations.

Introduction

Functional dyspepsia (FD) is a clinical syndrome defined by persistent or recurrent pain or discomfort centered in the upper abdomen without evidence of organic disease likely to explain the symptoms (1). Earlier studies have suggested that 15–20% of the general population experience dyspepsia over the course of year. The prevalence in Iran ranges from 0.1% in Tehran to 29.9% in Shiraz (2, 3). The symptoms, often aggravated by food ingestion, include epigastric pain, bloating, early satiety, postprandial fullness, epigastric burning, belching, nausea, and vomiting (4–6). Although FD is not a life-threatening condition, it is associated with decreased quality of life and might lead to swallowing difficulties. Other complications of untreated FD are pyloric stenosis and peritonitis.

Diet-related practices have been reported as contributing factors to FD. Among others, eating rate has received great attention in this regard. Earlier studies that have investigated eating rate in relation to FD have reached conflicting results (7–9). In a cross-sectional study, it has been reported that eating rate is higher among those with FD than those without FD (7). However, another report found that slower eating rate was not related to gastric emptying (8). Others have shown no significant difference in eating behavior between patients with FD and healthy controls (9). Overall, it seems that no definite conclusion is available about the association between eating rate and FD.

Besides the controversy in earlier findings, it must be kept in mind that almost all previous studies came from western countries and limited data are available about the dietary behaviors and FD in non-western nations. Nowadays, due to time limitations as well as the phenomenon of nutrition transition (10), most people in developing countries do not spend much time for their meals. This is in parallel to the increasing prevalence of gastrointestinal disorders including FD (11). Furthermore, earlier studies have mostly been limited in their sample size as well as controlling for confounding variables. Given the limited information, we aimed to investigate the association between eating rate and functional dyspepsia among a large group of Iranian adults.

Materials And Methods

This cross-sectional study was done in the framework of SEPAHAN project that was performed in two phases in a large population of Iranian adults working in 50 different health centers in Isfahan province (12). In the first phase, some questionnaires, demographic information, medical history, anthropometric measures, lifestyle and nutritional factors were sent to 10087 people. Totally, the questionnaires were completed and returned by 8691 subjects (response rate: 86%). In the second phase, required data on gastrointestinal health of study participants were collected through the use of self-administered questionnaires. After collecting and matching the information from both phases, 4763 people who had complete data on dietary habits and functional

gastrointestinal disorders (FGIDs) for the current analysis. Written Informed consent was obtained from all subjects before enrollment in the study. The Bioethics Committee of Isfahan University of Medical Sciences, Isfahan, Iran, approved the study.

Assessment of eating rate : We estimated eating rate using a dietary habits questionnaire that included detailed questions about meal regularity and frequency of meals, drinking fluids before and after meals as well as a couple of questions about eating rate. We asked participants to answer "how long does it take you to have lunch" as well as "how long it takes you to have dinner". They had four choices to respond to each question: "Don't have lunch or dinner", "less than 10 minutes", "10–20 minutes", "more than 20 minutes". In the current study, the responses to this question were considered as the main exposure variable. Individuals who reported that they spent less than 10 minutes to have lunch or dinner were defined as fast eaters. Total eating rate was calculated and scored as below; Score 1: people who ate lunch and dinner in more than 20 minutes; Score 2: people who had their lunch in more than 20 minutes and dinner at 10–20 minutes or who had their lunch at 10–20 minutes and dinner at more than 20 minutes; Score 3: subjects who ate lunch in more than 20 minutes and dinner in less than 10 minutes or who ate their lunch in less than 10 minutes and dinner in more than 20 minutes; Score 4: participants who ate their lunch and dinner at 10–20 minutes; Score 5: people who ate their lunch in 10–20 minutes and dinner at less than 10 minutes or their lunch in less than 10 minutes and dinner in 10–20 minutes.

