The role of diet in the overlap between gastroesophageal reflux disease and functional dyspepsia

NUTRITION

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ABSTRACT

Background/Aims: The prevalence of functional dyspepsia partially overlaps with gastroesophageal reflux disease (GERD), and this suggests common pathogenic mechanisms. The role of diet in these conditions is still under investigation. The present study evaluated the type of diet associated with functional dyspepsia and GERD.

Materials and Methods: A representative sample of subjects was invited to the family doctors' office, and an interview-based questionnaire was administered to diagnose functional dyspepsia and GERD (using Rome III and Montreal criteria, respectively) and to evaluate eating habits and the frequency of food intake. Correlation and regressions were used for statistical analyses, and the results were presented as odds ratio and 95% confidence interval.

Results: In total, 184 subjects participated in a 4-month study. Functional dyspepsia was present in 7.6%, and GERD was present in 31.0%. The predictors for dyspepsia were low educational level (22.4, 3.3–150.1, p=0.001), consumption of canned food, and the use of alcoholic drinks at least weekly. The predictors for GERD were advanced age and the use of canned food (13.9, 3.6–53.9, p<0.001) or fast food (4.6, 1.7–12.1, p=0.002).

Conclusion: This study provides new data on the overlap of GERD and functional dyspepsia and reveals that these disorders may be associated with the consumption of canned food, fast food, and alcoholic beverages.

Keywords: Gastroesophageal reflux, dyspepsia, abdominal pain, prevalence, food

INTRODUCTION

Upper gastrointestinal symptoms are highly prevalent among people worldwide. The prevalence of upper gastrointestinal symptoms was 44.9% in USA (1) and 38% in European countries. It was highest in Central and East European countries and was closely associated with socioeconomic factors (2).

Functional digestive disorders are considered to represent up to 50% of medical consultations in gastroenterology (3,4), and epidemiological studies suggest that there is a considerable overlap between these disorders (5).

Gastroesophageal reflux disease (GERD) is increasingly prevalent worldwide, particularly in the Western world, where reflux symptoms have a prevalence of up to 40% in population-based studies (6).

Approximately 20%–30% of the general population presents with dyspepsia which has not been investigated (7).

Dyspepsia may also overlap with GERD, suggesting common pathogenic mechanisms (8,9). In current practice, an over-diagnosis of GERD and under-diagnosis of functional dyspepsia was reported (10).

Recent papers highlighted the role of diet in dyspepsia and GERD, but its role in pathogenesis remains uncertain and under-studied. Although many patients recognize the impact of certain food in symptom occurrence, few population-based studies evaluated the role of diet in dyspepsia or GERD (11). However, the overlapping symptoms within the diagnostic criteria of the two entities (GERD and functional dyspepsia) may be linked to the consumption of certain foods (12,13).

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The aim of our study was to update the prevalence data for functional dyspepsia and GERD and for the overlap of these diseases and to evaluate the type of diet associated with them.

MATERIALS AND METHODS

Population
A randomly chosen representative sample of the adult general population living in an urban area was invited for an interview in the family doctor's office. The study was conducted in a medical center which serves 18,000 people in an area of the city of Iasi, in North East Romania. The sample size and demographic characteristics were calculated to be representative using Epi Info™ 3.5.2 software (Centers for Disease Control and Prevention (CDC); Atlanta, USA). We selected 250 subjects from family doctor's patient lists using a randomization function in Microsoft Excel™ software (Microsoft Corporation; Redmond, Washington, USA). The family doctors invited the selected subjects by telephone for an interview in their offices. The inclusion criteria were 18–79 years of age and a resident in this urban area. There were no exclusion criteria.

Measures
In the family doctor's office, an interview-based questionnaire was administered to all subjects to diagnose gastrointestinal disorders and to evaluate eating habits and frequency of food intake. General practitioners (GPs) were instructed to diagnose functional dyspepsia and GERD using Rome III and Montreal criteria, respectively. (14-16).

