

Belching symptoms in gastroesophageal reflux disease, and prevalence and clinical characteristics of belching in Japanese adults

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Research article

Keywords: Belching, gastroesophageal reflux disease, functional dyspepsia, anxiety/depression, sleep disturbances

Posted Date: June 9th, 2020

DOI: <https://doi.org/10.21203/rs.3.rs-33138/v1>

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Abstract

Background

Belching is the act of expelling gas from the stomach or esophagus noisily through the oral cavity. Although it is a physiological phenomenon, belching may also be a symptom of upper gastrointestinal diseases such as gastroesophageal reflux disease (GERD). A detailed epidemiology of belching has not yet been reported.

Aim

The aim of this study was to examine the prevalence and clinical characteristics of belching in Japanese adults.

Methods

We analyzed 1,998 subjects using data from a previous study of the association between GERD, psychological stress, and sleep disturbances in Japanese adults. Belching was evaluated according to the score to question 11 ('Do you burp a lot?') on the frequency scale for the symptoms of GERD (FSSG): 0 (never), 1 (occasionally), 2 (sometimes), 3 (often), and 4 (always). We also collected the clinical parameters, endoscopic findings, and data according to the Athens Insomnia Scale (AIS), Rome III questionnaire, and Hospital Anxiety and Depression scale (HADS).

Results

Subjects with GERD, especially non-erosive reflux disease, complained of belching more frequently. When we defined belching as an FSSG Q11 score ≥ 2 (sometimes or more frequent), 347 (17.4%) Japanese adults had belching. Subjects with belching were predominantly men and had more common functional dyspepsia. In addition, scores of HADS and AIS in subjects with belching were significantly higher compared to subjects without belching. Male sex, presence of functional dyspepsia, anxiety/depression, and sleep disturbances were significantly associated with a higher odds ratio for belching.

Conclusion

The epidemiology of belching in Japanese adults was clarified.

Introduction

Belching is the act of expelling gas from the stomach or esophagus noisily through the oral cavity (1, 2). Generally, healthy adults experience belching several times a day as a physiological phenomenon. Although belching is not a specific symptom of upper gastrointestinal (GI) diseases, patients with gastroesophageal reflux disease (GERD) commonly complain of belching (3). Gastric belching is caused by transient lower esophageal sphincter relaxation, which is similar to the major pathogenic mechanism of GERD (4). Several studies have reported the prevalence and clinical characteristics of reflux symptoms in the general population (5, 6). However, a detailed epidemiology of belching has not been elucidated. The aim of this study was to examine the prevalence and clinical characteristics of belching using data from a previous study on the association between GERD, psychological stress, and sleep disturbances in Japanese adults (6).

Materials And Methods

Data

This study was performed using data from our previous study. A detailed methodology has been previously described (6). Data of 1,998 Japanese subjects with annual health check-ups at Kashiwara Municipal Hospital were analyzed. These included clinical parameters such as age, sex, smoking and alcohol drinking status, upper gastrointestinal endoscopy findings, and the results of a self-report questionnaire comprising a frequency scale for the symptoms of GERD (FSSG) (7), Athens Insomnia Scale (AIS) (8), Rome III questionnaire (9), and Hospital Anxiety and Depression scale (HADS) (10). Patients who continuously took acid-suppressing drugs, had active peptic ulcer disease, or had a history of upper GI surgery were excluded. This study was approved by the Ethics Committee of Kashiwara Municipal Hospital. Written informed consent was obtained from all subjects, and all procedures performed conformed to the Declaration of Helsinki.

Definition of GERD

GERD is divided into reflux esophagitis and non-erosive reflux disease (NERD). Reflux esophagitis was defined as the presence of an esophageal mucosal break, according to the Los Angeles classification (Grade A and more) (11). NERD was defined as the absence of an esophageal mucosal break and an FSSG score ≥ 8 points (7). Subjects without a mucosal break and reflux symptoms (FSSG score < 8) were classified as subjects without GERD.

Assessment of belching

We evaluated the presence of belching according to the scores of 11th question in the FSSG ('Do you burp a lot?'): 0 (never), 1 (occasionally), 2 (sometimes), 3 (often), and 4 (always) (7).

