Irritable Bowel Syndrome: assessment of prevalence and risk factors in Saudi University students using Rome IV Criteria

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Abstract

The main objective of this study was to determine the prevalence of Irritable Bowel Syndrome (IBS) and its associated factors among University students in Saudi Arabia, as little is known about this issue in our country. This cross-sectional study was conducted between 13 March and 21 May of the Academic Year 2017-2018 at Jazan University, Saudi Arabia, involving a random sample of 890 students, selected using the stratified multistage method. IBS prevalence was determined using the Rome IV diagnostic Criteria. The overall prevalence of IBS was 8.8%. According to the results of the multivariate logistic regression, the most important independent predictors of IBS were being a student in a medical college (OR = 10.42; 95%CI: 3.45-31.51) and a scientific college (OR = 5.16; 95%CI: 1.64-16.22), cigarettes smoking (OR = 2.74; 95%CI: 1.24-6.07), emotional stress (OR = 2.53; 95%CI: 1.28-5.00), and food intolerance (OR = 2.15; 95%CI: 1.11-4.16). The present study revealed a prevalence rate of 8.8%. The main predictors of IBS were being a medical student, a scientific college student, cigarette smoker, and having emotional stress and food intolerance. No significant association was found between IBS and anxiety and depression.

Introduction

Irritable Bowel Syndrome (IBS) is a common chronic condition that is clinically characterized by recurrent abdominal pain, which is relieved by bowel evacuation and is associated with altered bowel habits in the absence of any detectable structural or biochemical pathologic process.[1] It is the most common disorder encountered in gastroenterology clinics,[2,3] affecting around 10-20% of adults globally.[4] Approximately 40% of individuals who meet diagnostic criteria for IBS do not have an established diagnosis,[5] and only a small proportion seek medical assessment.[3] The overall prevalence of IBS is higher in women as compared to men, with women possibly being more likely than men to have constipation-predominant IBS.[6]

Depending on the diagnostic criteria used and population studied, there is a wide variation in IBS prevalence rates among different studies.[4] With the advances in knowledge and the desire to make the Rome Criteria more useful in clinical settings, Rome IV Criteria, which differ from Rome III Criteria in several noticeable ways, was published in 2016.[7] For clarification purposes, the term 'discomfort' was removed from the previous criteria because it has different meanings or no specific word in different languages. Also, whether the distinction between pain and discomfort is quantitative or qualitative is still unclear.[8] To increase the specificity and sensitivity of the diagnostic Criteria in Rome III, abdominal pain frequency was increased from three days per month to one day per week in the recent update. Furthermore, categorizing IBS to subtypes is now based on the predominant bowel habits during the days with abnormal bowel movements rather than all bowel movements.[7]

Despite postulation of several mechanisms, the exact underlying etiology of IBS remains uncertain. Currently, available explanatory mechanisms include serotonin dysregulation, subtle inflammatory bowel disorder, post-infectious IBS, and bacterial overgrowth.[9] Twins and familial studies have also suggested a genetic basis of IBS.[10] Psychiatric disorders, including major depression, anxiety, and somatization, have also been shown to co-occur with IBS.[9]

In Saudi Arabia, little is known about the prevalence and associated factors of IBS, particularly among university students.[11] Using the Rome III diagnostic Criteria, some studies have reported that IBS is highly prevalent among undergraduate students, found in 21% and 31.8% of medical students in Riyadh and Jeddah, respectively, with significantly higher prevalence of IBS in students with co-morbid anxiety disorder.[12] University students are under continuous stress, given the duration of their studies and numerous exams that may lead to stress. The high prevalence of IBS observed in university students can be partly explained by the role of stress.[13] For example, Chu *et al* carried out a study among students of science, engineering, and medical colleges in Zhejiang province, China and found a high prevalence of IBS, with females and medical students having significantly increased risk as compared to males and non-medical students.[14]

Compared to non-IBS patients, individuals with IBS inflict more costs on the health care system.[15] The lower quality of life, concern of underlying causes, frequency of symptoms, and coexisting health problems may lead to repeated hospital visits and costly investigations of IBS patients.[3] Also, IBS is the second highest cause of absenteeism from work.[16] In the Southwestern part of Saudi Arabia (Jazan province), there is no available data on the prevalence rate of IBS among undergraduate students. Therefore, this study was designed to determine the prevalence of IBS and its associated factors in a large sample of undergraduate students from Jazan University, Saudi Arabia.

