

Original Article

Food Item Avoidance of Patients with Irritable Bowel Syndrome Compared with Healthy People

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Introduction

Irritable bowel syndrome (IBS) is a chronic functional disorder of the lower gastrointestinal tract. This syndrome is characterized by recurrent episodes of abdominal discomfort or pain associated with the onset of either a change in stool consistency or frequency.¹ It has been estimated that 11.2% (7%–21%) of the population in the world is affected by IBS.² The prevalence in Iran has been reported to be between 1.1% and 25%,³ being more common in women than men.⁴⁻⁶ It reduces quality of life in patients and has a significant economic burden on individuals.⁷⁻¹⁰

The precise etiology of IBS is still unclear,^{4,5} however, role of dietary factors in IBS pathogenesis is a primary topic of interest.¹⁰ IBS patients commonly relate occurrence of IBS symptoms to ingestion of milk, wheat, beans, onion, garlic,

cabbage, alcohol, hot spices and coffee.^{11,12} Two-thirds of patients with IBS initiate dietary restrictions to alleviate their symptoms.¹³ Although many patients with IBS limit or exclude some food items from the diet in an attempt to improve symptoms, until recently no conclusive dietary recommendation is available for patients with IBS.¹⁴ To construct a dietary guideline for these patients, it would be interesting to have data from a large group of these patients about the foods these people exclude to improve their symptoms. Although some studies have reported experiences of these patients with some foods, most were limited to a small group of patients, and the findings might not be generalizable to all IBS patients. This study aimed to investigate the prevalence of food exclusions as well as the reasons for such exclusions in a large group of IBS patients.

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Materials and Methods**Study Population**

This study was a cross-sectional analysis on data from the Study on the Epidemiology of Psychological, Alimentary Health and Nutrition (SEPAHAN) conducted in Iranian adults working in 50 different health centers across Isfahan province in central part of Iran. The SEPAHAN project was designed to examine the epidemiologic aspects of functional gastrointestinal (GI) disorders and their association with different lifestyle and psychological measures. The study design, sample selection, characteristics of study participants and details on data collection methods have been completely described elsewhere.¹⁵

General adult population living in Isfahan province and working in health centers affiliated with Isfahan University of Medical sciences were included in the project through the use of convenient sampling method. However, we did not include faculties, staffs of university teaching hospitals and research centers. The project was implemented in two main phases. In the first phase, relevant questionnaires including demographic information, medical history, anthropometric measures, lifestyle and nutritional factors were sent to 10 087 persons, and 8691 subjects returned the completed questionnaires (response rate: 86.16%). In the latter phase, gastrointestinal health-related questionnaires were sent out to participants. After linking data from both phases, 4633 people had the whole information on diet and functional gastrointestinal disorders. In the current analysis, we excluded participants who reported total daily energy intake outside the range of 800–4200 kcal. A written informed consent was obtained from all participants.

Dietary Assessment

A validated 106-item-semiquantitative food frequency questionnaire was used to assess usual dietary intakes in the preceding year.¹⁶ Detailed information about design and validity of this dish-based FFQ was reported elsewhere.¹⁶ In the current study, individuals who had reported consumption of different foods and dishes as “never or less than once a month”, were defined as “non-consumers” of that food.

For each food item, we asked about the self-perceived gastrointestinal symptoms following taking that food item. Some examples were given in Table 1. The symptom descriptions were classified by the investigators into the following: no problem, dislike, abdominal pain, abdominal bloating, diarrhea, acid regurgitation or heartburn. In other words, after reporting the frequency consumption of each food, participants were requested to report their feeling when consuming this food. They were able to choose the above-mentioned symptoms. In this part, they were free to choose more than one option.

To determine number of people with “no consumption” of food items because of gastrointestinal symptoms,

we considered participants’ responses to both parts of frequency consumption and the GI symptoms when eating that food. When a participant had reported “never or less than once a month” consumption of a given food item and at the same time he/she had reported one of the above-mentioned GI symptoms when consuming that food, this subject was counted as a “non-consumer” of that food item due to a GI problem after eating that food.