Socio-demographic factors and general medical history were also included in the interview together with an objective evaluation of obesity (the GPs measured the height and weight of subjects). Age, gender, and educational level were studied as demographic factors. The educational level was categorized into three classes: low (no school or elementary school only), medium (high school), and high (college or university). Health and health-related behaviors were investigated, such as smoking (classified as "current smokers" and "non-smokers"), physical activity (classified as "physically active" if the activity was performed at least weekly and "physically inactive" for a lower period), self-perceived stress (using a 3-point Likert-scale: "high, medium, or low level"), and general well-being (using a 5-point Likert scale: "very good, good, acceptable, poor, or very poor condition"). Subjects were considered overweight or obese if the body mass index (BMI) was between 25 kg/m^2 and 29.9 and ≥30.0 kg/m^2, respectively.

A food frequency questionnaire based on the validated European Prospective Investigation of Cancer (EPIC) protocol was designed to reveal the regular intake over a long period (17-19). Consumption frequencies were noted as "never or rarely," "monthly," "once a week," "several times a week," "once a day," and "several times a day." We also investigated the individuals' eating habits (including a daily breakfast, the number of meals and snacks a day, the use of home prepared food, and eating in a hurry).

Statistical analysis
All data were analyzed using the Statistical Package for the Social Sciences (SPSS) version 17.0 for Windows (SPSS Inc.; Chicago, IL, USA). We used the mean for parametric characteristics and median for non-parametric or ordinal variables. To characterize the frequency of food consumption in the population studied, we used the median as the cutoff point, and the group was divided into two categories of consumers (less than median frequency and equal to or more than median frequency). An initial Spearman's correlation test and cross-tabulation analysis were performed. These analyses examined whether there was any association between referral patterns, personal history of illness, eating habits, food consumption frequency, and other associated conditions. Finally, we used multivariate analysis for risk factors that were significant in univariate analysis, and we calculated odd ratios (ORs) and 95% confidence intervals (95% CIs) for significant predictors of functional dyspepsia and GERD derived from the initial analysis. A value of p<0.05 in both analyses was considered to be relevant for our statistics.

The study was approved by the Ethics Committee of the University of Medicine and Pharmacy, and informed consent was obtained from all subjects.

RESULTS

1. Prevalence of functional dyspepsia and GERD
During a period of 4 months (January–April), 184 subjects (106 women and 78 men, mean age 49.4 years) participated in the study. The participation rate was 73.6%. Functional dyspepsia was present in 7.6% (3.8% for women and 12.8 % for men, p<0.05) of patients, and GERD was present in 31.0% (33.0% in women and 28.2% in men, p>0.05) of patients (Figure 1). In total, 25.9% of GERD subjects were diagnosed with functional dyspepsia. Also, 92.9% of functional dyspepsia subjects were diagnosed with GERD. The overlap of the two diseases was 22.4% among subjects with upper gastrointestinal disorders, and in our sample, 7.1% of participants received both diagnoses.

The age distribution (Table 1) indicated an increased prevalence of functional dyspepsia for subjects above the mean age of the sample (11.7% vs. 2.5%, p<0.05). The prevalence of GERD also increased with age (r=0.938, p<0.05).

The educational level of the subjects significantly influenced the prevalence of functional dyspepsia in the general population (p<0.05). The prevalence of functional dyspepsia was 2.6% among high, 9.5% among medium, and 16.6% among low levels of education. The prevalence of GERD was 27.3% among high, 32.9% among medium, and 40.0% among low levels of education (p>0.05) (Figure 2).