Statistical analysis

Values are expressed as mean \pm SD and numbers (frequency) for continuous and categorical variables, respectively. Comparisons of categorical data between groups were performed using the chi-square test,

while data from each group were statistically analyzed using the Kruskal-Wallis test. P-values < 0.05 were considered significant. A backward stepwise multiple logistic regression model was created to identify independent factors associated with belching. First, we analyzed several factors including age (< 75 or ≥ 75 years), sex (male or female), body mass index (BMI) calculated by body weight divided by the squared height (< 25 or ≥ 25 kg/m²), smoking habits (current smoker or non-smoker), alcohol drinking habits (frequent drinker or infrequent/non-drinker), reflux esophagitis (present or absent), AIS scores (< 6 or ≥ 6, absence or presence of sleep disturbances) (8), functional dyspepsia (FD) (present or absent based on Rome IV criteria) (9), and HADS scores (< 8 or ≥ 8, absence or presence of anxiety/depression) (10). We calculated the odds ratio (OR) with 95% confidence intervals (CI) and excluded statistically insignificant factors using the Wald test. All statistical analyses were performed with EZR (Saitama Medical Center, Jichi Medical University, Saitama, Japan), a graphical user interface for R (The R Foundation for Statistical Computing, Vienna, Austria). More precisely, it is a modified version of R commander designed to add statistical functions frequently used in biostatistics (12).

Results

Prevalence of belching in subjects with and without GERD

Figure 1 shows the prevalence of belching according to the presence or absence and the subtypes of GERD. Among 1,250 subjects without GERD, 921 (73.7%) complained of never belching, 235 (18.8%) occasionally, 71 (5.7%) sometimes, 18 (1.4%) often, and 5 (0.4%) always belching. Among 748 subjects with GERD, the following results were seen for belching: 267 (35.7%) never, 228 (30.5%) occasionally, 155 (20.7%) sometimes, 75 (10.0%) often, and 23 (3.1%) always, $p < 0.01$ (Figure 1A). In the subtypes of GERD, subjects with NERD significantly commonly experienced belching compared to subjects with reflux esophagitis (Figure 1B).

Definition of significant belching

In our cohort, the prevalence of belching in GERD was 64.3% with an FSSG Q11 score ≥ 1 (occasionally or more frequent), 33.6% with scores ≥ 2 (sometimes or more frequent), 13.0% with scores ≥ 3 (often or more frequent), and 3.1% with a score of 4 (always). Since a previous outstanding study by Klauser showed that the prevalence of belching in patients with GERD was 40%–49%, we defined significant belching in this study as subjects whose FSSG Q11 score was ≥ 2 (sometimes or more frequent).

Prevalence of belching in Japanese adults

Figure 2 shows the prevalence of belching in Japanese adults. Among 1,998 subjects, 28 (1.4%) always experienced belching while 93 (4.3%) often, 226 (11.3%) sometimes, and 463 (23.2%) occasionally had

belching. This shows that 347 (17.4%) subjects had significant belching.

Clinical characteristics of belching

We compared the clinical parameters and questionnaire scores of subjects with and without belching. There were no significant differences in age, BMI, and alcohol drinking or smoking habits between the two groups. However, subjects with belching were predominantly male and more commonly had FD but not reflux esophagitis. In addition, the HADS and AIS scores in subjects with belching were significantly higher compared to subjects without belching (Table 1).

Risk factors for belching

Table 2 shows an analysis of the logistic regression model. After adjustment of statistically factors by univariate analysis, male sex, presence of FD, anxiety/depression (HADS score ≥ 8), and sleep disturbances (AIS score ≥ 6) were significantly associated with belching.

Discussion

This is the first epidemiological study of belching in Japanese adults. We found that the prevalence of belching was 17.3%. Male sex, FD, anxiety/depression, and sleep disturbances were associated with belching, while age, BMI, presence of reflux esophagitis, alcohol drinking, and smoking status were not.

Belching is divided into two distinct types, namely: gastric belching (GB) and supragastric belching (SGB) (1, 2). GB involves swallowed air in the stomach triggering a transient lower esophageal sphincter relaxation. Gastric air that flows into the esophagus increases the pressure of the proximal portion, causing upper esophageal sphincter relaxation. This results in air outflow from the esophagus into the oral cavity (1, 2). The mechanism of SGB differs in that contraction of the diaphragm induces a negative pressure in the esophagus. Air flows from the pharynx during relaxation of the upper esophageal sphincter and directly expels into the esophagus without entering the stomach (1, 2). However, it is difficult to distinguish these two types of belching without esophageal impedance pH monitoring (1, 2, 13). It is especially impossible in an epidemiological study. Therefore, we discuss identified factors associated with belching for both GB and SGB.