Assessment of functional dyspepsia: In this study, we used a modified Persian version of the Rome III questionnaire for assessment of FD. During the pre-study evaluation of the questionnaire, we noticed that most subjects barely can distinguish between the descriptors in the original Rome III questionnaire (never, less than one day a month, one day a month, two to three days a month, one day a week, more than one day a week, every day). We, therefore, used 4 modified descriptors (i.e. never or rarely, sometimes, often, always) as the rating scales (13). In our study, we recognized FD with one or more of the following characteristics: bothersome postprandial fullness (defined as feeling uncomfortably full after regular-sized meal, often or always), early satiation (defined as being unable to finish regular-sized meal, often or always), and/or epigastric pain or epigastric burning (defined as feeling pain or burning in the middle of abdomen, often or always). The reliability of Persian version of Rome III questionnaire has already been determined in an Iranian population (14).

Assessment of other variables

Standard questionnaires were distributed to collect information on age, gender and educational status. Weight, height and prevalence of diabetes were evaluated by a self-administered questionnaire. Data on smoking were collected through self-reported responses to the questionnaire and participants were categorized as "non-smokers", "ex-smokers" and "current smokers". The use of dietary supplements (yes/no) and oral contraceptive pills (yes/no) as well as patterns of tea consumption (never or less than 1 cup/month, 1–3 cups/month, 1–3 cups/wk, 4–6 cups/wk, 1 cup/day, 2–4 cups/day, 5–7 cups/day, 8–11 cups/day or at least 12 cups/day) was also assessed by a pre-tested questionnaire. Fluid intake was evaluated by questioning on drinking water, soft drink, yogurt drink ("dough") and other beverages before, after or intra-meals; for which subjects could answer as never, sometimes, often and always. Participants were asked about meal regularity and categorized as "never", "sometimes", "often" and "always" having regular meals. Study subjects were also categorized in terms of dental status as "fully dentate", "lost 1–3 teeth", "lost 4–5 teeth", "lost half or more teeth". Quality of chewing was also evaluated ("How thoroughly do you chew food?"), with responses including "not very well", "well", "very well". With regard to fried food intake, subjects were asked to report how many days per week they were consuming fried foods. We also asked participants to select one or more of the choices about their feelings after milk intake. Lactose intolerance was defined as the existence of abdominal pain, bloating, diarrhea or belching after milk consumption.

Statistical Analysis

Comparison of continuous variables across different categories of eating rate was assessed using one-way ANOVA. Chi-square test was used to examine the distribution of participants in term of categorical variables across different categories of eating rate. The relationship between eating rate and FD or its components was examined using logistic regression in different models. First, the relationship was assessed in crude model. Then, age and sex were adjusted for in the first model. We further controlled for physical activity, education level and smoking in model 2. Dietary behaviors including regular meal intake, chewing sufficiency level, regular having breakfast, drinking water while eating, fried foods consumption, frequency of spicy foods intake, daily water intake and dental status were additionally adjusted in the third model. Further adjustment for BMI was performed in the last model. In all models, subjects who spending more than 20 minutes to eat their lunch and dinner were considered as the reference category. All analyses were done for FD and its components separately. Statistical Package for Social Sciences (SPSS Inc., version 18.0, Chicago, IL) was used for all analyses and P-values less than 0.05 were considered statistically significant.

Results

Demographic information of the study participants across different categories of eating rate are provided in **Table 1**. We found that those spending less time for lunch or dinner were younger, had a higher weight and BMI and were more likely to be current smokers and less likely to be physically active compared with those who ate lunch or dinner slower. When we considered total eating rate as a combined variable we found that fast eaters were younger, had higher weight and BMI and were more likely to be university graduated and less likely to be current smokers and physically active.

Distribution of study subjects in terms of diet-related behaviors across various categories of eating rate are shown in **Table 2**. Slow eating rate was associated with having three main meals, irregular meal pattern and low chewing efficiency. Furthermore, those spending less time for having meals were less likely to eat breakfast regularly and to be frequent fried food consumers compared with those who had slow eating rates. Most participants were consuming 2-5 cups of water throughout the day.

Multivariable-adjusted odds ratios and 95% confidence intervals for FD across different categories of eating rate are provided in **Table 3**. Fast lunch eating was associated with increased of FD in crude model, however, after adjusting for confounders this relationship became non-significant. The relationship between dinner eating rate and FD was not significant either before or after adjusting for confounding factors. When total eating rate was considered, fast eating was associated with increased risk of FD. However, after adjusting for diet-related behaviors and BMI this relationship disappeared. No significant relationship was observed between lunch, dinner or total eating rate and risk of postprandial fullness, early satiation or epigastric pain, either in crude or adjusted models. We also failed to find a significant relationship between eating rate and frequency or severity of FD and its components (**Table 3**).

