

Irritable Bowel Syndrome among Medical Students in Jordan: A cross-Sectional Study

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Abstract

Background Irritable bowel syndrome (IBS) is one of the most common functional gastrointestinal disorders worldwide. IBS is not a life-threatening condition; however, it considerably reduces the quality of life of sufferers. This study aims at assessing the prevalence of IBS, its subtypes, and associated factors among medical students at Jordan University of Science and Technology (JUST).

Methods We conducted a cross-sectional study among medical students at JUST from November 2019 to February 2020. A structured, pre-validated, comprehensive, self-administered, and anonymous questionnaire was used. The questionnaire consists of three parts: sociodemographic and behavioral factors related questions, Rome IV diagnostic questionnaire, and Depression Anxiety Stress Scale (DASS-21). A total of 396 students participated in our study.

Results The prevalence of IBS among medical students at JUST was 28.5%. The predominant IBS subtype was IBS-mixed (IBS-M), which constituted 42.5% of the cases. Multivariate logistic regression analyses revealed that gender, family history of IBS, academic level, residence, stress level, anxiety level, and depression level were the main predictors of IBS. Males were fifty percent less likely to suffer from IBS compared to females. Students who had a family history of IBS were two and half times more likely to suffer from IBS. Students who had extremely severe stress were five times more likely to have IBS than those with normal stress levels. Students who had extremely severe depression were three and half times more likely to suffer from IBS than those who had normal depression level. Students who had extremely severe anxiety levels were two and half times more likely to suffer from IBS than those of normal anxiety level. The odds of having IBS were highest among fifth-year students, followed by sixth-year students compared to first-year students. The anxiety level regression model revealed that students living with their families have a reduced risk for IBS by 50% than students living in a private house.

Conclusion IBS is highly prevalent among medical students at JUST. Sex, family history of IBS, academic level, residence, stress level, anxiety level, and depression level were the risk factors of IBS. Offering emotional and psychological support and stress management courses may be needed to enhance students' ability to deal with stress, reduce anxiety and depression.

1. Background

IBS is one of the most common functional gastrointestinal disorders with symptoms that include abdominal pain or discomfort, bloating, and altered bowel habits such as constipation and diarrhea or alternating between the two. It's considered the most frequently diagnosed disorder by gastroenterologists in the outpatient setting (1). The natural history of IBS is one of deteriorating and remitting symptoms because of the chronic nature of the condition. It represents a substantial economic burden, including the costs of consultations, investigations, prescribed and over-the-counter medicines, and sick leaves (2). Approximately 40 percent of referrals to gastroenterologists are accounted for by functional gastrointestinal disorders (FGIDs). Of the 33 recognized adult functional gastrointestinal

disorders, the most common is irritable bowel syndrome (IBS), with a prevalence estimated at 12 percent worldwide (3). IBS is most prevalent in South America (21.0%) and least prevalent in Southeast Asia (7.0%) (1).

IBS patients have a low quality of life and low productivity; these patients miss more days of work, are less productive at work, and as a result of their symptoms, 38% of IBS patients have intended suicide (4). IBS is not a lethal condition; however, it considerably reduces the quality of life of sufferers. It negatively affects their education, working ability, and social life (5). Different diagnostic tools have been used to detect IBS, including the Manning criteria, Rome I criteria, Rome II criteria, and Rome III criteria (6). Currently, the Rome IV criteria are the most commonly used method for diagnosing IBS (3).

The Rome IV criteria defined irritable bowel syndrome (IBS) as a functional bowel disorder in which recurrent abdominal pain is associated with defecation or a change in bowel habits. Disordered bowel habits are typically present (i.e., constipation, diarrhea, or a mix of constipation and diarrhea), as are symptoms of abdominal bloating/distension. Symptoms should begin at least six months before diagnosis, and symptoms should occur during the last three months (3). IBS is classified into four subtypes: IBS with predominant constipation (IBS-C), IBS with predominant diarrhea (IBS-D), IBS with mixed bowel habits (IBS-M), and IBS un-subtyped (3). The Bristol stool form scale helps classify patients with IBS into different subtypes based on predominant bowel behaviors, as shown in (Fig. 1). The bowel movements of Type 1 or 2 and Type 6 or 7 in Fig. 1 below can be considered abnormal. Type 1 or 2 means constipation, and Type 6 or 7 means diarrhea (7).

IBS is classified into four subtypes:

IBS with Constipation (IBS-C)

Having hard stools at least 25% of the time and mushy or watery stools in less than 25% of the bowel movements (Type 1 and 2 in Bristol stool form scale) (8).