The reason for a male predominance in belching is still unknown. Saito et al. reported that men eat food faster than women (14), suggesting that men may swallow air more often during eating. In addition, men generally might prefer carbonated alcohol drinks and they do not hesitate to belch when compared to women. Although there is no sex difference in excessive SGB (1, 2), the male predominance may be seen in GB.

Although it is not specific, belching is one of the symptoms in patients with FD. Several studies demonstrated that 59–80% of patients with FD reported frequent belching (15, 16). Conchilo et al. examined ten patients with FD and ten controls using esophageal impedance pH monitoring (17). They found that the incidence of air swallowing in patients with FD was significantly higher compared with controls (17). These findings support our results.

The association between belching and anxiety/depression is uncertain. A high prevalence of anxiety disorders has been described in patients with excessive SGB. Among such patients, belching often increases during stressful events (2, 18). These findings might explain the positive association between anxiety/depression and the belching observed in this study.

Sleep disturbances are associated with several GI diseases, especially GERD (19) and FD (20, 21). Although belching rarely occurs during sleep, we found a significant association between belching and sleep disturbances. Similarly, a recent study by Hyun demonstrated that sleep disturbances were associated with belching (OR 1.59; 95% CI 1.24–2.03) in a cross-sectional study of 4,948 subjects (22). It might be related to the brain-gut axis which is involved in the pathogenesis of functional gastrointestinal disorders.

This study has some limitations. First, we assessed belching using only one question in the FSSG and defined belching as a score ≥ 2 (sometimes, often, or always) (7). Although FSSG is specific for GERD (7), there is currently no specific questionnaire for belching. It is difficult to evaluate the number of daily belching in an epidemiological study. Second, we did not include other confounding factors that could affect belching. Factors such as intake of carbonated drinks and speed of food intake should be included in future studies.

In conclusion, to our knowledge, this is the first report on the epidemiology of belching in Japanese adults. We also clarified several clinical characteristics of belching. Since a recent study showed that excessive belching was associated with proton pump inhibitor refractory GERD (23), understanding the epidemiology of belching is important.

Declarations

Acknowledgements

Not applicable.

Authors' information (optional)

Not applicable

Authors' contributions

YF designed the study protocol, performed data analysis, and writing the draft of the manuscript. MO collected data, performed data analysis, and participated in the manuscript writing. YN, KT, HI, OT, HS, TW supervised the whole project and reviewed critical version of the manuscript. All authors approved the final version of the manuscript.

Funding

This work was supported by a Grant-in-Aid for Scientific Research from the Ministry of Education, Culture, Sports, Science, and Technology in Japan (18K07917). The funders had no role in study design, data collection and analysis, decision to publish, or preparation of the manuscript.

Availability of data and materials

The datasets generated and analyzed in this article are available from the corresponding author.

Ethics approval and consent to participate

The study was approved by the institutional review board of Kashiwara Municipal Hospital. Informed consent from individuals was obtained.

Consent for publication

Not applicable.

Competing interests

The authors have no conflict of interest to declare.

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Tables

Table 1. Clinical characteristics of the study subjects

	Belching (-) N = 1651	Belching (+) N = 347	p-value
Age, years	61.3 ± 11.9	60.1 ± 12.6	0.108
Male sex (%)	919 (55.7%)	218 (62.8%)	0.015
BMI, kg/m ²	23.0 ± 3.3	22.8 ± 3.6	0.335
Alcohol drinkers (%)	361 (21.9%)	86 (24.8%)	0.257
Cigarette smokers (%)	259 (15.7%)	62 (17.9%)	0.334
Presence of RE (%)	220 (13.3%)	45 (13.0%)	0.931
Presence of FD (%)	154 (9.3%)	75 (21.6%)	<0.001
HADS score	6.6 ± 5.3	9.3 ± 6.2	<0.001
AIS score	3.3 ± 2.9	5.0 ± 3.4	<0.001

BMI, body mass index; RE, reflux esophagitis; FD, functional dyspepsia; HADS, Hospital Anxiety and Depression Scale; AIS, Athens Insomnia Scale.

Data are expressed as mean ± SD or number (frequency).

