



Foods Inducing Typical Gastroesophageal Reflux Disease Symptoms in Korea

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Background/Aims

Several specific foods are known to precipitate gastroesophageal reflux disease (GERD) symptoms and GERD patients are usually advised to avoid such foods. However, foods consumed daily are quite variable according to regions, cultures, etc. This study was done to elucidate the food items which induce typical GERD symptoms in Korean patients.

Methods

One hundred and twenty-six Korean patients with weekly typical GERD symptoms were asked to mark all food items that induced typical GERD symptoms from a list containing 152 typical foods consumed daily in Korea. All patients underwent upper gastrointestinal endoscopy followed by 24-hour ambulatory esophageal pH monitoring. The definition of “GERD” was if either of the 2 studies revealed evidence of GERD, and “possible GERD” if both studies were negative.

Results

One hundred and twenty-six cases (51 GERD and 75 possible GERD) were enrolled. In 19 (37.3%) of 51 GERD cases and in 17 (22.7%) of 75 possible GERD cases, foods inducing typical GERD symptoms were identified. In the GERD group (n = 19), frequent symptom-inducers were hot spicy stews, rice cakes, ramen noodles, fried foods, and topokki. In the possible GERD group (n = 17), frequent symptom-inducers were hot spicy stews, fried foods, doughnuts, breads, ramen noodles, coffee, pizza, topokki, rice cakes, champon noodles, and hotdogs.

Conclusions

In one-third of GERD patients, foods inducing typical symptoms were identified. Hot spicy stews, rice cakes, ramen noodles, fried foods, and topokki were the foods frequently inducing typical symptoms in Korea. The list of foods frequently inducing typical GERD symptoms needs to be modified based on their own local experiences.

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Key Words

Food; Gastroesophageal reflux; Korea; Symptom assessment

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Introduction

Gastroesophageal reflux disease (GERD) is characterized by abnormal reflux of the gastric contents into the esophagus.¹ In most patients with GERD, reflux of gastric juice commonly causes heartburn and regurgitation.² Barrett's esophagus, which is a pre-malignant lesion for esophageal adenocarcinoma, is considered one of the most important complications of GERD.³

These troublesome symptoms and complications are the main drivers for GERD patients to seek medical attention. The conditions, such as male gender, a presence of a hiatal hernia, history of *Helicobacter pylori* eradication, current alcohol intake, and abdominal obesity, are known as risk factors for GERD.^{4,5} Dietary factors traditionally have been thought to induce or worsen GERD. GERD symptoms are commonly reported postprandially, suggesting that some specific diet components are more likely to induce symptoms.⁴ With the introduction of 24-hour pH monitoring, it has been objectively shown that postprandial reflux is important in reflux symptom profiles.^{6,7} However, there have been few attempts to measure the effect of specific food stuffs that might provoke or increase gastroesophageal reflux. Although several studies have reported that high-fat foods, spicy foods, chocolate, mint, and citrus fruits are closely related to GERD symptoms,⁸⁻¹⁰ the daily consumed foods are quite variable according to race, geographic specificity, diet habit, and culture. The conflicting conditions may cause differences in food-induced GERD symptoms between Asian and Western populations. Therefore, dietary recommendations should be based on local experiences. According to a recent Korean study, dietary categories aggravating typical or atypical GERD symptoms in possible GERD cases were noodles, fatty meals, caffeinated drinks, spicy foods, alcohol, breads, carbonated drinks, and sweets.¹¹

This study was performed to investigate food items that are frequently consumed daily and may be responsible for inducing typical GERD symptoms in confirmed GERD patients in their daily lives in Korea.

Materials and Methods

One hundred and twenty-six consecutive subjects who visited our Digestive Disease Center between February 2009 and September 2014 due to at least weekly typical GERD symptoms (heartburn or regurgitation) for at least 3 months were recruited into this prospective study. Subjects were excluded if they had other significant gastrointestinal diseases (for example, active peptic ulcer disease,

infectious conditions of the intestine and gastric malignancy), a history of gastrectomy or severe health problems. Exclusion criteria also included any use of NSAIDs, oral steroids or aspirin, use of proton pump inhibitors or histamine H2 receptor antagonists over the preceding 3 months, and current pregnancy. All subjects provided written informed consent prior to the investigation.