Discussion

In current study, we found a positive association between eating rate and risk of FD. However, this relationship weakened after adjusting for confounding factors. No significant relationship was observed between lunch, dinner or total eating rate and risk of postprandial fullness, early satiation or epigastric pain either in crude or adjusted models. We also failed to find a significant relationship between eating rate and severity or frequency of FD components. This is one of the few studies that examined the association between eating rate and FD.

Prevalence of FD is high in the world affecting 15-20% of adult people in developed countries (15). Several factors including diet, psychosocial factors, non-steroidal anti-inflammatory (NSAID) use, alcohol, tobacco, and *Helicobacter pylori* infection are involved in its etiology (16). Among dietary behaviors, eating rate has long been unclear for patients and physicians. Although, it is claimed that eating speed may affect the FD symptoms, data on the association between eating rate and FD are rare. Earlier studies have mostly evaluated the relationship between eating patterns and FD (15, 17-18). Based on these findings, calorie or fat intake of patients with FD was lower than that in healthy individuals in general. We found a positive association between eating speed and FD. In line with our findings, Dong Hyun Sinn et al found that a higher percent of patients with FD reported that they ate their meals rapidly compared with those without FD or GERD (7). However, some others did not reach such results (18). In contrast to our findings, Carvalho et al. reported that eating rate was not significantly different between patients with FD and controls (18). Another study that was conducted in mini-pigs showed that slower eating rate is independent to gastric emptying (19). These inconclusive data might arise due to variety of methods used or the lack of standardization of measurements as well as differences in sample size, study population and consideration of confounders.

The exact mechanisms through which rapid eating might affect FD are unknown. The effect of fast eating on FD can be through altering gastric emptying and gastroduodenal motility or altering the accommodation of the proximal stomach (20).

Some limitations should be taken into account while interpreting our findings. First, it is a cross-sectional study; hence, we cannot infer a causal link between eating rate and FD. Further studies are required to confirm our findings. Second, in spite of several adjustments for a wide range of variables, residual confounding cannot be excluded. Third, the presence of FD was examined by the use of self-administered questionnaire. However, ROME III questionnaire has earlier been validated for assessment of FGIDs in Iranian population. Moreover, factors such as appetite, the amount of consumed food, culture and type of recipe might influence the

eating time and should be considered. Another limitation of this study is the ability to generalize the relation between eating rate and dyspepsia.

Conclusions

We found evidence indicating a positive association between fast eating and risk of FD. Fast eating was not associated with postprandial fullness and epigastric pain. Further studies, particularly prospective ones are required to confirm these relations.

Declarations

Ethical Approval and Consent to participate: Written Informed consent was obtained from all subjects before enrollment in the study. The Bioethics Committee of Isfahan University of Medical Sciences, Isfahan, Iran, approved the study.

Consent for publication: Each author acknowledges he/she has participated in the work in a substantive way and is prepared to take public responsibility for the work.

Availability of supporting data: Supporting data for this investigation can be available by contacting the supervisor of the research (AE).

Competing interests: None of the authors declared potential personal or financial conflicts of interest.

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Authors' contributions: PS, AHK, HR, HD, AF, AE and PA designed the research, conducted the study, analyzed the data, wrote the manuscript and had the responsibility for the final content. All authors read and approved the final manuscript.

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Tables

Table 1: General characteristics of study participants across different categories of eating rate¹