Table 2. Risk factors for belching

	Univariate analysis			Multiple-adjusted analysis		
	OR	95%CI	p-value	OR	95%CI	p-value
Age \leq 75 years	1.20	0.75-1.95	0.46			
Male sex	1.35	1.05-1.72	0.015	1.41	1.10-1.80	<0.001
BMI \geq 25 kg/m ²	0.85	0.68-1.21	0.91			
Alcohol drinker	1.18	0.89-1.55	0.26			
Smoker	1.17	0.85-1.60	0.33			
Presence of RE	1.03	0.73-1.49	0.93			
Presence of FD	2.68	1.95-3.67	<0.001	2.04	1.48-2.82	<0.001
HADS score \geq 8	2.32	1.82-2.96	<0.001	1.67	1.30-2.16	<0.001
AIS score \geq 6	2.98	2.38-3.85	<0.001	2.28	1.74-2.99	<0.001

BMI, body mass index; RE, reflux esophagitis; FD, functional dyspepsia; HADS, Hospital Anxiety and Depression Scale; AIS, Athens Insomnia Scale; OR, odds ratio; CI, confidence intervals.

Figures

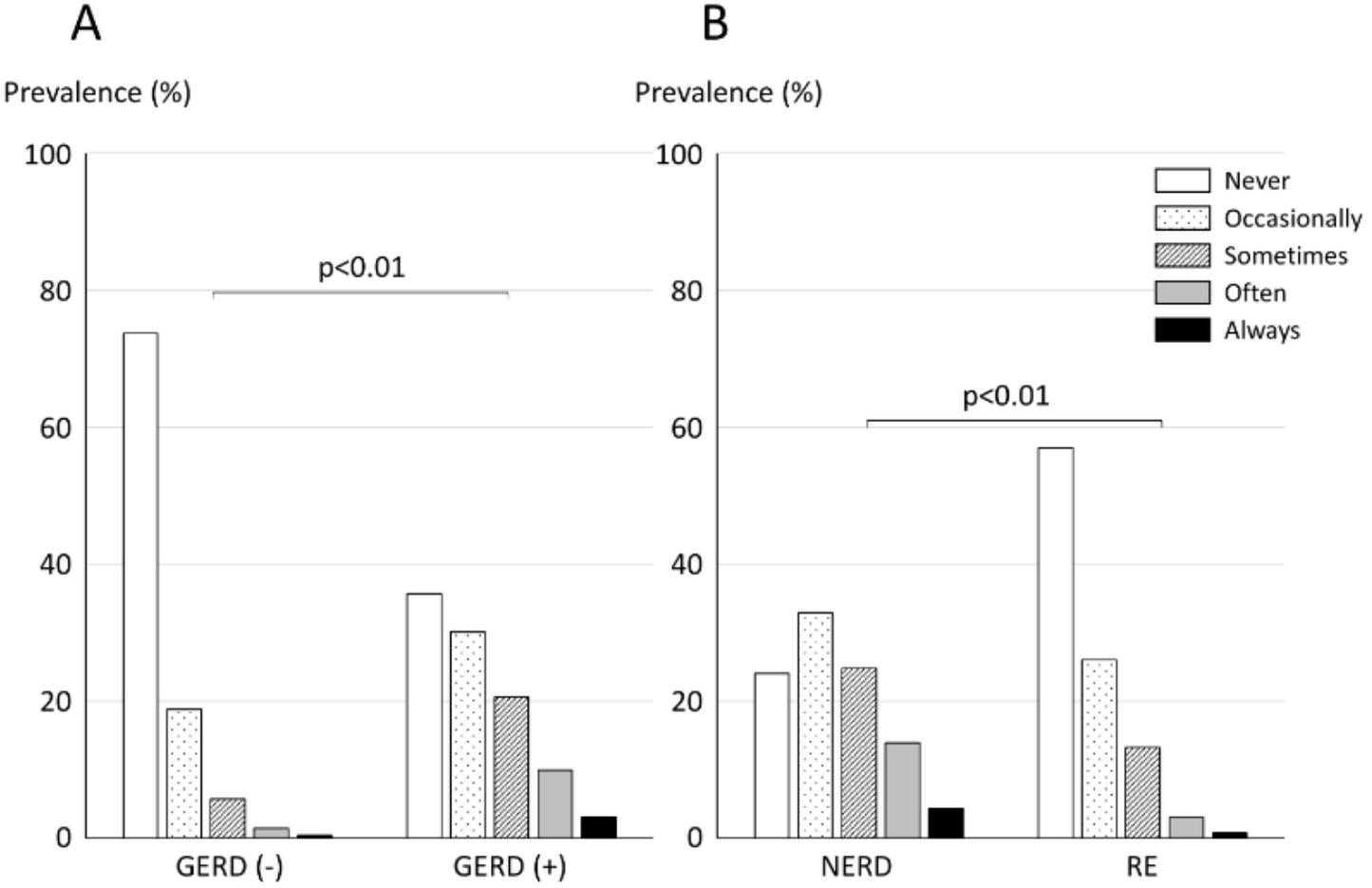


Figure 1

Prevalence of belching according to the presence or absence and subtypes of gastroesophageal reflux disease (GERD). A: Subjects with GERD commonly complained of belching compared to those without GERD, $p < 0.01$. B: Subjects with non-erosive reflux disease (NERD) commonly complained of belching compared to subjects with reflux esophagitis (RE), $p < 0.01$.