All patients underwent upper gastrointestinal endoscopy to assess the presence and extent of esophageal mucosal breaks. Thereafter, 24-hour ambulatory esophageal pH monitoring was carried out. Patients with GERD symptoms were divided into 2 groups according to the results of endoscopy and pH monitoring; "GERD" if either of the 2 studies revealed evidence of GERD, and "possible GERD" if both studies were negative.

The patients were asked during their first visit whether they experienced their typical GERD symptoms induced by any specific food intake for the preceding 3 months. Then they marked all food items which induced their typical GERD symptoms from a food list containing 152 foods usually consumed daily by Koreans. The food list was made including all individually collected daily food consumption lists from more than 20 hospital staffs and patients. Considering the possibility of omission of any foods, if the patients could not find any symptom-inducing foods of their own from the list, they were instructed to add such foods freely to the list. In addition, they crossed out all food items that they had not consumed for the preceding 3 months from the list.

Symptom-inducing foods were categorized into 2 groups: "frequent symptom-inducers" if they induced symptom(s) in half or more occasions of consumption, and "occasional symptom-inducers" if they induced symptom(s) in less than half occasions of consumption. When any food induced typical GERD symptoms in half or more patients of the group, it was regarded as a meaningful culprit food.

All statistical analyses were conducted using the SPSS statistical software (version 20.0; IBM Corp, Armonk, NY, USA). *P*-values less than 0.05 were considered statistically significant. The data with continuous variables were expressed as mean \pm standard deviation. The estimated internal consistency of the food list questionnaire was assessed through Cronbach's alpha coefficients.

Written informed consent was obtained from all participants. This study received approval from the institutional review board of Korea University Guro Hospital.

Results

A total of 126 patients completed the study. Among these sub-

jects, the age of 51 GERD patients ranged from 27 to 72 years, and the 75 possible GERD patients were aged 17 to 79 years. In 19 (37.3%) out of the 51 GERD cases and in 17 (22.7%) out of the 75 possible GERD cases, foods inducing typical GERD symptoms were identified (Figure). The Cronbach's alpha value of the overall questionnaire was 0.77 (95% confidence interval 0.75 - 0.78) among the 152 food items and, therefore, it was acceptable for internal consistency.

Table 1 shows clinical characteristics of the 4 subgroups according to the presence of mucosal breaks and/or pathologic refluxes and symptom-inducing foods. There were no differences in age, gender, height, weight, and body mass index (BMI) between patients with and without symptom-inducing foods in both GERD and possible GERD groups, except a female predominance in the possible GERD group with symptom-inducing foods. Among the patients without symptom-inducing foods, the BMI in GERD patients was significantly greater than that in possible GERD patients (24.9 ± 4.6 vs 22.5 ± 3.7 , $P = 0.007$).

In the GERD group, foods that frequently induced typical

GERD symptoms in half or more patients were hot spicy stews, rice cakes, ramen noodles, fried foods, and topokki (stir-fried rice cakes). Foods that frequently or occasionally induced GERD symptoms in half or more patients included biscuits, breads, hand-pulled dough soups, hamburgers, doughnuts, spicy noodles with vegetables and seafoods (champon), noodles with stir-fried bean paste (jajangmyeon), alcohols, carbonated beverages, pizzas, mandarins, plain noodles, oranges, and milk (Table 2).

In the possible GERD group, foods that frequently induced typical GERD symptoms in half or more patients were hot spicy stews, fried foods, doughnuts, breads, ramen noodles, coffee, pizzas, topokki, rice cakes, champon, and hotdogs. Moreover, cola, oranges, alcohols, hamburgers, jajangmyeon, hand-pulled dough soups, dumplings, red beans, green tea, and rice cake soups were added to the list of foods that frequently or occasionally induced GERD symptoms in half or more patients (Table 3).