2. Functional dyspepsia, GERD, and health-related behaviors/conditions

Smoking
Smoking was not associated with functional dyspepsia or GERD (p>0.05): 35.7% of dyspeptic patients were smokers vs.
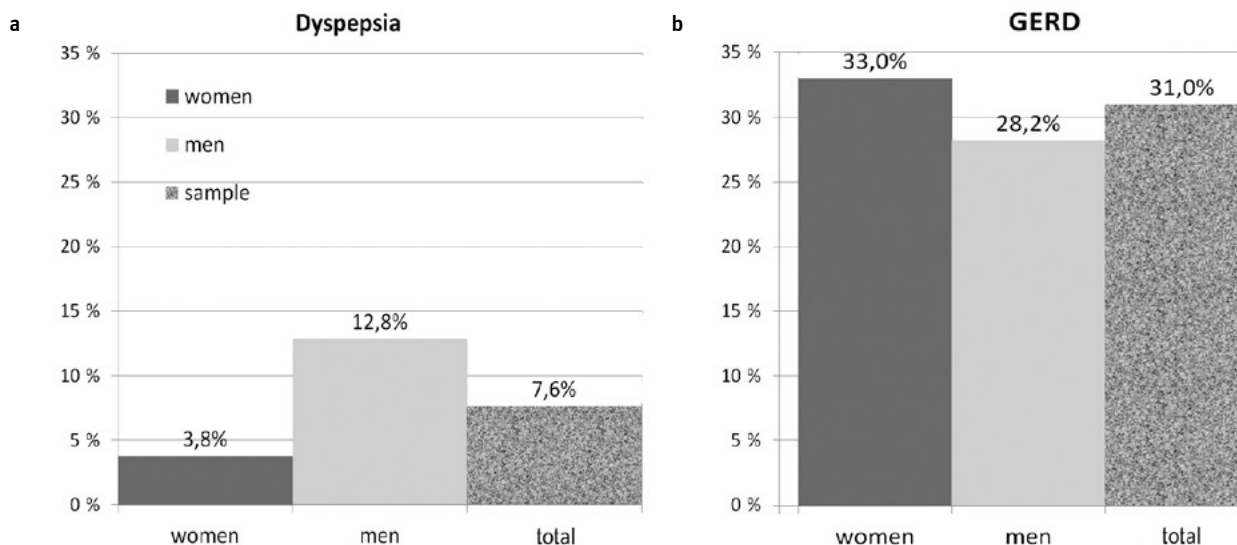
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a

b

Figure 1. a, b. Prevalence of functional dyspepsia (a) and GERD (b) according to gender.

Table 1. Prevalence of functional dyspepsia and GERD in different age groups

Age (years)	Prevalence	
	GERD	Dyspepsia
20–29	20.8%	0.0%
30–39	26.5%	2.9%
40–49	25.0%	4.2%
50–59	35.4%	14.6%
60–69	36.8%	13.2%
70–79	37.5%	0.0%

GERD: gastroesophageal reflux disease

Figure 2. Educational level and prevalence of functional dyspepsia and GERD. GERD: gastroesophageal reflux disease

26.5% of non-dyspeptic subjects (p>0.05); a similar situation was observed in the case of GERD (22.8% vs. 29.1%, p>0.05).

Physical activity
The majority of subjects were physically inactive: 71.4% of patients with functional dyspepsia, 63.8% of non-dyspeptic subjects (p>0.05), 73.7% of GERD patients, and 60% of non-GERD subjects (p>0.05).

Stress
The perception of stress was not significantly associated with functional dyspepsia. High and medium levels of stress were perceived in 21.4% and 78.6% of functional dyspepsia patients, respectively, whereas high and medium levels of stress were perceived in 13.6% and 75.1% of non-dyspeptic subjects, respectively (p>0.05). However, stress was associated with GERD. High and medium levels of stress were perceived in 12.3% and 86% of GERD patients, respectively, whereas high and medium levels of stress were perceived in 15.6% and 70.6% of non-GERD subjects, respectively (p=0.025). A very good general well-being was perceived only in non-dyspeptic subjects (15.4% vs.
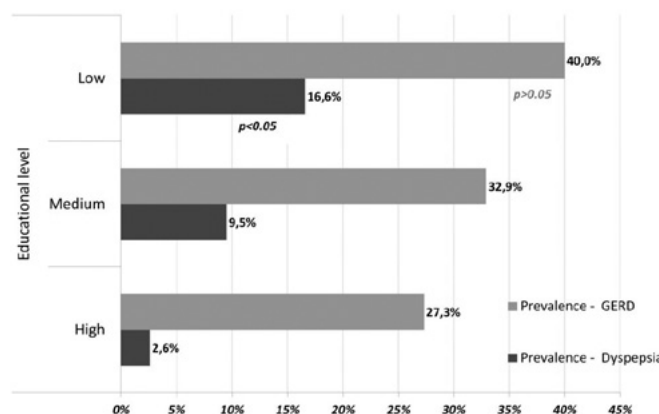
0%, in dyspeptic patients) and was more frequent in non-GERD subjects than in GERD patients (18.1% vs. 6.4%, p=0.06).

Obesity
In the sample studied, 48.4% were overweight and 21.2% were obese. The presence of overweight and obese subjects was not significantly different in dyspeptic (85.7%) and non-dyspeptic subjects (68.2%) (p>0.05). However, GERD was more frequently present in overweight subjects (35.9%) than in subjects with normal weight (19.6%) (p<0.05).