IBS with Diarrhea (IBS-D)

Having mushy or watery stools at least 25% of the time and hard stools in less than 25% of the bowel movement (Type 6 and type 7 in Bristol stool form scale) (8).

Mixed IBS (IBS-M)

Having mushy or watery stools at least 25% of bowel movements and hard stools in at least 25% of bowel movements (8).

Unsubtyped IBS (IBS-U)

This is an insufficient abnormality of stool consistency to meet the other three subtypes' criteria (8).

IBS is highly influenced by demographic factors, especially sex and age. IBS is more prevalent in females than males and has an onset, decreasing with age, between late adolescents and the twenties (8). Females from developing countries are 2–4 times more likely than men to have IBS (9). Evidence suggests a genetic role in the etiology of IBS, with 33% of IBS patients reporting positive family history (10). Lifestyle and behavioral factors such as smoking status, physical inactivity, residence, sleep pattern, family income, academic level, and eating habits have been linked to IBS (6, 8, 11, 12). Several studies have linked IBS with depression, anxiety, and stress (6, 12, 13, 14). Medical students are often exposed to a challenging environment and stressful conditions; they undergo a lot of physical stress, sleeplessness, and psychological stress because they must carry tremendous future responsibility (14). Many studies concluded that stress is a risk factor for IBS (11,14,15). this means that people living in stressful conditions are more likely to develop IBS. As a result, medical students are more likely to be at risk of IBS than other groups of the population (15). The objectives of this study are:1. To assess the prevalence of IBS and its subtypes among medical students at JUST using the Rome IV criteria. 2. To determine the influence of sociodemographic and behavioral factors on IBS prevalence among medical students (sex, cigarette smoking, physical activity, family history of IBS, living conditions, common food source, daily sleeping hours, family income, and academic level). 3. To explore the association between IBS with anxiety, depression, and stress.

2. Material And Methods

2.1 Study Design, Participants, and Setting

A cross-sectional study was conducted over a period of four months from November 2019 to February 2020. The study population included undergraduate medical students at Jordan University of Science and Technology (JUST), Irbid, from different academic levels (1st through 6th year).

2.2 Sampling and Data Collection

The sample size was calculated using the following formula: $(n = z^2pq / \text{margin of error}^2)$. Where Z value equals 1.96 for a 95% confidence level, the expected prevalence of IBS is 20%, and a margin of error of 0.04. Accordingly, our sample size was estimated to be 384. A total of 396 students were actually included in the study. All medical students in the different years of their study were eligible for inclusion in the study.

The Data collection process was done in two ways:

2.2.1 The Paper Version of the Questionnaire

A research assistant was appointed. His mission was to contribute to collecting data from medical students of different academic levels by going to their lecture places and asking them about the possibility of participating in the study and filling out the questionnaire

2.2.2 The Electronic Version of the Questionnaire

An electronic version of the questionnaire was prepared using a google form; we contacted the class representative of each study year from the first year to the sixth year. We asked them to inform the students about the study and encourage them to fill it out.

A total of 396 students participated in our study using both paper and electronic versions of the survey.

2.3 Study Tool

The data of this study was collected using pre-validated, self-administered, and anonymous questionnaires. We told the students about their rights, including their full right, and under any circumstances, to leave the study at any stage. Participation in this study was voluntary without any incentive.

Our questionnaire consisted of three sections, distributed as follows:

2.3.1 Sociodemographic and Behavioral Factors Related Questions

This part consisted of questions related to sociodemographic and behavioral factors including sex (male, female), academic level (first year, second year, third year, fourth year, fifth year, and sixth year), smoking status (currently a smoker, never smoked and the previous smoker), regular physical activity (yes, no), family history of IBS (yes, no), living conditions (private house, school dormitory and with family), a common food source (home, restaurant), sleep pattern (< 8 hours, >= 8 hours), and family income (< 500JD, 500–1000 JD, 1000–1500 JD and > 1500 JD).

2.3.2 Rome IV Diagnostic Questionnaire for Adults (Irritable Bowel Syndrome Module)

The Rome IV Diagnostic Questionnaire for Adults has adequate sensitivity (62.7%) and excellent specificity (94.5%). It consists of five questions related to IBS diagnosis and one question to determine IBS subtype, using a picture of the Bristol Stool Scale shown in Fig. 1.