Materials and Methods

Study population and design

This observational cross-sectional study was conducted between 13 March and 21 May of the academic year 2017-2018 at Jazan University, Saudi Arabia. The target

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study population was both male and female students of the following colleges: computer sciences, sciences, applied medical sciences, medicine, education, and business administration. The study included all students from the aforementioned colleges who accepted to participate. Excluded from the study were students who had Inflammatory Bowel Disease (IBD) or red flag symptoms in form of fever, weight loss, blood in stool, anemia, abnormal physical findings or blood studies, and family history of IBD or cancer.[17]

Using the stratified multistage random sampling method, a sample of 890 participants was calculated for the purpose of the current study. The sample was first stratified according to the three sectors, namely, scientific colleges, health-related colleges, and humanity colleges. Then, colleges were selected randomly from each sector and, finally, clusters of classes were randomly selected from each stratum. The formula for a cross-sectional study, $n = ([z^2 \times p \times q])/d^2$, was used to calculate the sample size, where z = 95% confidence interval, p = prevalence of knowledge 50%, q = 1 – p, d = error ≤5%, and a 25% nonresponse rate. To adjust the number of students in each faculty, probability proportional to size sampling was used.

Data collection and outcome assessment

The study subjects were approached in their colleges by data collectors who were trained and well-prepared to explain the purpose of the study to students. After obtaining a written consent from each student, data collectors waited somewhere near for the completion of the questionnaire to give respondents the opportunity to ask clarifying questions regarding the interpretation of terms or questions in the questionnaire. Data were collected using a validated, structured, anonymous, and self-assessment Arabic questionnaire. The questionnaire was presented in three main parts. First part included questions about sociodemographic and behavioral characteristics. Given the self-assessment nature of the study questionnaire, first part was ended by 'yes' or 'no' questions to rule out red flag symptoms listed in the previous section.

Second part included questions to screen for IBS symptoms.[18] According to the Rome IV diagnostic Criteria, diagnosis of IBS requires the presence of recurrent abdominal pain for at least one day/week during the past three months for at least six months or more duration associated with two or more of the following: i) the pain is related to defecation; and/or ii) onset is associated with stool frequency change; and/or iii) onset is associated with stool appearance change. The Arabic translated version of Rome IV questionnaire was used with an official permission obtained from the foundation (www.theromefoundation.org). The Rome IV Criteria for IBS diagnosis have an excellent specificity of 97.1% and a moderate sensitivity of 62.7%.[19] The classification of IBS subtypes was obtained using the Bristol Stool Form Scale (BSFS) and participants were classified as Constipation predominant (IBS-C) group, Diarrhea predominant (IBS-D) group, Mixed (IBS-M) group, and Unspecified (IBS-U) group.[20] BSFS was translated into Arabic by the study authors using back translation and was pre-tested for clarity on a sample of 10 students who were not included in the final analysis. BSFS has a sensitivity of 68.0% and a specificity of 69.7% when used with an optimal stool frequency of ≤ 3 bowel movements in 5 days; a sensitivity of 64.0% and a specificity of 83.4% when used with an optimal stool frequency of ≤ 2 in 5 days.[21] Second part was ended by 'yes' or 'no' questions regarding family history of IBS, history of recent travel, preceding diagnosis of IBS by a physician, absenteeism from the university due to IBS symptoms.

Last part screened for anxiety and depressive symptoms using the Arabic version of the Hospital Anxiety and Depression Scale (HADS),[22,23] which is a standardized, validated and reliable self-assessment rating scale consisting of 14 items for detecting cases of anxiety and depression. A four-point scale was used to classify subjects according to the severity of anxiety and depression symptoms, with 0 indicating no symptoms, 1 for mild symptoms, 2 for moderate symptoms, and 3 for severe symptoms. The total score of HADS (*i.e.* the summation of all seven items in each subscale) ranged from 0 to 21. Then, responses were divided into: normal (0-7); borderline (8-10); and case (11-21).[22] The current study yielded a Cronbach's α of .84 and .74 for the anxiety and depression subscales of the HADS, respectively.

Ethical statement

All participants gave written consent after being informed of the study objectives, their rights to participate, and that their information will be kept anonymous and only used for the scientific purpose of the present study. Ethical approval (reference no: REC39/8-S035) was obtained from the Scientific Research Ethics Committee at Jazan University.