3. Food consumption frequency and eating habits
The median frequency of food consumption in the studied population is presented in Figure 3. Using the median as a cutoff point, we analyzed the frequency of food consumption among subjects with or without functional dyspepsia and GERD (Table 2).

Dyspeptic patients consumed canned food significantly more frequently; all of them consumed canned food (fish, meat, or vegetables) at least monthly. Grain cereals (p=0.05) and alco-

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Figure 3. Median frequency of food consumption.

holic beverages were consumed at least weekly (OR=5.58, 95% CI=1.58–25.74, p=0.004).

Also, GERD patients consumed canned food (13.6, 4.46–57.5, p<0.001), grain cereals (p<0.05), and alcoholic beverages (2.24, 1.18–4.27, p=0.011) significantly more frequently. They consumed the following foods more frequently: fresh fish (17.65, 6.47–60.45, p=0.022), processed meat (2.57, 1.31–5.22, p=0.005), milk (9.57, 2.56–61.32, p<0.001), cheese (3.34, 1.03–14.69, p=0.047), animal fat (butter, lard) (4.89, 2.26–11.37, p<0.001), vegetables with a low content of carbohydrates (3.76, 1.62–9.66, p=0.002), pulses (12.4, 5.38–31.8, p=0.001), confectionary (4.04, 1.87–9.41, p<0.001), stewed fruit (3.64, 1.85-7.4, p<0.001), carbonated sweetened beverages (3.4, 1.71–7.02, p<0.001), coffee (3.34, 1.28–10.2, p=0.013), herb teas (2.35, 1.21–4.72, p=0.011), and fast food (3.66, 1.89–7.62, p<0.001).

There were no statistical differences regarding the consumption of the following types of food: red meat, poultry, eggs, vegetable oil, potatoes and vegetables with a high content of carbohydrates, white bread, fruits, sugar, and sweets.

None of the eating habits we investigated was significantly related to dyspepsia or GERD.

4. Predictors of functional dyspepsia and GERD

Using a multivariate regression analysis to reduce confounding factors, the predictors for dyspepsia were low educational level (22.44, 3.36–150.1, p=0.001), consumption of canned food (2.38, p<0.05), and alcoholic drinks at least weekly (5.4, 1.23–23.61, p=0.025).

The predictors for GERD were advanced age (1.086, 1.052–1.122, p<0.001) and the use of canned food (13.94, 3.61–53.98, p<0.001) or fast food (4.646, 1.773-12.177, p=0.002).

The predictors of overlap between GERD and functional dyspepsia were advanced age (1.057, 1.012–1.105, p=0.013) and the consumption of canned food (2.82, p<0.05).

DISCUSSION

Prevalence
In our study, the prevalence of functional dyspepsia was 7.6%. In other studies, the prevalence of dyspepsia varied according to country and the definition used, i.e., from 1.8% to 57.0%, and was higher in women (OR 1.24; 95% CI 1.13–1.36) and smokers (20). The overall pooled prevalence of uninvestigated dyspepsia in a very recent meta-analysis of 100 separate study populations was 20.8%. The greatest prevalence was found when a broad definition for dyspepsia (29.5%) or upper abdominal or epigastric pain or discomfort (20.4%) were used (20). The prevalence for functional dyspepsia may vary from 20% to 40%. In USA, functional dyspepsia was 29.2% and 15% if subjects with GERD were excluded. Approximately 20%–30% of the general population presents every year with uninvestigated dyspepsia (7).

The estimated prevalence in Romania is 20%–30 %, half being considered functional. However, there are no conclusive epidemiological studies, and it is clearly under-reported. At the Ministry of Health, records can be found with a prevalence of 60–70/100,000 inhabitants in 2002–2003 (21).

The prevalence of GERD varies worldwide for unknown reasons, but genetic differences, difference in the *Helicobacter pylori* prevalence, and lifestyle factors such as obesity might be an influence. The highest population-based prevalence is reported from Europe (23.7%) and USA (28.8%) (22). In our sample, using Montreal criteria, the prevalence of GERD was higher. The older age and the high percentage of overweight participants may explain this high GERD prevalence.

In our sample, the overlap of functional dyspepsia and GERD was 22.4%. In a recent review, the prevalence of dyspepsia was 27%, and this overlapped partially with GERD (from 10% to 66%, depending on the diagnostic criteria used for each) (9,23). More studies suggest common pathogenic mechanisms with other functional digestive disorders (8,23,24).