	Age (year)	Weight (kg)	BMI (kg/cm ²)	Academically Educated (%)	Current Smokers (%)	Physically Active (%) ²
Lunch eating rate						
>20 min	38.4±8.6	69.3±13.9	25.0±5.0	6	17	12
10-20 min	36.1±7.9	68.4±13.2	25.9±4.4	7	13	9
<10 min	36.0±7.6	70.0±13.6	25.7±5.0	7	18	10
P	∅ 0.001	∅ 0.001	∅ 0.001	∅ 0.001	∅ 0.001	0.002
Dinner eating rate						
>20 min	37.5±8.3	68.9±14.3	24.8±4.7	6	17	12
10-20 min	36.0±7.9	68.3±13.3	24.75±4.49	7	13	9
<10 min	36.5±8.1	69.8±13.5	25.6±4.9	7	16	9
P	0.001	0.001	∅ 0.001	∅ 0.001	0.018	0.036
Total eating rate ³						
Very slow	38.3±8.6	69.3±13.8	24.9±4.6	6	19	12
Slow	36.3±8.4	68.3±15.3	24.5±5.1	5	14	12
Moderate	36.1±7.9	68.5±13.1	24.8±4.4	7	13	7
Fast	35.9±7.9	67.8±12.8	25.1±4.3	6	15	6
Very fast	36.4±7.8	71.7±14.0	24.9±4.6	7	18	11
P	∅ 0.001	∅ 0.001	∅ 0.001	∅ 0.001	0.001	0.001

¹All values are mean ± standard deviation unless indicated.

²Physically active: people who had more than one hour physical activity per week.

³Total eating rate: Very slow: people who ate lunch and dinner in more than 20 minutes; slow: people who had their lunch in more than 20 minutes and dinner at 10-20 minutes or who had their lunch at 10-20 minutes and dinner at more than 20 minutes; moderate: subjects who ate lunch in more than 20 minutes and dinner in less than 10 minutes or who ate their lunch in less than 10 minutes and dinner in more than 20 minutes; fast: participants who ate their lunch and dinner at 10-20 minutes; very fast: people who ate their lunch in 10-20 minutes and dinner at less than 10 minutes or their lunch in less than 10 minutes and dinner in 10-20 minutes.

Table 2: Distribution of study subjects in terms of eating behaviors across different categories of eating rate

	Lunch eating rate (min)			P	Dinner eating rate (min)			P	Total eating rate (min) ¹						
	>20	10-20	<10		>20	10-20	<10		Very slow	slow	moderate	fast	Very fast	P	
Main meal number (%)				0.017				0.001							0.001
1 main meal/d	4	3	4		3	2	4		3	2	2	3	4		
2 main meals/d	24	27	28		22	19	27		17	22	19	29	23		
3 main meals/d	72	70	68		75	79	69		80	76	79	67	73		
Having regular meals (%) ²	60	62	46	0.001	53	62	55	0.001	58	58	63	58	47		0.001
Chewing level (%)				0.001				0.001							0.001
Low	5	12	39		6	11	26		4	5	11	16	43		
moderate	68	77	57		67	76	66		67	71	77	74	55		
high	27	11	4		27	12	7		29	23	12	10	2		
Having regular breakfast (%) ³	79	78	70	0.001	77	79	76	0.229	78	80	78	79	70		0.018
Having drinks while eating (%) ⁴	49	54	51	0.053	51	55	53	0.418	51	53	55	52	54		0.114
Frequency of Consumption of fried foods (%) ⁵	18	16	17	0.001	18	17	16	0.015	19	19	17	14	18		0.003
Consuming spicy food (%) ⁶	49	54	55	0.006	51	56	55	0.015	48	56	56	58	54		0.019
Daily water drinking (%)				0.001				0.001							0.001
< 2cups	19	24	33		21	23	30		20	19	23	27	35		
2-5 cups	50	54	47		50	53	50		49	51	54	53	46		
6-8 cups	23	17	15		23	18	16		24	23	18	16	15		
> 8cups	8	4	5		6	5	4		7	6	5	4	5		
Dental status (%)				0.083				0.083							0.047
complete	30	32	35		30	32	35		27	34	32	36	34		
Lack 1-5	59	60	56		59	60	56		60	58	60	56	57		
Lack > 5	9	6	7		9	6	7		10	7	7	7	8		
none	3	2	2		3	2	2		3	2	1	2	1		

¹Total eating rate:Very slow: people who ate lunch and dinner in more than 20 minutes; slow: people who had their lunch in more than 20 minutes and dinner at 10-20 minutes or who had their lunch at 10-20 minutes and dinner at more than 20 minutes; moderate: subjects who ate lunch in more than 20 minutes and dinner in less than 10 minutes or who ate their lunch in less than 10 minutes and dinner in more than 20 minutes; fast: participants

who ate their lunch and dinner at 10-20 minutes; very fast: people who ate their lunch in 10-20 minutes and dinner at less than 10 minutes or their lunch in less than 10 minutes and dinner in 10-20 minutes.