Statistical analysis

The analysis was conducted using Statistical Package of Social Sciences (SPSS) Version 20 (SPSS Inc., Chicago, IL). All eligible questionnaires were double checked before coding. Frequencies of categorical variables were determined using descriptive analyses. Qualitative and quantitative variables were compared using Pearson's χ^2 test or Fisher's exact test and Student's t-test, respectively. In addition, multivariate logistic regression was conducted to determine potential independent risk factors for IBS using a model simultaneously including all significant results from the bivariate logistic regression. Unadjusted and adjusted Odds Ratios (ORs) and their 95% Confidence Intervals (CIs) are reported. Associations were considered statistically significant when P value <0.05.

Results

Of the 890 recruited students, 65 (7.3%) were excluded because of incomplete data. The remaining 825 completed the study questionnaire, giving a response rate of 92.7%. Of the 825 respondents, 442 (53.6%) were females and 383 (46.4%) were males, with a mean age of 22.13 ± 1.66 years and 21.23 ± 1.68 years, respectively. Table 1 describes the overall prevalence of IBS and its subtypes in the study population. Rome IV Criteria identified 73 (8.8%) individuals as having IBS, with a female/male ratio of 1.5:1. Twenty-three cases were IBS-C (31.5%), 21 were IBS-M (28.8%), 16 were IBS-D (21.9%), and 13

Table 1 Prevalence of Irritable Bowel Syndrome (IBS) and its subtypes in the study population (N=825)

Variable	Students with IBS (n = 73)
IBS	73 (8.8)
IBS subtypes	
IBS constipation (IBS-C)	23 (31.5)
IBS diarrhea (IBS-D)	16 (21.9)
IBS mixed (IBS-M)	21 (28.8)
IBS unspecified (IBS-U)	13 (17.8)

IBS-C, constipation predominant IBS; IBS-M, mixed IBS; IBS-D, diarrhea predominant IBS, IBS-U, unspecified IBS.

were IBS-U (17.8%).

Table 2 describes the sociodemographic characteristics of students with and without IBS. Female students (10.0%) were more affected by IBS than were male students (7.6%). The prevalence of IBS was highest in students of scientific colleges (16.5%) and lowest in students of humanities college (3.4%). Regarding living condition, IBS was more common in students living on campus (26.7%), followed by students living in a rented apartment (9.4%), with students living with their families having the lowest prevalence rate of IBS (7.6%). The study showed that there was significant difference in IBS prevalence between different college types (p<0.0001) and different living conditions (p<0.0001).

Behavioral and health background characteristics were compared between IBS and non-IBS groups. As shown in Table 3, IBS was found in 28 (21.5%) of smokers, 9 (18.0) of Khat chewers, 33 (14.3%) of students who reported having food intolerance, 22 (14.3%) of students who reported a past history of travel diarrhea, 27 (12.7%) of students with a 1st degree relative affected by IBS, and 43 (13.4%) of students who reported suffered from emotional stress in the past 6 months preceding the study. A statistically significant difference was observed in cigarette smoking (p<0.0001), Khat chewing (p=0.003), food intolerance (p=0.001), travel diarrhea (p=0.01), family history of IBS (p=0.01), and emotional stress (p=0.005).

The number of anxiety cases (HADS < 11) was slightly higher in non-IBS group (22.5%) than in IBS group (20.6%). Regarding depression, the number of cases was higher in IBS group (16.2%) than in non-IBS group (13.9%). No difference was observed in both anxiety and depression subtypes between IBS and non-IBS groups (Table 4).

Separate bivariate analyses were conducted to determine potential risk factors for IBS among the study subjects. Then, a multivariate logistic regression analysis was adjusted for all significant variables (p<0.05) listed in Table 5. The analysis showed that the odds of having IBS are 2.74 times higher for smokers compared to non-smokers (OR=2.74; 95%CI: 1.24-6.07). Those who experienced emotional stress in the 6 months prior to the study were 2.53 times more likely to have IBS than those who did not (OR=2.53; 95%CI: 1.28-5.00). Those who suffered from food intolerance were 2.15 times more likely to have IBS than those who did not (OR=2.15; 95%CI: 1.11-4.16). Medical colleges (OR=10.42; 95%CI: 3.45-31.51) and scientific colleges (OR=5.16; 95%CI: 1.64-16.22) were associated with a higher risk of IBS compared to humanities colleges.