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Table 2. Median frequency of food consumption among subjects with or without functional dyspepsia and GERD

Food frequency consumption		Non- dyspepsia n=170		Dyspepsia n=14		p*	Non-GERD n=127		GERD n= 57		p*
		No.	%	No.	%		No.	%	No.	%	
Pork	Less than once a week	79	46.5%	4	28.6%	0.196	59	46.5%	24	42.1%	0.583
	At least once a week	91	53.5%	10	71.4%		68	53.5%	33	57.9%	
Beef	Less than once a week	135	79.4%	8	57.1%	0.054	103	81.1%	40	70.2%	0.100
	At least once a week	35	20.6%	6	42.9%		24	18.9%	17	29.8%	
Poultry	Once a week or less	26	15.3%	3	21.4%	0.545	25	19.7%	4	7.0%	0.029
	At least several times a week	144	84.7%	11	78.6%		102	80.3%	53	93.0%	
Processed meat	Once a week or less	73	42.9%	3	21.4%	0.116	61	48.0%	15	26.3%	0.006
	At least several times a week	97	57.1%	11	78.6%		66	52.0%	42	73.7%	
Fish (fresh)	Less than once a week	61	35.9%	3	21.4%	0.275	51	40.2%	13	22.8%	0.022
	At least once a week	109	64.1%	11	78.6%		76	59.8%	44	77.2%	
Fish (canned)	Rarely	77	45.3%	0	0.0%	0.001	73	57.5%	4	7.0%	<0.001
	At least monthly	93	54.7%	14	100.0%		54	42.5%	53	93.0%	
Canned mixed (meat/ fish + vegetables)	Rarely	84	49.4%	2	14.3%	0.011	78	61.4%	8	14.0%	<0.001
	At least monthly	86	50.6%	12	85.7%		49	38.6%	49	86.0%	
Canned vegetables	Rarely	73	42.9%	0	0.0%	0.002	70	55.1%	3	5.3%	<0.001
	At least monthly	97	57.1%	14	100.0%		57	44.9%	54	94.7%	
Canned food	Rarely	58	34.1%	0	0.0%	0.008	55	43.3%	3	5.3%	<0.001
	At least monthly	112	65.9%	14	100.0%		72	56.7%	54	94.7%	
Eggs	Once a week or less	43	25.3%	3	21.4%	0.748	32	25.2%	14	24.6%	0.927
	At least several times a week	127	74.7%	11	78.6%		95	74.8%	43	75.4%	
Milk	Once a week or less	34	20.0%	1	7.1%	0.239	33	26.0%	2	3.5%	<0.001
	At least several times a week	136	80.0%	13	92.9%		94	74.0%	55	96.5%	
Cheese	Once a week or less	21	12.4%	2	14.3%	0.837	20	15.7%	3	5.3%	0.047
	At least several times a week	149	87.6%	12	85.7%		107	84.3%	54	94.7%	
Butter, lard	Less than once a week	67	39.4%	3	21.4%	0.183	61	48.0%	9	15.8%	<0.001
	At least once a week	103	60.6%	11	78.6%		66	52.0%	48	84.2%	
Vegetable oil	Less than once a day	32	18.8%	3	21.4%	0.811	24	18.9%	11	19.3%	0.949
	At least once a day	138	81.2%	11	78.6%		103	81.1%	46	80.7%	
Potatoes	Once a week or less	48	28.2%	3	21.4%	0.584	40	31.5%	11	19.3%	0.087
	At least several times a week	122	71.8%	11	78.6%		87	68.5%	46	80.7%	
Vegetables with 5% carbohydrates (lettuce, spinach, tomatoes, peppers)	Once a week or less	49	28.8%	2	14.3%	0.243	44	34.6%	7	12.3%	0.002
	At least several times a week	121	71.2%	12	85.7%		83	65.4%	50	87.7%	
Vegetables with 10% carbohydrate (carrots, onions, beets)	Once a week or less	25	14.7%	2	14.3%	0.966	21	16.5%	6	10.5%	0.287
	At least several times a week	145	85.3%	12	85.7%		106	83.5%	51	89.5%	
Pulses (beans, peas, lentils soybeans,)	Less than once a week	51	30.0%	2	14.3%	0.212	46	36.2%	7	12.3%	0.001
	At least once a week	119	70.0%	12	85.7%		81	63.8%	50	87.7%	