Assessment of Irritable Bowel Syndrome

To examine gastrointestinal health, we used a modified Persian version of the Rome III questionnaire as part of the main questionnaire.¹⁵ During the validation of the questionnaire, most participants were unable to comprehend the difference between the descriptors used 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). Therefore, the rating scales were modified to contain only four descriptors (i.e., never or rarely, sometimes, often, always).¹⁵ Participants were also asked about whether they had certain symptoms in the previous three months. IBS was defined according to Rome III criteria as recurrent abdominal pain or discomfort within the past three months along with two or more of the following: (1) improvement with defecation; (2) pain with an alteration in stool frequency; and (3) pain with an alteration in the form (appearance) of stool.

Statistical Methods

Continuous variables were expressed as mean \pm SD and categorical variables as percentages. To compare general characteristics of individuals with IBS and those without, we used Student’s *t* test for continuous variables and χ^2 test for categorical variables. To compare the prevalence of “non-consumption” of different foods between individuals with IBS and those without IBS, we applied chi square test. These analyses were performed using SPSS (version 20; SPSS Inc.) The association of “non-consumption” of foods with IBS, was examined using relevant formulas,¹⁷ in which non-IBS individuals were considered as reference and the prevalence ratio of IBS was computed. The computed prevalence ratios of IBS were further controlled for age, sex, physical activity and meal regularity in an additional model. Calculation of prevalence ratio and adjustment for covariates was done using Stata, version 14.2 (StataCorp). *P* values < 0.05 were considered as statistically significant.

Results

The whole prevalence of IBS was 21.5% (n = 828) in total population (23.9% in women and 18.6% in men). Mean age of patients with IBS was 36.26 \pm 7.91 years and for subjects without IBS, it was 36.52 \pm 8.12 years. Mean age difference between the two groups was 0.26 years. General characteristics of subjects with and without

Table 1. Some Foods and Beverages (or Food Items) with Response Categories In Food Frequency Questionnaire

Food items	Response Categories					
	Never or Less Than Once/Month	1-3 Times/Month	1 Time/Week	2-4 Times/Week	5-6 Times/Week	1-2 Times/Day
Tuna	Never or Less Than Once/Month	1-3 Times/Month	1 Time/Week	2-4 Times/Week	5-6 Times/Week	1-2 Times/Day
What is your feeling when consuming this food?	No problem	Dislike	Abdominal pain	Abdominal bloating	Diarrhea	Acid regurgitation or heartburn
Tea	Never or less than 1 cup/month	1-3 cups/month	1-3 cups/week	4-6 cups/week	1 cup/day	2-4 cups/day
What is your feeling when consuming this food?	No problem	Dislike	Abdominal pain	Abdominal bloating	Diarrhea	Acid regurgitation or heartburn
Rice	Never or less than 1 plate/month	1-3 plate/month	1 plate/week	2-4 plate/week	5-6 plate/week	1 plate/day
What is your feeling when consuming this food?	No problem	Dislike	Abdominal pain	Abdominal bloating	Diarrhea	Acid regurgitation or heartburn
						2-3 plate/day
						4-5 plate/day
						5-7 cups/day
						8-11 cups/day
						≥12 cups/day

IBS are presented in Table 2. Compared to individuals without IBS, participants with IBS were more likely to be females (61.6% vs. 53.8%, $P < 0.001$), less likely to be physically active (30.1% vs. 36%, $P = 0.002$) and have regular meal pattern (54.4% vs. 59.5%, $P = 0.008$). No significant differences were found in terms of other general characteristics between subjects with and without IBS.

Distribution of people with “no consumption” of food items due to a given GI problem among IBS patients, compared with healthy individuals, are shown in Table 3. IBS patients who avoid consumption of plum and pickles due to abdominal pain were lower than non-IBS participants. However, a greater percentage of IBS patients reported non-consumption of ketchup compared to non-IBS individuals. Fifty percent of IBS patients, compared with zero percent in healthy individuals, were not consuming Gaz due to abdominal bloating. In addition, compared with non-IBS individuals, IBS patients were less likely to not consume egg due to getting abdominal bloating. All IBS patients reported avoiding Dough consumption due to diarrhea while none of healthy individuals reported that. Low percentage of IBS patients, in comparison with healthy individuals, reported non-consumption of fresh fig and cake due to diarrhea. When we asked participants to report food avoidance due to acid regurgitation or heartburn, greater percentage of IBS patients, compared to healthy individuals, reported the avoidance of grapes, fresh berries and butter due to this problem. In addition, 21% of IBS patients (vs. 35% of non-IBS individuals) reported the omission of lemon juice consumption due to acid regurgitation or heartburn ($P = 0.027$). No other significant difference was seen between the two groups in terms of food avoidance due to GI problems.