²Having regular meals: people who often or always have regular meals

³Having regular breakfast: people who have breakfast more than 5 times per week

⁴Having drinks while eating: subjects who often or always have drinks while eating

⁵Consuming fried foods: subjects consuming fried foods more than 4 times per week

⁶Consuming spicy food: people who intake spicy foods more than 4 times per week

Table 3: Multivariable-adjusted odds ratios and 95% CIs for having functional dyspepsia (FD) and its components across different categories of eating rate¹

	Lunch eating rate (min)			Dinner eating rate (min)			Total eating rate ²					
	>20	10-20	<10	>20	10-20	<10	Very Slow	Slow	Moderate	Fast	Very Fast	
FD												
Crude	1.00	1.00 (0.81-1.2)	1.37 (1.04-1.8)	1.00	0.99 (0.76-1.28)	1.16 (0.8-1.54)	1.00	1.21 (0.81-1.80)	1.10 (0.81-1.51)	1.32 (0.92-1.89)	1.45 (1-2.11)	
Model 1	1.00	0.97 (0.76-1.2)	1.26 (0.93-1.6)	1.00	0.92 (0.70-1.23)	1.12 (0.82-1.53)	1.00	1.17 (0.76-1.82)	1.07 (0.76-1.51)	1.15 (0.77-1.71)	1.47 (0.98-2.21)	
Model 2	1.00	1.01 (0.78-1.3)	1.38 (1.00-1.9)	1.00	1.03 (0.75-1.40)	1.25 (0.89-1.76)	1.00	1.30 (0.81-2.09)	1.18 (0.81-1.72)	1.32 (0.86-2.03)	1.67 (1.07-2.61)	
Model 3	1.00	0.92 (0.69-1.21)	1.06 (0.73-1.53)	1.00	1.04 (0.74-1.47)	1.14 (0.77-1.66)	1.00	1.33 (0.80-2.22)	1.10 (0.73-1.66)	1.20 (0.75-1.92)	1.28 (0.78-2.10)	
Model 4	1.00	0.94 (0.70-1.25)	1.12 (0.77-1.64)	1.00	1.06 (0.74-1.51)	1.23 (0.83-1.51)	1.00	1.33 (0.78-2.26)	1.14 (0.75-1.75)	1.27 (0.78-2.05)	1.41 (0.85-2.36)	
Postprandial fullness												
Crude	1.00	1 (0.75-1.33)	1.18 (0.82-1.69)	1.00	0.85 (0.60-1.19)	1.19 (0.83-1.72)	1.00	1.21 (0.71-2.05)	1.05 (0.69-1.60)	1.53 (0.96-2.44)	1.27 (0.77-2.10)	
Model 1	1.00	0.98 (0.71-1.33)	1.20 (0.81-1.87)	1.00	0.78 (0.54-1.12)	1.16 (0.78-1.71)	1.00	1.10 (0.62-1.96)	0.97 (0.62-1.53)	1.41 (0.85-2.33)	1.31 (0.77-2.26)	
Model 2	1.00	1.02 (0.72-1.43)	1.29 (0.85-1.98)	1.00	0.91 (0.60-1.36)	1.32 (0.85-2.04)	1.00	1.06 (0.56-2.03)	1.08 (0.65-1.77)	1.57 (0.91-2.72)	1.42 (0.78-2.56)	
Model 3	1.00	0.88 (0.8-1.28)	0.98 (0.60-1.58)	1.00	0.88 (0.56-1.38)	1.19 (0.73-1.94)	1.00	1.08 (0.54-2.14)	0.93 (0.55-1.59)	1.29 (0.71-2.34)	1.10 (0.58-2.09)	
Model 4	1.00	0.86 (0.59-1.25)	0.98 (0.60-1.59)	1.00	0.84 (0.53-1.32)	1.19 (0.72-1.94)	1.00	1.03 (0.51-2.06)	0.88 (0.51-1.51)	1.28 (0.70-2.32)	1.08 (0.56-2.07)	
Early satiation												
Crude	1.00	0.98 (0.71-1.35)	1.34 (0.90-1.99)	1.00	1.09 (.74-1.61)	1.05 (0.68-1.63)	1.00	0.95 (0.52-1.73)	1.08 (0.69-1.70)	1.10 (0.65-1.86)	1.19 (0.69-2.05)	
Model1	1.00	0.90 (0.63-1.27)	1.25 (0.81-1.93)	1.00	1.03 (0.67-1.56)	1.01 (0.63-1.61)	1.00	0.93 (0.49-1.77)	1.01 (0.61-1.65)	0.84 (0.47-1.52)	1.28 (0.71-2.29)	
Model2	1.00	0.93 (0.63-1.36)	1.42 (0.90-2.25)	1.00	1.19 (0.74-1.91)	1.23 (0.73-2.06)	1.00	1.04 (0.51-2.12)	1.15 (0.66-1.98)	0.99 (0.52-1.90)	1.53 (0.83-2.98)	
Model3	1.00	0.91 (0.61-1.37)	1.36 (0.81-2.29)	1.00	1.31 (0.77-2.23)	1.33 (0.74-2.40)	1.00	1.19 (0.56-2.52)	1.15 (0.63-2.07)	1.02 (0.51-2.04)	1.54 (0.76-3.12)	
Model4	1.00	0.96 (0.63-1.47)	1.61 (0.94-2.76)	1.00	1.40 (0.80-2.44)	1.59 (0.86-2.92)	1.00	1.14 (0.52-2.50)	1.25 (0.67-2.32)	1.15 (0.56-2.36)	1.95 (0.93-4.06)	
Epigastric pain												
Crude	1.00	1 (0.74-1.33)	1.26 (0.88-1.82)	1.00	1.02 (0.72-1.45)	1.14 (0.78-1.68)	1.00	1.31 (0.76-2.24)	1.20 (0.78-1.74)	1.32 (0.80-2.15)	1.45 (0.87-2.41)	
Model1	1.00	1.02 (0.74-1.40)	1.16 (0.77-1.74)	1.00	1.02 (0.70-1.49)	1.17 (0.77-1.78)	1.00	1.23 (0.68-2.24)	1.26 (0.78-2.03)	1.28 (0.74-2.20)	1.49 (0.85-2.61)	