In all confirmed or possible GERD cases, foods that frequently induced typical GERD symptoms in half or more patients were hot spicy stews, rice cakes, ramen noodles, fried foods, breads, and

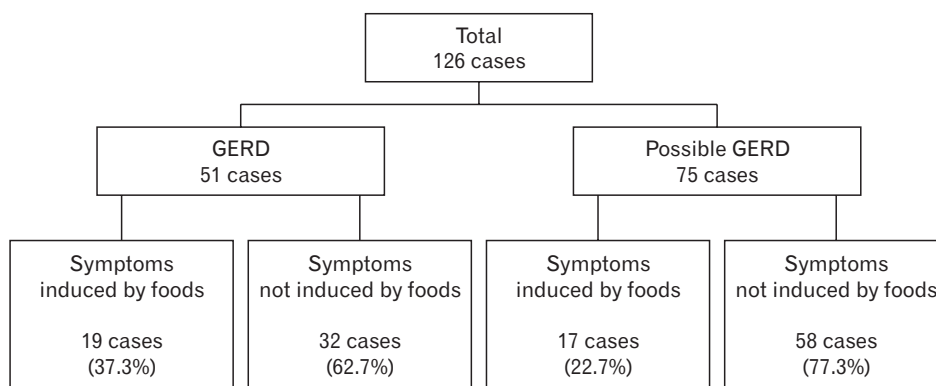


Figure. Enrolled cases. GERD, gastroesophageal reflux disease.

Table 1. Baseline Characteristics According to Status of Gastroesophageal Reflux Disease and Symptom-inducing Foods

	GERD		P-value	Possible GERD		P-value
	Food (+) (n = 19)	Food (-) (n = 32)		Food (+) (n = 17)	Food (-) (n = 58)	
Age (mean \pm SD)	55.5 \pm 9.8	52.7 \pm 11.5	0.358	50.8 \pm 13.1	52.5 \pm 14.1	0.670
Gender (M/F)	7/12	12/20	0.963	1/16	20/38	0.021
Height (mean \pm SD, cm)	160.0 \pm 10.2	161.5 \pm 7.9	0.554	159.3 \pm 6.7	161.2 \pm 8.2	0.182
Weight (mean \pm SD, kg)	62.3 \pm 11.4	65.1 \pm 13.4	0.454	58.5 \pm 7.8	59.5 \pm 13.0	0.375
BMI (mean \pm SD)	24.3 \pm 3.2	24.9 \pm 4.6	0.609	23.1 \pm 2.1	22.5 \pm 3.7	0.809

GERD, gastroesophageal reflux disease; M, male; F, female; BMI, body mass index.

GERD patients with at least weekly typical GERD symptoms were divided into 2 groups according to the results of endoscopy and pH monitoring; "GERD" if either of the 2 studies revealed evidence of GERD, and "possible GERD" if both studies were negative.

Table 2. List of Food Items That Frequently or Occasionally Induced Typical Gastroesophageal Reflux Disease Symptoms and Percentage of Patients in Gastroesophageal Reflux Disease Cases

GERD patients (n = 19)			
Frequent inducers		Frequent or occasional inducers	
Food items	Patients (%)	Food items	Patients (%)
Hot spicy stews	63.2	Hot spicy stews	84.2
Rice cakes	63.2	Ramen noodles	84.2
Ramen noodles	57.9	Fried foods	75.0
Fried foods	50.0	Rice cakes	73.7
Topokki	50.0	Biscuits	64.3
		Breads	63.2
		Hand-pulled dough soups	60.0
		Topokki	56.3
		Hamburgers	56.3
		Doughnuts	55.6
		Champon	55.6
		Jajangmyeon	55.6
		Alcohols	54.5
		Fanta beverages	54.5
		Pizzas	53.3
		Mandarins	52.6
		Plain noodles	52.6
		Oranges	50.0
		Milk	50.0

GERD, gastroesophageal reflux disease; Champon, spicy noodles with vegetables and seafoods; Jajangmyeon, noodles with stir-fried bean paste.

topokki. Foods that frequently or occasionally induced GERD symptoms in half or more patients additionally included pizzas, doughnuts, coffee, hand-pulled dough soups, champon, hamburgers, alcohols, jajangmyeon, oranges, biscuits, cola, and plain noodles (Table 4).

Discussion

It is commonly accepted that meals can trigger symptoms in GERD patients, but accurate and objective data are limited. Most of the recommendations on changes in dietary habits are not strongly supported by objective measurements. The relationship between foods and GERD in the Korean population still remains unclear. The results of our study show that hot spicy stews, rice cakes, ramen noodles, fried foods, and topokki are frequently inducing typical GERD symptoms in Korean GERD patients.