2.3.3 Depression Anxiety Stress Scale Test (DASS-21)

This tool evaluates the severity of behavioral and emotional symptoms correlated with depression, anxiety disorder, and stress. It consists of 21 items, seven items related to depression, seven items related to anxiety, and seven items related to stress. Each item is scored from 0 (did not apply to me at all over the last week) to 3 (applied to me very much or most of the time over the past week). The test usually takes about 3 minutes to complete. The assessor advises the patient to consider what they have experienced in the past week and at present and choose the answer that first comes to mind. To calculate the depression score for each medical student, the sum of the depression-related item scores was obtained and then multiplied by 2. We did the same thing for stress and anxiety. After the final scores of depression, anxiety and stress were obtained, we converted them into five categories: normal, mild, moderate, severe, and extremely severe by using the DASS Severity rating; this allowed us to compare depression, anxiety, and stress as categorical variables between IBS students and non-IBS student.

2.4 Data Management and Statistical Analyses

Data entry was performed using Microsoft Excel 2016 sheets, and data analysis was performed using the IBM Statistical Package for Social Sciences (SPSS), version 22. Descriptive statistics were used to determine frequency and percentages for sociodemographic and behavioral factors, IBS prevalence, and subtypes.

The chi-square test was used to assess the significance of the association between categorical variables and the outcome variable (presence, absence of IBS). A p-value of less than 0.05 was considered statistically significant.

Potential risk factors for IBS with a p-value \leq of 0.25 in the cross-tabulation analyses were subjected to multivariate logistic regression analyses. The purpose of this was to assess the effect of a specific factor on IBS prevalence after controlling the effect of potential confounders. Adjusted odds ratios and 95% confidence intervals were obtained.

3. Results

Our results are based on studying 396 medical students at (JUST) who participated in this study using the paper version or the questionnaire's electronic version. Because there were no relevant differences, the two groups were combined in our analyses.

3.1 Characteristics of the Study Population

The percentage of females was slightly higher than that of males (223 (56.3%) female vs. 173 (43.7%) male). We had good representation of different academic level groups: 64 (16.2%) first-year, 69 (17.4%) second-year, 92 (23.2%) third-year, 53 (13.4%) fourth-year, 57 (14.4%) fifth-year, and 61 (15.4%) sixth-year. Over 19% of students were current smokers, 71.5% never smokers, and 9.1% previous smokers. Only 33.8% of students performed regular physical activity. Approximately 33.8% of medical students had a family history of IBS, 31.1% were living in a private house, 18.4% were living in a school dormitory, and the majority of students (50.5%) were living with family. Family income was less than 500 JDs (U.S. \$ 700) for 10.4% of students, between 500–1000 JDs for 21% of students, between 1000–1500 JDs for 18.7% of students, and more than 1500 JDs for 49.7% of students. About 73% of the students were eating at home. Most medical students (83.6%) had average daily sleeping hours of less than 8 hours (Table 1).

3.2 Prevalence of IBS among Medical Students

Of 396 participants, 113 fulfilled the Rome IV diagnostic criteria for IBS, yielding an overall prevalence of 28.5 %, of whom 42.5% were classified as IBS-M, the most common IBS subtype in our study, 27.4% IBS-D, 25.7% IBS-C, and 4.4% IBS-U (Table 2).

3.3 IBS Risk factors

Bivariate analyses revealed that sex, family history of IBS, academic level, residence, family income, anxiety level, depression level, and stress level had a statistically significant association with IBS.

Conversely, smoking status, physical activity, food source, and sleep pattern were not significantly associated with IBS (Table 3).

Potential risk factors for IBS with a p-value ≤ 0.25 were further examined in multivariate logistic regression analyses. Because anxiety, depression, and stress are highly correlated, each was included in a separate model to avoid multicollinearity. This resulted in three distinct models.

3.4 The Stress Model

The risk of having IBS was significantly higher among females than males ($OR = 0.537$; 95% CI: 0.296–0.974) and those with a family history of IBS ($OR = 2.38$; 95% CI: 1.401–4.04). The risk of having IBS was significantly higher among fifth-year students, followed by sixth-year students and third-year students, respectively, compared with first-year students ($OR = 4.52$; 95% CI: 1.505–13.586, $OR = 4.15$; 95% CI: 1.407–12.263, $OR = 3.072$; 95% CI: 1.088–8.675). IBS increased with the level of stress (P -value = 0.0). The risk of having IBS was significantly higher among students who had extremely severe stress followed by severe, moderate, and mild respectively compared to students with normal stress level ($OR = 5.167$; 95% CI: 2.477–10.777, $OR = 2.806$; 95% CI: 1.325–5.944, $OR = 2.706$; 95% CI: 1.201–6.095, $OR = 2.657$; 95% CI: 1.182–5.971) (Table 4).