Table 2. Median frequency of food consumption among subjects with or without functional dyspepsia and GERD (Continuation)

Food frequency consumption		Non- dyspepsia n=170		Dyspepsia n=14		p*	Non-GERD n=127		GERD n= 57		p*
		No.	%	No.	%		No.	%	No.	%	
Fruits	Less than once a day	32	18.8%	4	28.6%	0.377	28	22.0%	8	14.0%	0.205
	At least once a day	138	81.2%	10	71.4%		99	78.0%	49	86.0%	
White bread	Less than once a day	17	10.0%	1	7.1%	0.729	10	7.9%	8	14.0%	0.193
	At least once a day	153	90.0%	13	92.9%		117	92.1%	49	86.0%	
Grain bread / pasta	Once a week or less	47	27.6%	2	14.3%	0.277	45	35.4%	4	7.0%	<0.001
	At least several times a week	123	72.4%	12	85.7%		82	64.6%	53	93.0%	
Corn flour***	Less than once a week	23	13.5%	0	0.0%	0.141	21	16.5%	2	3.5%	0.013
	At least once a week	147	86.5%	14	100.0%		106	83.5%	55	96.5%	
Grain cereals	Less than once a week	73	42.9%	0	0.0%	0.005	69	54.3%	8	14.0%	0.038
	At least once a week	97	57.1%	14	100.0%		58	45.7%	49	86.0%	
Sugar	Less than once a day	70	41.2%	5	35.7%	0.689	52	40.9%	23	40.4%	0.940
	At least once a day	100	58.8%	9	64.3%		75	59.1%	34	59.6%	
Sweets	Less than once a week	84	49.4%	7	50.0%	0.966	66	52.0%	25	43.9%	0.309
	At least once a week	86	50.6%	7	50.0%		61	48.0%	32	56.1%	
Confectionary (cakes, cream, ice-cream)	Rarely	59	34.7%	5	35.7%	0.939	55	43.3%	9	15.8%	<0.001
	At least monthly	111	65.3%	9	64.3%		72	56.7%	48	84.2%	
Stewed fruit	Less than once a week	81	47.6%	6	42.9%	0.730	72	56.7%	15	26.3%	<0.001
	At least once a week	89	52.4%	8	57.1%		55	43.3%	42	73.7%	
Alcoholic beverages (beer, wine, distilled beverages)	Less than once a week	103	60.6%	3	21.4%	0.004	81	63.8%	25	43.9%	0.011
	At least once a week	67	39.4%	11	78.6%		46	36.2%	32	56.1%	
Carbonated sweetened beverages	Rarely	77	45.3%	4	28.6%	0.226	67	52.8%	14	24.6%	<0.001
	At least monthly	93	54.7%	10	71.4%		60	47.2%	43	75.4%	
Coffee	Less than once a day	36	21.2%	0	0.0%	0.055	31	24.4%	5	8.8%	0.013
	At least once a day	134	78.8%	14	100.0%		96	75.6%	52	91.2%	
Herb teas	Less than once a day	71	41.8%	6	42.9%	0.937	61	48.0%	16	28.1%	0.011
	At least once a day	99	58.2%	8	57.1%		66	52.0%	41	71.9%	
Fast-food (hamburger, hot-dog, chips, pretzels)	Never / rarely	91	53.5%	7	50.0%	0.799	80	63.0%	18	31.6%	<0.001
	At least monthly	79	46.5%	7	50.0%		47	37.0%	39	68.4%	

GERD: gastroesophageal reflux disease
*p-value from chi-square test
***Corn flour was excluded from the category of "cereals" because it is a staple food in the study area.

The overlap of functional dyspepsia with GERD can also be explained by the inability of GPs to discriminate between the two entities. The term "dyspepsia" has been confusing in the past. Patients do not use the term and physicians have variable interpretations, minimizing its usefulness (7,14). The difficulty in differentiating between dyspepsia and GERD symptoms was also reported; a recent paper revealed an over-diagnosis of GERD and under-diagnosis of functional dyspepsia in a US community. Actually, only 62.9% of subjects reporting GERD symptoms were correctly diagnosed with

GERD, and only 12.5% of subjects reporting dyspepsia were correctly diagnosed (10). In our unpublished data, looking for recent symptoms, we found that heartburn (epigastric pain) was frequently present in both diseases, and this suggests the same idea and explains the overlap.