Although some studies reported that some nutrients and foods are related to the presence of GERD symptoms in Western patients,^{10,12} there are no well-organized data regarding foods as-

Table 3. List of Food Items That Frequently or Occasionally Induced Typical Gastroesophageal Reflux Disease Symptoms and Percentage of the Patients in Possible Gastroesophageal Reflux Disease Cases

Possible GERD patients (n = 17)			
Frequent inducers		Frequent or occasional inducers	
Food items	Patients (%)	Food items	Patients (%)
Hot spicy stews	76.9	Fried foods	88.9
Fried foods	66.7	Hot spicy stews	84.6
Doughnuts	66.7	Topokki	81.8
Breads	62.5	Breads	81.3
Ramen noodles	57.1	Pizzas	77.8
Coffee	57.1	Rice cakes	73.3
Pizzas	55.6	Coffee	71.4
Topokki	54.5	Doughnuts	66.7
Rice cakes	53.3	Ramen noodles	64.3
Champon	50.0	Hotdogs	62.5
Hotdogs	50.0	Cola	60.0
		Oranges	58.3
		Champon	57.1
		Alcohols	57.1
		Hamburgers	57.1
		Jajangmyeon	55.6
		Hand-pulled dough soup	53.8
		Dumplings	50.0
		Red beans	50.0
		Green tea	50.0
		Rice cake soups	50.0

GERD, gastroesophageal reflux disease.

sociated with GERD symptoms in Asian patients. In Europe and the United States, some investigators have shown that dietary fat, cholesterol, saturated fatty acid, dietary fiber, and other nutrients are associated with GERD.^{10,12} They believe that both improved socioeconomic status and the westernized pattern of diet consumption may be associated with the increasing prevalence of GERD in Asians.¹³ However, the currently available data do not support a strong relationship between GERD and dietary factors in Asians including Koreans. Taken together, our findings support a recommendation for Korean patients with GERD and possible GERD to avoid specific foods because GERD symptoms appear more frequently after consumption of the common symptom-inducing foods. This study also systematically evaluated the role of daily consumed Korean traditional foods as well as westernized foods in GERD symptom generation.

Supporting data exist regarding some specific meals in relation to GERD symptoms. The role of fat in symptom generation has been demonstrated in several studies.^{6,14-16} In some clinical stud-

Table 4. List of Food Items That Frequently or Occasionally Induced Typical Gastroesophageal Reflux Disease Symptoms, and Percentage of Patients with Gastroesophageal Reflux Disease and Possible Gastroesophageal Reflux Disease Cases

GERD or possible GERD patients (n = 36)			
Frequent inducers		Frequent or occasional inducers	
Food items	Patients (%)	Food items	Patients (%)
Hot spicy stews	68.8	Hot spicy stews	84.4
Rice cakes	58.8	Fried foods	80.0
Ramen noodles	57.6	Ramen noodles	75.8
Fried foods	56.0	Rice cakes	73.5
Breads	54.3	Breads	71.4
Topokki	51.9	Topokki	66.7
		Pizzas	62.5
		Doughnuts	59.1
		Coffee	58.1
		Hand-pulled dough soups	57.1
		Champon	56.3
		Hamburgers	56.0
		Alcohols	55.6
		Jajangmyeon	54.8
		Oranges	53.1
		Biscuits	51.9
		Cola	51.9
		Plain noodles	50.0

GERD, gastroesophageal reflux disease.

ies, it was shown that esophageal pH monitoring provides direct evidence on the association between dietary fat and acid reflux, and that high-fat meal decreases the lower esophageal sphincter pressure, increases the rate of transient lower esophageal sphincter relaxation, and delays the gastric emptying,⁵ which may lead to a greater incidence of reflux.^{14,15} Spicy foods attributable to direct irritation of already inflamed lower esophageal mucosa may exacerbate heartburn.¹⁷ Red pepper, which contains the neurotoxin capsaicin, has been shown to delay gastric emptying,^{18,19} and it can possibly provoke reflux. Some previous studies have found that an increase in salt consumption was associated with GERD, which was attributed to the inhibited gastric motor activity and delayed gastric emptying after high salt intake.^{20,21} It was also found that a low-carbohydrate diet reduces distal esophageal acid exposure in 24-hour pH testing and improves GERD symptoms.²² In a study, ingestion of lactose resulted in an increased number of transient lower esophageal sphincter relaxations, increased reflux episodes, higher esophageal acid exposure, and more severe GERD symptoms in healthy volunteers.²³ Similarly, our results also revealed a relationship between