Discussion

To the best of our knowledge, this appears to be the first investigation on the epidemiology of IBS using Rome IV Criteria in Saudi University students. Our data revealed that the overall prevalence of IBS was 8.8%, which is lower than what was found by other studies on university students. In a study from the King Abdulaziz University, Jeddah, 31.8% of medical students met the Rome III Criteria for IBS diagnosis. In another study from the King Saud bin Abdulaziz University in Riyadh, 21% of students were affected by IBS as per Rome III Criteria.[12]

In terms of sex difference, the prevalence of IBS in the present study was higher among females as compared to males (with female to male ratio of 1.5:1). In contrast to some of the previous studies, the difference was not statistically significant. It is noteworthy that, according to a 2018 systematic review, the sex difference in IBS prevalence may be geographically variable.[6] For instance, the distribution of IBS cases is fairly equal between Asian women and men, but in the United States, Canada, and Israel, IBS is twice as prevalent in women. Possible explanations for these findings are differences between Asian and Western individuals with IBS, including intestinal microbiota and diet, a hygiene hypothesis model, or cultural differences in behaviors related to health care seeking.[24]

In a comparison between the two criteria for IBS diagnosis (Rome III *vs* Rome IV), Bai *et al* found a substantially lower prevalence rate using Rome IV criteria (6.1% *vs* 12.4% using Rome III criteria) and concluded that Rome IV-positive IBS patients represented a subgroup of Rome III-positive patients with more severe symptoms.[25] This is consistent with another large-scale population-based study which showed that Rome IV-positive IBS patients

Table 2. Sociodemographic characteristics of the study population according to IBS prevalence.

Variable	IBS (%)	Non-IBS (%)	χ^2 or t-value	p value
Sex			1.444	0.229
Males (n=383)	29 (7.6)	354 (92.4)		
Females (n=442)	44 (10.0)	398 (90.0)		
Mean age years (SD)	21.96 (1.7)	21.58 (1.7)	1.72	0.09
College			30.402	<0.0001
Medical colleges (n=252)	20 (7.9)	232 (92.1)		
Scientific colleges (n=254)	42 (16.5)	212 (83.5)		
Humanities colleges (n=319)	11 (3.4)	308 (96.6)		
Academic year of study			8.460	0.21
1st (n=80)	2 (2.5)	78 (97.5)		
2nd (n=216)	26 (12.0)	191 (88.0)		
3rd (n=196)	14 (7.1)	182 (92.9)		
4th (n=265)	27 (10.2)	238 (89.8)		
5th (n=20)	1 (5.0)	19 (95.0)		
6th (n=27)	2 (7.4)	25 (92.6)		
Marital status			0.037	0.874
Single (n=672)	59 (8.8)	613 (91.2)		
Married (n=151)	14 (9.3)	137 (90.7)		
Living condition			19.064	<0.0001
With parents (n=684)	52 (7.6)	632 (92.4)		
In rented apartment (n=96)	9 (9.4)	87 (90.6)		
On campus (n=45)	12 (26.7)	33 (73.3)		
Income			3.538	0.17
Enough and exceeds (n=239)	17 (7.1)	222 (92.9)		
Enough only (n=481)	50 (10.4)	431 (89.6)		
Not enough (n=104)	6 (5.8)	98 (94.2)		
Parents			8.550	0.07
Living together (n=638)	48 (7.5)	590 (92.5)		
Divorced (n=60)	7 (11.7)	53 (88.3)		
Father passed out (n=91)	11 (12.1)	80 (87.9)		
Mother passed out (n=20)	4 (20.0)	16 (80.0)		
Both passed out (n=15)	3 (20.0)	12 (80.0)		

IBS, subjects with IBS (Irritable bowel syndrome); Non-IBS, subjects without IBS. Medical colleges include medicine and applied medical sciences; scientific colleges include computer sciences and sciences; humanities colleges include business administration and education.