Socio-demographic factors
Many studies show a high prevalence of dyspepsia in women. In our study, the higher prevalence of functional dyspepsia in men than in women could be explained by the large overlap

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with GERD. Also, in our region, the presence of *H. pylori* is more common, particularly in men (25). As in other studies, the prevalence of GERD increased with age, obesity, physical inactivity, a low education level, and with stress (11,26,27), but we did not observe an association with smoking.

Food
The possible contribution of food and dietary habits as a cause or exacerbating factor of dyspeptic symptoms represent a relatively new area for evidence-based research. Despite frequent reports by patients that their symptoms are often related to food ingestion, this association has not been formally assessed.

Dietary assessments have frequently implicated fatty foods in symptom induction, and these findings are supported by laboratory-based studies, particularly the demonstration that patients with functional dyspepsia more often experience symptoms after intra-duodenal infusions of fat than glucose. Some studies suggest that food intolerance has no remarkable influence on food pattern and nutritional status in most functional dyspepsia patients. Further studies on the potential role of dietary factors as a cause of dyspeptic symptoms are required to establish whether dietary therapies have any place in the management of functional dyspepsia (28). Although GERD can have anatomical explanations, there may be a relationship between the presence of symptoms and food because of food allergies (29,30).

A very frequent consumption of some foods was related to GERD and functional dyspepsia. Bhatia et al. (11) reported that the consumption of non-vegetarian and fried foods, aerated drinks, tea, and coffee were associated with GERD, and using multivariate analysis, the consumption of non-vegetarian food was independently associated with GERD symptoms. In a Chinese study, routine usage of greasy food was considered a significant independent risk factor for non-erosive reflux disease (31).

Using a multivariate regression analysis, to reduce confounding factors, the predictors for functional dyspepsia were educational level, consumption of canned food, and alcoholic drinks. The predictors for GERD were age and use of canned food or fast food.

Canned foods appear as a predictor in both illnesses. Although the consumption of canned food was not so popular in the studied group (median frequency was monthly), it was significantly correlated with the presence of disease. Some components of cans (food additives, pH, and tin) may possibly determine digestive symptoms by certain mechanisms (intolerance, interference with medication, etc.).

Tin is present in low concentrations in most canned foods and beverages; the highest levels are found in products when plain uncoated internal surfaces are used. A limited number of case reports of acute gastrointestinal disorders after consumption of food containing high concentrations (700 ppm or above) of tin have been reported, but there is little evidence for an association between the consumption of food containing tin at concentrations up to 200 ppm and significant acute adverse gastrointestinal effects (32,33).

Limitations, drawbacks, and shortcomings
The study design, based on the invitation to the medical center of the selected subjects, may have influenced the results, presenting to the doctor mainly those who had symptoms in the last period.

A cross-sectional study cannot establish causality but only a relationship between the studied elements. A correlation can have several possible explanations. Frequent consumption of a particular food may positively or negatively influence the presence of disease; for example, canned food, alcoholic drinks, or processed meat for upper gastrointestinal disorders. Also, the disease can lead to a certain lifestyle or diet, sometimes in compliance with dietary recommendations or due to the subjects preconception about the protective role of food in diseases (they may frequently use herb teas or grain cereals). Both factors may be dependent on a third factor; for example, age or educational level, which influenced both the eating or lifestyle and the presence of disease. To reduce confounding factors, we used a multivariate regression analysis.

Unfortunately, we could not assess what types of cans were consumed. This has become a topic for future research.

In conclusion, this survey, conducted in an urban population from Romania, using interviews in a doctor's office, revealed a 7.6% prevalence of functional dyspepsia using Rome III criteria and a 31.0% prevalence of GERD using Montreal criteria, and it showed that the overlap of the two diseases was 22.4%.

Both diseases occurred at an increased rate in subjects who were older and who had a low educational level, and they were associated with the consumption of canned food, grain cereals, and alcoholic beverages.

The mechanisms by which diet influences gastrointestinal disorders are not fully elucidated, but the findings suggest the need for extensive research and specific strategies tailored to each specific population to promote healthy eating and lifestyle habits.

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