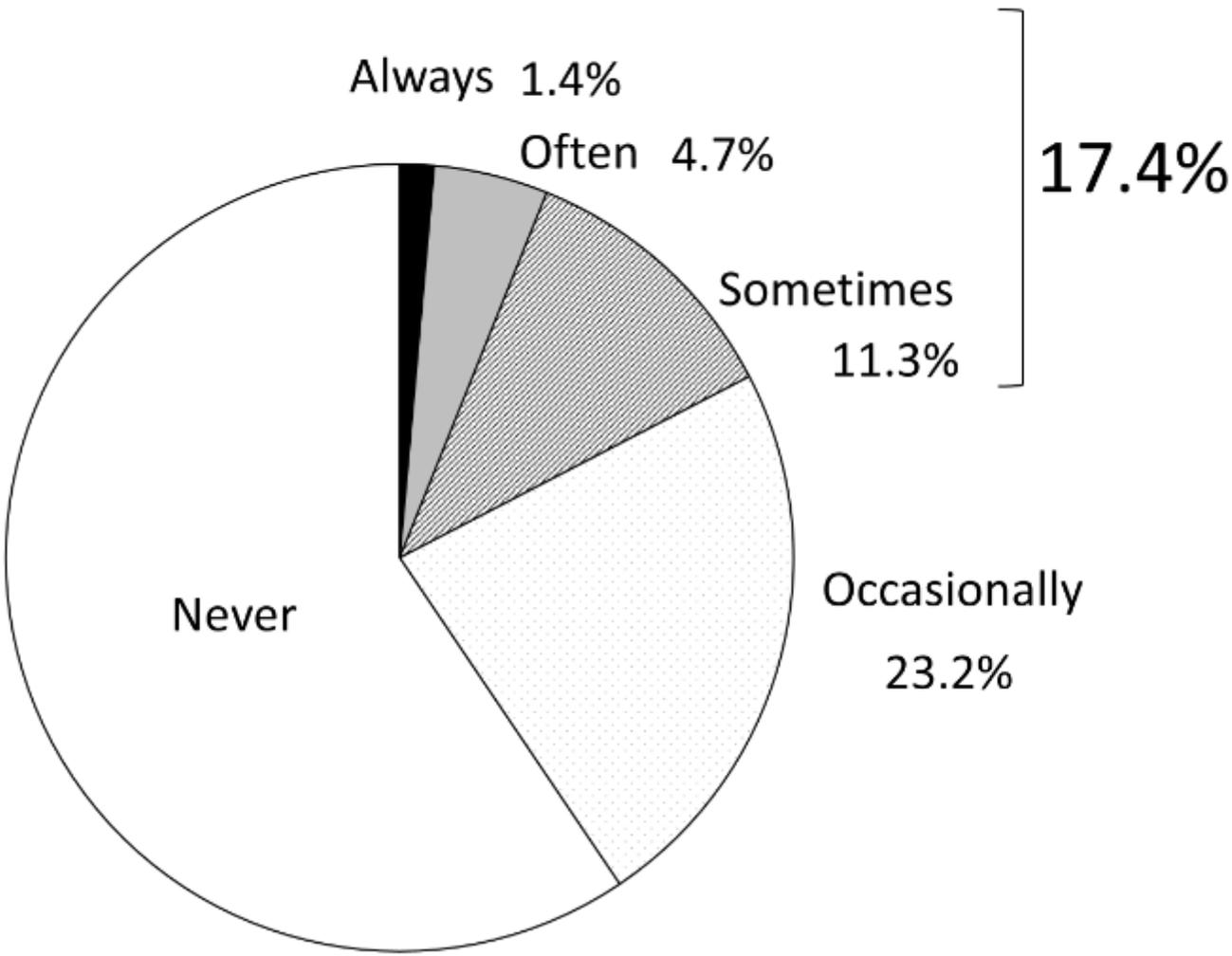


Figure 2

Prevalence of belching in Japanese adults.