(5.7%) represented half of Rome III-positive patients (10.7%).[26] Furthermore, several population-based studies from the USA, Canada and the UK have reported reduction of IBS prevalence to 50% when using Rome IV instead of Rome III diagnostic criteria.[27] This could be a reasonable explanation for the lower prevalence rate of IBS in this study as compared to prior reports from Saudi Arabia using Rome III criteria.[11,28]

Another important difference between our study and most of the similar studies from Saudi Arabia is that we included students of scientific and humanities colleges, along with medical students, to assess the effect of college type-related factors on IBS prevalence. IBS is most commonly reported to be higher among medical students, possibly due to stressful medical students' lifestyle.[12,13] However, taking non-academic stressors into consideration, we should not assume that non-medical students are less prone to stress. For instance, they may have less job opportunities in Saudi Arabia as compared to medical students. In the current study, the analysis of emotional stress revealed that students of sciences (21.3%) and students of humanities (28.0%) significantly reported more stress than did medical students (15.9%). This is in accordance to a previous study from Jazan University.[29] Additionally, the role of stress in IBS in the current study is evident from the increased occurrence of IBS in those living away from home, which is in agreement with some previous reports.[30,31]

Regular cigarette smoking in our study was the most significant independent risk factor for IBS (OR = 2.74; 95%CI: 1.24-6.07). The relationship between cigarette smoking and IBS has been reported to be inconsistent in the literature. While some studies showed that smoking was associated with a higher IBS prevalence,[32,33] other studies found no effect.[30,34] The disagreement in the association between smoking and IBS may be due to the fact that smoking has a close correlation with sociodemographic variables and stress, therefore it may reflect a multiplicity of several different factors affecting the digestive system.[32]

Khat (*Catha edulis*) is a stimulant substance that is commonly used in the East Africa, Yemen, and the Southern region of KSA. A large scale population-based study showed that almost one-third (33.2%) of Jizani population (people who live in Jazan Province of the KSA) used Khat at some point in their lives.[32] Although some studies have linked Khat chewing to gastrointestinal disorders, no research prior to this investigation has directly examined the role of Khat in the development of IBS. We found that regular Khat chewers (defined as individuals who used Khat on daily or weekly basis, and not occasionally in social events) were significantly more likely to have IBS. Despite being a significant predictor in the bivariate analysis (OR = 2.44; 95%CI: 1.13-5.24), Khat chewing was not associated with IBS after adjustment for variables listed in Table 5. This finding may indirectly confirm the important role of smoking in IBS as Khat chewing may induce and sustain tobacco smoking and trigger cessation relapses among simultaneous tobacco and Khat users.[35] Moreover, we found that 56.0% of Khat chewers (56.0%) were simultaneously cigarette smokers. Certainly, more studies are needed for a better understanding of the association between Khat chewing and IBS.

Food intolerance is a well-established provoking and exacerbating factor in patients with IBS. The finding that respondents with food intolerance were twice as likely to have IBS symptoms is consistent with what has been reported in the literature.[30,34] However, we did not examine which type of food caused food intolerance in the studied population, which is a limitation of this study.

Several studies have suggested that heredity play an important role in IBS development.[26,36] In accordance with what has been reported previously, having a first-degree relative with IBS in this study was significantly associated with IBS. However, family history was not found to be significant in multivariate analysis. This may indicate that both heredity and environmental factors are integral to the etiology of IBS.[37]

Table 3. Behavioral and health background characteristics of the study population according to IBS prevalence.

Variable	IBS (%)	Non-IBS (%)	χ^2	*p* value
Regular exercise			0.177	0.655
Yes (n=176)	17 (9.7)	159 (90.3)		
No (n=648)	56 (8.6)	592 (91.4)		
Cigarettes smoking status			30.653	<0.0001
Regular smoker (n=130)	28 (21.5)	102 (78.5)		
Non- or occasional smoker (n=693)	45 (6.5)	648 (93.5)		
Khat chewing status			5.527	0.03
Regular Khat chewer (n=50)	9 (18.0)	41 (82.0)		
Non- or occasional Khat chewer (n=775)		64 (8.3)	711 (91.7)	
Food intolerance			12.389	0.001
Yes (n=231)	33 (14.3)	198 (85.7)		
No (n=593)	39 (6.6)	554 (93.4)		
Travel diarrhea			6.808	0.01
Yes (n=154)	22 (14.3)	132 (85.7)		
No (n=667)	51 (7.6)	616 (92.4)		
IBS in a 1st degree relative			6.012	0.01
Yes (n=213)	27 (12.7)	186 (87.3)		
No (n=361)	24 (6.6)	337 (93.4)		
Chronic medical conditions			2.627	0.12
Yes (n=71)	10 (14.1)	61 (85.9)		
No (n=753)	63 (8.4)	690 (91.6)		
Emotional stress in past 6 months			7.984	0.005
Yes (n=321)	43 (13.4)	278 (86.6)		
No (n=385)	27 (7.0)	358 (93.0)		

IBS, subjects with IBS (Irritable bowel syndrome); Non-IBS, subjects without IBS.