Distribution of “non-consumers” of food items, regardless of the reason for food avoidance, among individuals with and without IBS are presented in Table 4. We also computed the prevalence ratios for IBS with the non-consumption of food items in this table. Overall, 39.4% of IBS patients, compared with 34.2% of healthy individuals ($P = 0.006$), reported no-consumption of fresh berries. In addition, 20% of IBS patients, versus 24% of non-IBS individuals, reported no-consumption of cake ($P = 0.01$). With regards to prevalence ratios (PRs) for IBS, we found that no-consumption of fresh berries was associated with increased PRs of IBS and no-consumption of cake was associated with decreased PRs of IBS. Adjustment for covariates did not influence these findings.

Discussion

In the current study, persons with IBS were less likely to avoid consumption of plum, pickles, lemon juice, egg, fresh fig and cake and were more likely to report avoidance of ketchup, Dough, Gaz, grapes, fresh berries and butter

Table 2. General Characteristics of Study Participants Separately by Their IBS Status^a

	IBS Status		P ^b
	IBS (n = 828)	Non-IBS (n = 3018)	
Age (y)	36.26 ± 7.91	36.52 ± 8.12	0.44
BMI (kg/m ²)	25.06 ± 4.40	25.13 ± 4.79	0.67
Female; n (%)	510 (61.6)	1624 (53.8)	<0.001
Education (university graduated); n (%)	450 (56)	1682 (57.1)	0.58
Current smokers; n (%)	120 (14.5)	432 (14.3)	0.83
Physically active ^c ; n (%)	233 (30.1)	996 (36)	0.002
Overweight or obesity; n (%)	359 (45.4)	1361 (47.2)	0.38
Regular meal pattern ^d ; n (%)	447 (54.4)	1768 (59.5)	0.008

IBS, irritable bowel syndrome. IBS was defined according to Rome III criteria as recurrent abdominal pain or discomfort within the past three months along with two or more of the following: (1) improvement with defecation; (2) pain with an alteration in stool frequency; and (3) pain with an alteration in the form (appearance) of stool.

^a All values are mean ± SD, unless indicated.

^b ANOVA for continuous variables and Chi-squared test for categorical variables.

^c ≥1 h/week physical activity.

^d Defined as individuals who had reported having regular meals often or always.

due to GI symptoms compared with non-IBS patients. No other significant difference was seen between the two groups in terms of food avoidance due to GI problems. This study is the first to compare food item avoidance between patient with IBS and healthy people among a large population of adults in Middle East.

IBS has been recognized as one of the most prevalent gastrointestinal disorders with chronic or intermittent abdominal pain. Dietary modification has remarkable effect on the management and controlling of IBS symptoms. Despite several studies, the pathogenesis and pathophysiology of IBS has not been completely

understood. We found that consumption of several food items may initiate the symptoms of IBS. People with IBS might avoid some healthy foods as a way of coping with the disease, which possibly could lead to a lower intake of essential nutrients. Therefore, they should replace intolerable foods with other healthy food items.

In this study, we found that Dough, a yogurt drink, was more likely to be avoided by IBS patients due to diarrhea. Although earlier studies have shown that consumption of probiotics might improve IBS symptoms,^{18,19} it must be kept in mind that the probiotic content of yogurt is not emphasized in the Iranian culture. Even yogurts that have been claimed as probiotic yogurts in Iranian culture do not contain so much probiotics. In addition, the produced Dough in Iran is carbonated. Gas-containing foods have been shown not to be tolerated well by IBS patients.

In the current study, we found that butter was more likely to be avoided by IBS patients due to acid regurgitation or heartburn compared with healthy individuals. Halpert et al suggested fatty food restriction in IBS patients to control symptoms.²⁰ However, Saito and colleagues, in a population-based case-control study in Minnesota, found that IBS patients consumed significantly higher proportions of energy as fat than controls.²¹ It was also observed that dietary fat intake was significantly higher among Swedish women (not men) with IBS than the control group.¹¹ Dietary intakes of fat, through inducing cholecystokinin secretion, might delay gastric emptying and increase acid regurgitation or heartburn in patients with IBS.^{14,22}

We found that Gaz, a bakery product that contains egg white, rosewater, sugar, pistachios or almonds²³ was more likely to be avoided by IBS patients due to abdominal

Table 3. Distribution of People with "no Consumption" of Food Items Due to a Given GI Problem Across IBS Patients and Healthy Individuals