the above mentioned tastes or nutrients and GERD symptoms. Many GERD patients are more likely to experience a perceived reflux event when they eat some fatty, spicy, salty foods, and meals with high carbohydrate content. Ramen noodles, hot spicy stews, and topokki are typically spicy and salty Korean traditional foods. Rice cake and bread contain high carbohydrate nutrients. These are the foods to which Koreans have easy access and they are frequently used for main meal replacement.

Conflicting data exist regarding the roles of specific meals in relation to GERD symptoms. In several studies investigating the effect of diet on gastroesophageal reflux, the results have not been consistent.²⁴⁻²⁶ Certain eating habits, such as eating quickly and irregularly, eating big meals, eating between meals, or eating directly before sleeping, individualized acid hypersensitivity and psychological stress may contribute to the appearance of symptoms.^{11,27,28} As shown in our study, females were predominant among possible GERD patients with food related symptoms. It may be that females have a tendency to have a sensitive esophagus or to relate to psychological stress.

This is the first study that systematically and prospectively evaluated the role of 152 variable diets with frequency in symptom generation among patients with GERD and possible GERD by permitting multiple choices and using a comprehensive diet tool. In addition, many possible GERD patients, who are commonly encountered in one-third to one-half of the Korean population with GERD symptoms, were enrolled.²⁹ Hence, this study can reflect the actual aspects of the racial, geographic, and cultural specificities in Korean patients with GERD symptoms. Interestingly, most symptom-inducing foods are Korean traditional foods which have been consumed since a long time ago. The recent increase in GERD prevalence in Korea cannot be fully explained by the change to westernized foods. Finally, although a high BMI is a well-known independent risk factor for esophageal erosions, it did not affect esophageal inflammation particularly in patients with food-induced symptoms in our study. This finding is in contrast with patients without food-related symptoms.

This study could be used as a reference for the development and validation of diet recommendations for GERD patients that are applicable to Korean patients. A recent cross-sectional study demonstrated that GERD patients consumed symptom-inducing foods more frequently than in asymptomatic individuals. This suggested that dietary modification could be effective in reducing and managing GERD symptoms.³⁰ Based on our study, a dietary education program for GERD patients could be developed using figures of foods which are familiar to the patients and are encountered daily. It

could help physicians and patients to gain an insight into the symptoms possibly related to foods and reinstate avoidance of these foods. Regardless of the emergence of potent medicines (such as improved proton pump inhibitors, transient lower esophageal sphincter relaxation reducers, mucosal protectants, and esophageal-specific pain modulators),³¹ correctable diet modifications should be emphasized. Avoiding such foods may be important for maintaining patients in a symptom-free state which was attained with medications, although it may not be helpful to induce healing of GERD. Dietary advice such as avoidance of symptom-inducing foods may not be very difficult to follow and can reduce unnecessary medical costs.

Our study has some limitations. First, although we used a rather short time window of 3 months, the recall bias and residual confounding factors (eating habits, lifestyle, and genetic risk factors) might have influenced the results. Second, this study has a limitation stemming from its small sample size. The reason why we could not recruit more cases was that we included only new patients with typical GERD symptoms while excluding users of NSAIDs, oral steroids or aspirin, users of proton pump inhibitors or histamine H₂ receptor antagonists over the preceding 3 months, and we included only those who underwent both upper gastrointestinal endoscopy and 24-hour ambulatory pH monitoring. Further researches with a larger scale multicenter national study seem to warrant better clarification of the relationship between foods and GERD symptoms in Korea.

In conclusion, hot spicy stews, rice cakes, ramen noodles, fried foods, and topokki are most common foods that induce typical GERD symptoms in Korean GERD patients. The list of food items that produce typical GERD symptoms in patients from Asian countries needs to be revised substantially from the Western literature based on their own local experiences.

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