3.5 The Depression Model

The risk of having IBS was significantly higher among females than males ($OR = 0.433$; 95% CI: 0.242–0.776) and those with a family history of IBS ($OR = 2.77$; 95% CI: 1.635–4.695). The risk of having IBS was significantly higher among fifth-year students, followed by sixth-year students and third-year students, respectively, compared with first-year students ($OR = 4.304$; 95% CI: 1.450–12.777, $OR = 3.92$; 95% CI: 1.339–11.504, $OR = 3.246$; 95% CI: 1.164–9.053). The risk of having IBS was significantly higher among students who had extremely severe depression, followed by mild depression compared to students with normal depression level ($OR = 3.616$; 95% CI: 1.763–7.420), $OR = 3.407$; 95% CI: 1.506–7.712) (Table 5).

3.6 The Anxiety Model

The risk of having IBS was significantly higher among females than males ($OR = 0.505$; 95% CI: 0.28–0.91), those who have a family history of IBS ($OR = 2.53$; 95% CI: 1.502–4.263), and those who were living at private house compared to those who were living with family ($OR = 0.545$; 95% CI: 0.306–0.969). The risk of having IBS was significantly higher among fifth-year students, followed by sixth-year students and third-year students, respectively, compared with first-year students ($OR = 4.711$; 95% CI: 1.582–14.029, $OR = 4.536$; 95% CI: 1.547–13.3, $OR = 3.109$; 95% CI: 1.111–8.697). The risk of having IBS was significantly higher among students who had extremely severe anxiety compared with those of normal anxiety level ($OR = 2.69$; 95% CI: 1.393–5.196) (Table 6).

Table 1
Sociodemographic and behavioral characteristics of the medical students, Jordan, 2020

Category	Variable	N (%)
Sex	Male	173 (43.7)
	Female	223 (56.3)
Academic level	First-year medicine	64 (16.2)
	Second-year medicine	69 (17.4)
	Third-year medicine	92 (23.2)
	Fourth-year medicine	53 (13.4)
	Fifth-year medicine	57 (14.4)
	Sixth-year medicine	61 (15.4)
Smoking status	Currently a smoker	77 (19.4)
	Never smoked	283 (71.5)
	Previous smoker	36 (9.1)
Practice physical exercise	Yes	134 (33.8)
	No	262 (66.2)
Family history of IBS	Yes	134 (33.8)
	No	261 (65.9)
Residence	Private house	123 (31.1)
	School dormitory	73 (18.4)
	With family	200 (50.5)
Monthly family income from all sources	< 500JD	41 (10.4)
	500-1000JD	83 (21)
	1000-1500JD	74 (18.7)
	> 1500JD	197 (49.7)
The usual place for eating	Restaurant	101 (25.5)
	Home	289 (73)
Daily sleeping hours	< 8 hours	331 (83.6)
	=> 8 hours	50 (12.6)

Table 2
The prevalence of IBS and its
subtypes among medical
students, Jordan, 2020

IBS-subtypes	N	%
Overall IBS	113	28.5
IBS-M	48	42.5
IBS-D	31	27.4
IBS-C	29	25.7
IBS-U	5	4.4

Table 3
Characteristics of medical students in relation to IBS using bivariate analyses, Jordan, 2020

Variable	IBS students	Non-IBS students	P-value
	N (%)	N (%)	
Sex	36 (20.8)	137 (79.2)	0.003
Male	77 (34.5)	146 (65.5)	
Female			
Academic level	6 (9.4)	58 (90.6)	0.000
First-year medicine	14 (20.3)	55 (79.7)	
Second-year medicine	31 (33.7)	61 (66.3)	
Third-year medicine	13 (24.5)	40 (75.5)	
Fourth-year medicine	23 (40.4)	34 (59.6)	
Fifth-year medicine	26 (42.6)	35 (57.4)	
Sixth-year medicine			
Smoking status	28 (36.4)	49 (63.6)	0.196
Currently a smoker	77 (27.2)	206 (72.8)	
Never smoked	8 (22.2)	28 (77.8)	
Previous smoker			
Practice physical exercise	38 (28.4)	96 (71.6)	0.955
Yes	75 (28.6)	187 (71.4)	
No			
Family history of IBS	60 (44.8)	74 (55.2)	0.000
Yes	52 (19.9)	209 (80.1)	
No			
Residence	45 (36.6)	78 (63.4)	0.041
Private house	21 (28.8)	52 (71.2)	
School dormitory	47 (23.5)	153 (76.5)	
With family			