Food items	Abdominal Pain		Abdominal Bloating		Diarrhea		Acid Regurgitation or Heartburn	
	Non-IBS	IBS	Non-IBS	IBS	Non-IBS	IBS	Non-IBS	IBS
Dough	3 (21) ^a	1 (1)	10 (14)	12 (25)	1 (1)	1 (100) ^c	10 (28)	4 (20)
Egg	13 (36)	4 (24)	18 (25)	2 (5) ^b	1 (25)	1 (1)	13 (24)	10 (28)
Plum	7 (26)	2 (1) ^c	4 (8)	6 (15)	3 (11)	8 (21)	3 (10)	5 (25)
Fresh fig	7 (64)	1 (17)	3 (17)	4 (20)	16 (44)	5 (19) ^b	3 (23)	5 (50)
Grapes	5 (17)	6 (30)	13 (28)	7 (23)	8 (31)	5 (23)	2 (7)	4 (33) ^b
Fresh berries	7 (41)	6 (35)	5 (19)	8 (47)	20 (33)	19 (45)	2 (14)	5 (56) ^b
Cake	6 (35)	2 (18)	3 (18)	6 (32)	4 (100)	1 (25) ^b	33 (39)	15 (34)
Gaz	1 (33)	2 (50)	1 (1)	1 (50) ^b	1 (1)	1 (100)	6 (67)	4 (50)
Ketchup	5 (33)	9 (90) ^c	8 (57)	12 (71)	2 (40)	1 (50)	62 (66)	25 (56)
Lemon juice	3 (25)	2 (18)	4 (24)	4 (24)	1 (50)	1 (1)	45 (35)	16 (21) ^b
Pickles	35 (67)	20 (39) ^c	19 (43)	10 (29)	1 (50)	1 (1)	107 (42)	56 (39)
Butter	8 (73)	4 (80)	3 (43)	2 (33)	15 (52)	6 (43)	22 (60)	9 (100) ^b

IBS, irritable bowel syndrome. IBS was defined according to Rome III criteria as recurrent abdominal pain or discomfort within the past three months along with two or more of the following: (1) improvement with defecation; (2) pain with an alteration in stool frequency; and (3) pain with an alteration in the form (appearance) of stool.

^a Values are presented as number (%). When a participant had reported "never or less than once a month" consumption of a given food item and at the same time he/she had reported GI symptoms when consuming that food, this subject was counted as a "non-consumer" of that food item due to a GI problem after eating that food.

Chi-squared analysis: ^b $P < 0.05$; ^c $P < 0.01$ compared to non-IBS participants.

Table 4. Prevalence Ratios (95% CIs) for IBS with the Non-consumption of Foods and Distribution of “Non-consumers” of Food Items among Individuals with and without IBS

Food items	IBS Status		P	IBS Status		P ^c
	Non-IBS	IBS ^a		Non-IBS ^c	IBS	
Dough				212 (7)	65 (7.9)	0.41
Crude	1.00	1.09 (0.87–1.37)	0.41			
Adjusted ^b	1.00	1.19 (0.86–1.64)	0.29			
Egg				278 (9.2)	76 (9.2)	0.97
Crude	1.00	0.99 (0.80–1.22)	0.97			
Adjusted	1.00	1.03 (0.76–1.39)	0.84			
Plum				294 (9.7)	97 (11.7)	0.09
Crude	1.00	1.17 (0.97–1.40)	0.09			
Adjusted	1.00	1.23 (0.94–1.61)	0.12			
Fresh fig				1032 (34.2)	305 (36.8)	0.15
Crude	1.00	1.09 (0.96–1.23)	0.15			
Adjusted	1.00	1.06 (0.88–1.26)	0.50			
Grapes				504 (16.7)	142 (17.1)	0.75
Crude	1.00	1.02 (0.87–1.20)	0.75			
Adjusted	1.00	0.94 (0.75–1.19)	0.65			
Fresh berries				1033 (34.2)	326 (39.4)	0.006
Crude	1.00	1.18 (1.05–1.34)	0.006			
Adjusted	1.00	1.24 (1.04–1.48)	0.01			
Cake				724 (24)	166 (20)	0.01
Crude	1.00	0.83 (0.71–0.97)	0.01			
Adjusted	1.00	0.76 (0.61–0.93)	0.01			
Gaz				1369 (45.4)	366 (44.2)	0.55
Crude	1.00	0.96 (0.85–1.08)	0.55			
Adjusted	1.00	0.94 (0.79–1.11)	0.49			
Ketchup				1339 (44.4)	362 (43.7)	0.74
Crude	1.00	0.97 (0.86–1.10)	0.74			
Adjusted	1.00	0.96 (0.81–1.14)	0.69			
Lemon juice				416 (13.8)	109 (13.2)	0.64
Crude	1.00	0.95 (0.80–1.14)	0.64			
Adjusted	1.00	0.90 (0.69–1.17)	0.43			
Pickles				756 (25.0)	220 (26.6)	0.37
Crude	1.00	1.06 (0.92–1.21)	0.37			
Adjusted	1.00	1.04 (0.85–1.26)	0.68			
Butter				1263 (41.8)	350 (42.3)	0.82
Crude	1.00	1.01 (0.89–1.14)	0.82			
Adjusted	1.00	0.97 (0.81–1.15)	0.76			