Table 4. Prevalence of anxiety and depression according to IBS prevalence.

Variable	IBS (%)	Non-IBS (%)	χ^2	*p* value
Anxiety			0.903	0.64
No anxiety	43 (63.2)	412 (57.5)		
Borderline	11 (16.2)	143 (20.0)		
Diseased	14 (20.6)	161 (22.5)		
Depression			0.501	0.78
No depression	44 (64.7)	455 (63.9)		
Borderline	13 (19.1)	158 (22.2)		
Diseased	11 (16.2)	99 (13.9)		

IBS, subjects with IBS (Irritable bowel syndrome); Non-IBS, subjects without IBS.

Additionally, it is still uncertain whether genetic factors or traits related to learned behavior are closely linked to IBS.[36,38] Furthermore, the possibility that some respondents were not aware of family members with IBS is noteworthy, and the real frequency of students with IBS-positive relatives may be much higher than what we found. IBS in this study was significantly more common in respondents who reported a history of traveler's diarrhea as compared to those who did not. Although the mechanism is not fully understood, IBS has been linked to traveler's diarrhea in the literature.[39,40] To accurately assess the role of traveler's diarrhea in IBS, we recommend future works to include details regarding the onset and symptoms of traveler's diarrhea, as well as to exclude cases in which IBS was diagnosed before travel.

As discussed earlier in this section, we found that emotional stress was common in IBS-positive participants and significantly predicted the odds of having IBS after adjustment for other factors. However, in contrast to previous studies in KSA, we found no significant association between IBS and anxiety and depression. Using Rome III criteria and HADS, some studies showed that anxiety was significantly more common among patients with IBS.[41] However, the association between psychiatric disorders (anxiety and depression) and IBS was inconsistent in a recent meta-analysis of eight studies.[42] Therefore, further investigation of the role of anxiety and depression in IBS patients using longitudinal prospective interview-based study designs is warranted.

In conclusion, our analysis identified 8.8% IBS-positive cases. The main predictors of IBS were cigarette smoking, emotional stress during the past six months prior to the study, food intolerance, and being a student in a scientific college. However, no significant association was found between IBS and psychiatric disorders. Future studies are required to reveal the complex pathogenicity of IBS in order to open the door towards new management lines.

Study limitations

This study was not without limitations. We used self-administered questionnaires to collect data which may result in a high frequency of missed data and inaccurate answers than in interview-based study designs. In addition, Rome IV is a newly published tool and only few studies have used it to diagnose IBS, thus we could not compare our results to previous studies on similar target subjects (*i.e.* undergraduate students). The amount and duration of cigarettes smoking and Khat chewing were not quantified. Some participants with celiac disease could have been included in the study as there were no questions to exclude cases with celiac disease. Finally, details regarding the onset and symptoms of traveler's diarrhea were not included.

Table 5. Evaluation of risk factors for IBS by bivariate and multivariate logistic regression analyses.

Variable	Unadjusted			Adjusted		
	OR	95%CI	*p* value	OR	95%CI	*p* value
College						
Humanities	1			1		
Scientific	2.4	1.13-5.14	0.02	5.16	1.64-16.22	0.005
Medical	5.5	2.79-11.02	0.000	10.42	3.45-31.51	0.000
Accommodation						
At parents	1			1		
In rented accommodation	1.26	0.60-2.64	0.54	1.63	0.62-4.31	0.32
On campus	4.42	2.15-9.07	0.000	2.33	0.66-8.22	0.19
Smoking						
No	1			1		
Yes	3.95	2.36-6.62	0.000	2.74	1.24-6.07	0.01
Khat chewing						
No	1			1		
Yes	2.44	1.13-5.24	0.02	1.44	0.35-5.91	0.61
Food intolerance						
No	1			1		
Yes	2.37	1.45-3.87	0.000	2.15	1.11-4.16	0.02
Travel diarrhea						
No	1			1		
Yes	2.01	1.18-3.43	0.01	1.08	0.49-2.36	0.85
IBS in a 1st degree relative						
No	1			1		
Yes	2.04	1.14-3.63	0.02	1.49	0.75-2.93	0.25
Emotional stress in past 6 months						
No	1			1		
Yes	2.05	1.24-3.40	0.01	2.53	1.28-5.00	0.01

IBS, irritable bowel syndrome; OR, odds ratio; CI, Confidence interval.

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