Variable	IBS students	Non-IBS students	P-value
	N (%)	N (%)	
Monthly family income from all sources	12 (29.3)	29 (70.7)	0.026
< 500JD	14 (16.9)	69 (83.1)	
500-1000JD	19 (25.7)	55 (74.3)	
1000-1500JD	68 (34.5)	129 (65.5)	
> 1500JD			
The usual place for eating	32 (31.7)	69 (68.3)	0.486
Restaurant	81 (28.0)	208 (72.0)	
Home			

Table 3
continued

Variable	IBS students	Non-IBS students	P-value
	N (%)	N (%)	
Daily sleeping hours	97 (29.3)	234 (70.7)	0.631
< 8 hours	13 (26.0)	37 (74.0)	
=> 8 hours			
Anxiety level	26 (19.5)	107 (80.5)	0.002
Normal	5 (19.2)	21 (80.8)	
Mild	23 (28.8)	57 (71.2)	
Moderate	10 (28.6)	25 (71.4)	
Severe	49 (41.9)	68 (58.1)	
Extremely severe			
Depression level	22 (16.8)	109 (83.2)	0.002
Normal	20 (39.2)	31 (60.8)	
Mild	23 (29.5)	55 (70.5)	
Moderate	15 (30.6)	34 (69.4)	
Severe	33 (40.2)	49 (59.8)	
Extremely severe			
Stress level	27 (15.3)	149 (84.7)	0.000
Normal	15 (34.1)	29 (65.9)	
Mild	16 (33.3)	32 (66.7)	
Moderate	22 (37.3)	37 (62.7)	
Severe	33 (51.6)	31 (48.4)	
Extremely severe			

Table 4
 Factors related to IBS in the Stress model, using logistic regression, Jordan,
 2020

Factors	P-value	Adjusted odds Ratios (95%CI)
Family history of IBS	0.003	1
No	0.001	2.38 (1.401–4.040)
Yes		
Stress level	0.000	1
Normal	0.018	2.657 (1.182–5.971)
Mild	0.016	2.706 (1.201–6.095)
Moderate	0.007	2.806 (1.325–5.944)
Severe	0.00	5.167 (2.477–10.777)
Extremely severe		
Academic level	0.007	1
First-year medicine	0.094	2.599 (0.850–7.95)
Second-year medicine	0.034	3.072 (1.088–8.675)
Third-year medicine	0.151	2.35 (0.732–7.545)
Fourth-year medicine	0.007	4.52 (1.505–13.586)
Fifth-year medicine	0.01	4.15 (1.407–12.263)
Sixth-year medicine		
Gender	0.036	1
Female	0.041	0.537(0.296–0.974)
Male		

***Each variable in this table is adjusted for all other variables in the table.**

Table 5
 Factors related to IBS in the Depression model, using logistic regression,
 Jordan, 2020

Factors	P-value	Odds Ratio (95%CI)
Family history of IBS	0.001	1
No	0.000	2.77 (1.635–4.695)
Yes		
Depression level	0.001	1
Normal	0.003	3.407 (1.506–7.712)
Mild	0.054	2.044 (0.988–4.230)
Moderate	0.129	1.953 (0.824–4.629)
Severe	0.000	3.616 (1.763–7.420)
Extremely severe		
Academic level	0.005	1
First-year medicine	0.077	2.684 (0.897–8.033)
Second-year medicine	0.024	3.246 (1.164–9.053)
Third-year medicine	0.156	2.305 (0.726–7.318)
Fourth-year medicine	0.009	4.304 (1.450–12.777)
Fifth-year medicine	0.013	3.924 (1.339–11.504)
Sixth-year medicine		
Gender	0.006	1
Female	0.005	0.433 (0.242–0.776)
Male		

***Each variable in this table is adjusted for all other variables in the table.**

Table 6
 Factors related to IBS in the Anxiety Model, using logistic regression,
 Jordan, 2020

Factors	P-value	Odds Ratio (95%CI)
Family history of IBS	0.001	1
No	0.000	2.531 (1.502–4.263)
Yes		
Anxiety level	0.002	1
Normal	0.690	1.264 (0.399– 4.00)
Mild	0.293	1.472 (0.716–3.03)
Moderate	0.461	1.415 (0.563–3.558)
Severe	0.003	2.690 (1.393–5.196)
Extremely severe		
Academic level	0.005	1
First-year medicine	0.076	2.712 (0.902–8.155)
Second-year medicine	0.031	3.109 (1.111–8.697)
Third-year medicine	0.145	2.358 (0.744–7.470)
Fourth-year medicine	0.005	4.711 (1.582–14.029)
Fifth-year medicine	0.006	4.536 (1.547–13.3)
Sixth-year medicine		
Gender	0.021	1
Female	0.023	0.505 (0.280–0.910)
Male		
Residence	0.032	1
Private house	0.11	0.551 (0.266–1.144)
School dormitory	0.039	0.545 (0.306–0.969)
With family		
*Each variable in this table is adjusted for all other variables in the table		