IBS, irritable bowel syndrome. IBS was defined according to Rome III criteria as recurrent abdominal pain or discomfort within the past three months along with two or more of the following: (1) improvement with defecation; (2) pain with an alteration in stool frequency; and (3) pain with an alteration in the form (appearance) of stool.

^a Values in this column are PRs (95% CIs) for IBS with the “non-consumption” of food items. Non-IBS individuals were considered as the reference group. “Non-consumption” of food items were defined as those who had reported “never or less than once a month” consumption of a given food item (without considering their feeling after consuming a food).

^b Adjusted for age, sex, physical activity and meal regularity

^c Values in these columns are numbers (%) which indicate people who had reported “never or less than once a month” consumption of a given food item (without considering their feeling after consuming a food).

bloating. It seems that the contents of sugar and pistachios in this product might be responsible for this symptom. It has been shown that consumption of products rich in sucrose positively correlated with symptom exacerbation in IBS patients. These sucrose-rich products may induce excessive gas, abdominal bloating, osmotic diarrhea and stomachache.²⁴ Moreover, the pistachio content of Gaz might also explain avoidance of this product by IBS patients. Pistachio is high in fermentable oligo-, di-, and monosaccharides and polyols (FODMAPs) that may cause GI symptoms. FODMAPs have been defined as a group of short-chain carbohydrates and monosaccharides that are

poorly absorbed in the small intestine and later fermented by intestinal bacteria in the colon leading to release of gas and short chain fatty acids.^{25,26}

Our findings indicated that a greater percentage of IBS patients reported avoidance of ketchup in comparison with healthy individuals. Some condiments including ketchup have been reported to induce diarrhea and abdominal cramping in sensitive patients.²⁷ This might be attributed to the high amounts of fructose in this product because patients with IBS have fructose malabsorption and dietary fructose intolerance.²⁵ Interestingly, we found that consumption of grapes and fresh berries, as low

FODMAP foods, was more likely to be avoided by IBS patients compared to healthy individuals. Previous studies showed that consumption of grapes and fresh berries, as an alternative for high FODMAP fruits, can alleviate IBS symptoms.²⁸ Avoidance of these fruits in patients with IBS might be explained by the recommendation of physicians, and not nutritionists, to these patients to avoid the consumption of all fruits.

Some limitations need to be considered when interpreting our findings. First of all, due to the cross-sectional design of the study, we cannot confer causality. In addition, in this study, the questionnaire-based method was used to evaluate the status of IBS. This might result in misclassification of these patients. Despite large numbers of patients with IBS (n = 748) in this study, findings cannot easily be generalized to other patients with IBS. In addition, it must also be kept in mind that our findings were based on the frequency in consumption of food items in IBS patients and the amount of food intake was not considered. Further studies are needed to focus on the amount of food intake in these patients.

In conclusion, we found that patients with IBS were more likely to avoid consumption of ketchup, Dough, Gaz, grapes, fresh berries and butter due to GI symptoms compared with healthy individuals. Further studies are required to confirm these findings.

Authors' Contribution

SS, AHK, AE and PA contributed to the conception, design, data collection, statistical analyses, data interpretation, manuscript drafting, approval of the final version of the manuscript and agreed for all aspects of the work.

Conflict of Interest Disclosures

None of the authors had any personal or financial conflicts of interest.

Ethical Statement

Approval of the study was obtained from the Bioethics Committee of Isfahan University of Medical Sciences, Isfahan, Iran.

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