Model 2	1.00	1.14 (0.80-1.61)	1.36 (0.88-2.09)	1.00	1.05 (0.70-1.57)	1.23 (0.79-1.92)	1.00	1.49 (0.79-2.81)	1.38 (0.8-2.31)	1.48 (0.8-2.65)	1.75 (0.96-3.18)
Model 3	1.00	0.99 (0.67-1.46)	0.87 (0.5-1.45)	1.00	1 (0.64-1.57)	0.96 (0.58-1.59)	1.00	1.32 (0.66-2.64)	1.19 (0.68-2.08)	1.18 (0.63-2.22)	1.04 (0.53-2.04)
Model 4	1.00	1.04 (0.7-1.56)	0.92 (0.5-1.55)	1.00	1.01 (0.64-1.60)	1.04 (0.63-1.74)	1.00	1.31 (0.64-2.70)	1.24 (0.70-2.21)	1.23 (0.64-2.35)	1.14 (0.5-2.28)

¹Functional dyspepsia was defined as having one or more of the following characteristics: bothersome postprandial fullness, early satiation, and/or epigastric pain or epigastric burning.

²Total eating rate: Very slow: people who ate lunch and dinner in more than 20 minutes; slow: people who had their lunch in more than 20 minutes and dinner at 10-20 minutes or who had their lunch at 10-20 minutes and dinner at more than 20 minutes; moderate: subjects who ate lunch in more than 20 minutes and dinner in less than 10 minutes or who ate their lunch in less than 10 minutes and dinner in more than 20 minutes; fast: participants who ate their lunch and dinner at 10-20 minutes; very fast: people who ate their lunch in 10-20 minutes and dinner at less than 10 minutes or their lunch in less than 10 minutes and dinner in 10-20 minutes.

Model 1: Adjusted for age and sex

Model 2: Additionally adjusted for physical activity, education level and smoking

Model 3: Further controlled for dietary behaviors including regular meal intake, chewing sufficiency level, regular having breakfast, drinking water while eating, fried foods consumption, frequency of spicy foods intake, daily water intake and dental status

Model 4: Further adjusted for BMI.