4. Discussion

The prevalence of IBS reported in this study was relatively high at 28.5%. This is higher than the IBS population prevalence in North America (12%), South America (21.0%), and Southeast Asia (7.0%) (1). The risk of having IBS was significantly higher among females than males, those who have a family history of IBS, those who were in the fifth-year, sixth-year, and third-year academic level, respectively, and those who were living in a private house (anxiety model only). IBS was significantly associated with depression, anxiety, and stress in our study. While the 28.5% prevalence rate of IBS among medical students in Jordan is relatively higher than that found in North America, South America, and Southeast Asia, but lower than reported by a Pakistani study using the Rome II criteria, 45.0% (16). The prevalence rate obtained in this study is similar to the prevalence of IBS among medical students at Hali University, Saudi Arabia (11) and to the prevalence of IBS among medical students in Pakistan Karachi (15). Our study result is higher compared to a study in China among university students at 7.85% (12), international research in eight different European countries at 11.5 percent (17), and a Lebanese study at five major universities in the Greater Beirut area, which was 20.05% (8). On the other hand, our study result is lower than a study in Saudi Arabia at King Abdul-Aziz University, Jeddah, which showed an IBS prevalence of 31.8 percent among medical students and interns (18). Inconsistency of reported prevalence rates may be due to many reasons, including the diagnostic method used and the population studied.

The present study reported IBS-M as the predominant IBS subtype among all the other subtypes accounting for 42.5% of all cases. In agreement with our study, Costanian et al. described a similar finding in their study among medical students at five large universities in Beirut, Lebanon, with IBS-M accounting for 44.8% of those diagnosed with IBS (8). Naeem et al. also described a similar finding in their study among medical students in Pakistan, with IBS-M accounting for around 55% of those diagnosed with IBS (15). Furthermore, our study corresponded to what was found by Almutairi et al., who found that IBS-M was the predominant subtype among medical students in the Qassim region, Saudi Arabia, with 64.3% (6). On the other hand, our result is inconsistent with a study from Germany by Gulewitsch et al., in which IBS-D was higher than IBS-M (19). Another study conducted among medical students at Inner Mongolia Medical University, China, found that the predominant subtype was IBS-D in males and females (20).

Concerning IBS according to sex, our study showed that female students were more likely to suffer from IBS than male students, a finding consistent with most of available literature. Costanian et al. showed that female students were more likely to have IBS than males (8). Similarly, Shen et al. found that the prevalence of IBS was higher among Chinese female students than males (21). Also, in a study conducted in Germany, the prevalence of IBS was significantly higher among females than males (19). An explanation for this finding may be that females tend to be more emotional and more likely to suffer from depression, anxiety and stress. Other explanations include socio-cultural differences, differences in health-seeking behavior between men and women, or actual biological differences. On the other hand, our study result was inconsistent with a few studies including Jung et al. (22). a few reports from Mumbai, Europe, and North America (23).

The current work illustrates that sixth-year students and fifth-year students were more likely to develop IBS than first-year students. This result may reflect an increasing level of stress, anxiety, and depression with the increase of academic level and an increase in IBS. Our findings in this respect are consistent with Almutairi et al., who reported that advanced academic level was a risk factor for IBS. As the academic level increases, the odds of IBS also increase; those in the fifth year are 3.61 times more likely to have IBS than 1st years (6). Alaqeel et al. conducted a study among medical students at King Saud bin Abdulaziz University for Health Sciences in Riyadh. They reported that IBS was most prevalent among students in the final year, followed by students in the second year (13). On the other hand, our result was inconsistent with Almezani et al., who reported no statistically significant correlation between medical student educational level and irritable bowel syndrome (11).

We have found that a family history of IBS was associated with an increase in IBS. The odds of having IBS were two and half times higher in students who had a family history of IBS than students that did not have a family history of IBS. This study result agrees with the results obtained from most studies in the literature. A study conducted at the Hail University of Saudi Arabia showed a statistically significant association between family history of IBS and IBS prevalence (11). Almutairi et al. concluded that the family history of IBS was one of the significant predictors of IBS (6). On the contrary, our result was inconsistent with a study in Beirut, Lebanon, which showed that most of the respondents with IBS did not have a family history of IBS (8).

Bivariate analyses showed a statistically significant association between IBS and living situation ($P = 0.041$). IBS was most prevalent among students who lived at a private house, followed by those who lived in the school dormitory. Although on bivariate analysis, living situation was significantly related to IBS, this relationship disappeared when we controlled for confounders in the Stress level regression model and depression level regression model. The result of this study is consistent with most of the studies in the literature. Costanian et al. revealed that students living in private dormitories were three times more likely to suffer from IBS (8). Similarly, a study conducted in Saudi Arabia reported that the chance of having IBS was higher in those who were living alone away from their families ($p = 0.005$) (8).

Regarding sleep pattern, our study showed the association between daily sleeping hours and IBS was not statistically significant ($P = 0.631$). Similarly, Almutairi et al. reported that daily sleeping hours did not influence the risk of IBS. $P = 0.546$ (6). Another study explored the relation between overnight calls and IBS and found no significant relationship (24). However, our result was inconsistent with a study performed on nursing and medical students in Japan, showing that IBS students had bedtime later than non-IBS students (16).

Almutairi et al. reported that eating habits did not influence the risk of IBS $P = 0.634$ (6). Similarly, the current study illustrated that the prevalence rate of IBS among medical students at JUST was not related to eating habits.

Concerning physical activity, Costanian et al. found that students who reported regular practicing of physical activity had a significantly lower IBS prevalence than others (8). However, our study showed no

protective effect of physical activity on the prevalence rate of IBS.

Our study showed no association between smoking status and IBS prevalence; this was consistent with what was found by Ibrahim et al. who revealed an insignificant association between smoking and IBS (18).

Our study showed that IBS prevalence was highest among students with a family income of more than 1500JD (US \$ 2200). However, this association disappeared when we controlled for confounders in the regression models. The result of this study, although not significant, is similar to what was found by Costanian et al. who reported that IBS was significantly higher among students with higher levels of income (8).

Our study revealed that depression, anxiety, and stress were significantly associated with IBS. The results of this study are consistent with most of the studies in the literature. A Chinese study reported that the anxiety and depression score for IBS students was significantly higher than for those without IBS. 65.9% of IBS patients believed that discomfort is related to a bad mood (12). A study performed in Saudi Arabia demonstrated a significant impact on IBS prevalence by depression ($p = 0.042$). Students with morbid depression levels had a higher prevalence of IBS compared with those with borderline depression. This study showed that the prevalence of IBS was higher in students with morbid anxiety levels than those with borderline anxiety levels. However, this was not statistically significant (6). Differences between our study and this study regarding anxiety may be explained by differences in the diagnostic tool used to determine the degree of depression and anxiety; we used the DASS-21 scale, but Almutairi et al. used the Hospital Anxiety and Depression Scale (HAD) which is a different tool. In another study conducted among medical students at Inner Mongolia Medical University, China, the researcher reported that Students with anxiety and depression had almost twice as high a prevalence of IBS as those without anxiety and depression; this finding is congruent with our finding (20). Moreover, a study conducted at King Saud bin Abdulaziz University for Health Sciences in Riyadh, Saudi Arabia, revealed a significant association between anxiety and IBS ($p = 0.039$) (13). Also, Ibrahim et al. reported that (41.9%) of medical students with IBS were diagnosed as having a morbid level of depression compared to normal students (31.5%) in Jeddah (18).

The present study is that the first to use Rome IV criteria as a diagnostic tool among Jordanian medical students. We assessed the effect of many factors on IBS prevalence using an adequate sample size. However, our study had three limitations. First, this study was conducted without consideration of red flags symptoms; other conditions that have symptoms that may mimic IBS were not checked. Therefore, our results had the potential to overestimate the prevalence of IBS. Second, our study was based on self-reported data. Third, due to the cross-sectional nature of our study, it is difficult to establish a temporal sequence from cause to effect. Thus, we can't know which started first, depression, anxiety, and stress or IBS.

Research on IBS in Jordan is very scarce. There is a need for research on the economic impact of IBS and the extent to which IBS influences the quality of life of the different sectors of the population.

Conclusion

IBS prevalence among medical students at JUST is 28.5%, which is high compared with other studies. IBS-M is the most predominant subtype constituting 42.5% of cases. Sex, family history of IBS, academic level, residence, stress level, depression level, and anxiety level are the main predictors of IBS.

Recommendations

We recommend conducting counseling sessions to help medical students, particularly females cope with stressful conditions, manage their time, and improve their quality of life. A stress management course may be useful in this regard. We also recommend increasing the awareness of physicians to the high risk of IBS in medical students.

List Of Abbreviations

IBS: Irritable bowel syndrome, JUST: Jordan University of Science and Technology, IBS-C: IBS-Constipation, IBS-D: IBS- Diarrhea, IBS-M: IBS- Mixed, IBS-U: IBS- Unsubtyped, DASS-21: Depression Anxiety Stress Scale, HADS: Hospital Anxiety and Depression Scale.

Declarations

Acknowledgment

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Author contributions

S.Y. and A.B. the principal investigators involved in study design, data collection, data analysis, and manuscript writing. K.J, K.K, and M.N contributed to the guidance, reviewing, and finalization of the manuscript. All authors read and approved the final version of the manuscript submitted for publication.

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Availability of data and materials

The data that support the findings of this study are available from the corresponding author upon request.

Ethics declarations

Ethics approval and consent to participate

The study was approved by the Institutional Review Board (IRB) at King Abdullah University Hospital and the Jordan University of Science and Technology. Out of 396 students who participated in our study, 329 responded to this study online using Google Forms; they had to give their informed consent before being able to complete the questionnaire. The remaining 67 students participated using the paper version of the questionnaire; they provided informed written consent prior to study enrollment. All study procedures were conducted according to the World Medical Association Declaration of Helsinki. This study was anonymous, confidentiality was strictly adhered to, and the data were used only for scientific purposes. The study carries no foreseeable harm to participants.

Consent for publication

N/A.

Competing interests

All authors have no potential competing interests relevant to this article.

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Figures

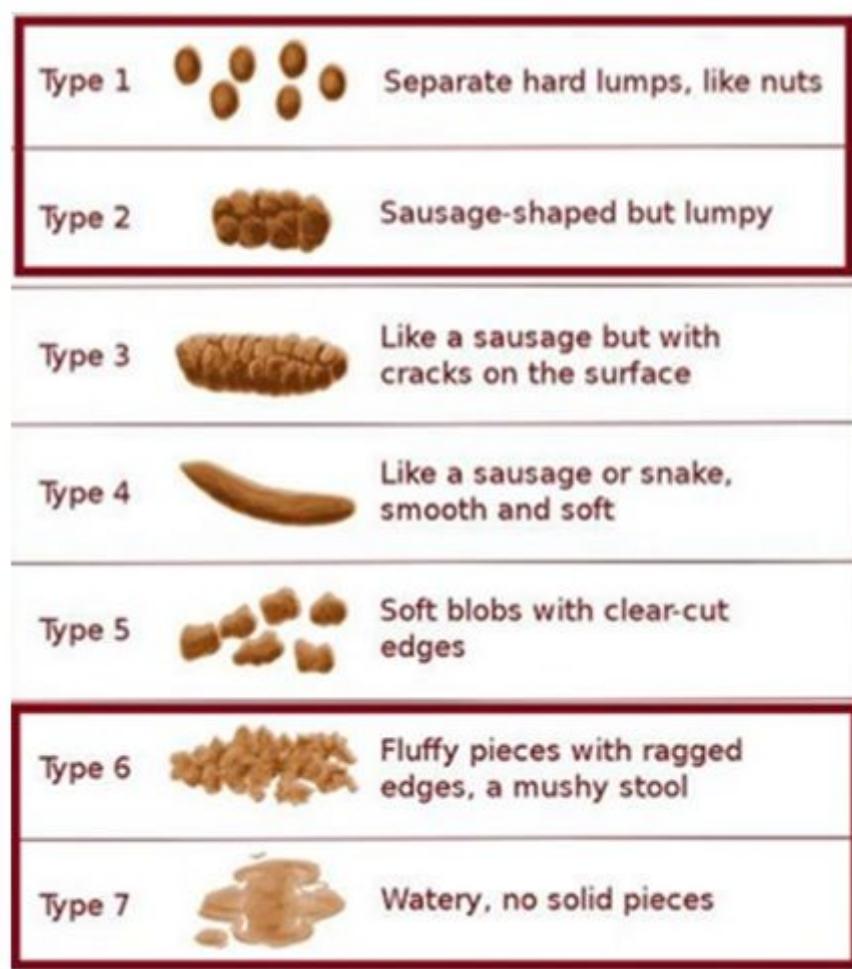


Figure 1

Bristol stool form scale