

## Observational Study

# Prevalence and factors associated with irritable bowel syndrome among university students in Lebanon: Findings from a cross-sectional study

Christy Costanian, Hala Tamim, Shafika Assaad

Christy Costanian, Hala Tamim, School of Kinesiology and Health Science, York University, Toronto, ON M3J1P3, Canada  
Shafika Assaad, Lebanese University, Faculty of Sciences, Beirut 961, Lebanon

**Author contributions:** Costanian C contributed towards study design, hypothesis conception, data analysis and interpretation, manuscript drafting and write-up; Tamim H contributed to the analysis, interpretation, drafting and write up of the paper; Assaad S contributed to hypothesis conception, study logistics, and data collection; all authors provided critical insight, and revisions to the manuscript; all authors read and approved the final version of the manuscript submitted for publication.

**Supported by** Pathophysiology Research Unit at the Lebanese University.

**Ethics approval:** The study was reviewed and approved by the Lebanese University Institutional Review Board.

**Informed consent:** All study participants, or their legal guardian, provided informed written consent prior to study enrollment.

**Conflict-of-interest:** The authors declare that they have no competing interests.

**Data sharing:** No additional data are available.

**Open-Access:** This article is an open-access article which was selected by an in-house editor and fully peer-reviewed by external reviewers. It is distributed in accordance with the Creative Commons Attribution Non Commercial (CC BY-NC 4.0) license, which permits others to distribute, remix, adapt, build upon this work non-commercially, and license their derivative works on different terms, provided the original work is properly cited and the use is non-commercial. See: <http://creativecommons.org/licenses/by-nc/4.0/>

**Correspondence to:** Christy Costanian, MSC, School of Kinesiology and Health Science, York University, 4700 Keele Street, Toronto, ON M3J1P3, Canada. [chc01@yorku.ca](mailto:chc01@yorku.ca)

Telephone: +1-416-7362100

Fax: +1-416-7365774

Received: October 9, 2014

Peer-review started: October 10, 2014

First decision: October 29, 2014

Revised: December 9, 2014

Accepted: January 8, 2015

Article in press: January 8, 2015

Published online: March 28, 2015

## Abstract

**AIM:** To describe the bowel habits and the prevalence of irritable bowel syndrome (IBS) and to investigate the influence of health behavior and social factors on IBS prevalence in university students.

**METHODS:** This cross-sectional study was conducted at five major universities in Greater Beirut and its suburbs, between February and June 2014. Using a convenience sample, a total of 813 students aged 18 years old and above participated in this study. Participants were asked to complete a comprehensive anonymous questionnaire which detailed characteristics on socio-demographic, health-related, and lifestyle factors, as well as IBS. The ROME III criteria were used as a tool to ascertain IBS. A  $\chi^2$  test was used to determine differences between categorical variables; stepwise logistic regression was used to measure the association between IBS and its risk factors.

**RESULTS:** An overall prevalence of IBS of 20% was recorded among university students. The bivariate analysis showed that females were significantly more likely to report having IBS than males (29.1% vs 18.2%,  $P < 0.01$ ). Those living at the school dormitory or in a private residence (39.5%) were more likely to have IBS than those living with their families (16.3%) ( $P < 0.01$ ). The multivariate analysis showed that those who had a relatively high family income level (US\$ > 2000) were almost 6 times more likely to report having

IBS than their counterparts.

**CONCLUSION:** This is the first study to describe the nature of IBS among young adults in Lebanon. The prevalence of IBS among university students in our sample was higher than that reported in the West.

**Key words:** Irritable bowel syndrome; Lebanon; Social factors; Prevalence; ROME III criteria

© **The Author(s) 2015.** Published by Baishideng Publishing Group Inc. All rights reserved.

**Core tip:** Irritable bowel syndrome (IBS) is an acknowledged functional gastrointestinal disorder of major public health concern. Little is known about IBS prevalence in Arab countries and specifically among university students, including Lebanon. Therefore, an epidemiological study, the first of its kind, investigating IBS among university students in Lebanon was conducted. The prevalence of IBS reported in this study was relatively high and similar to the estimate found in industrialized countries. The risk of having IBS, after adjusting for confounders was significantly higher among females than males, those aged 22 years or younger, among those who were living in a private house or in the school dormitory on their own, and among subjects with middle to high income levels. Findings of this study have important implications for IBS screening and management, as they highlight the importance of engaging in healthy behaviors to minimize IBS symptoms and enhance quality of life among IBS patients.

Costanian C, Tamim H, Assaad S. Prevalence and factors associated with irritable bowel syndrome among university students in Lebanon: Findings from a cross-sectional study. *World J Gastroenterol* 2015; 21(12): 3628-3635 Available from: URL: <http://www.wjgnet.com/1007-9327/full/v21/i12/3628.htm> DOI: <http://dx.doi.org/10.3748/wjg.v21.i12.3628>

## INTRODUCTION

Irritable bowel syndrome (IBS) is an acknowledged functional gastrointestinal disorder (FGID) that is associated with abdominal pain and bloating, along with other symptoms such as changes in bowel habits<sup>[1]</sup>. The worldwide prevalence of IBS ranges from 5.7% to 34%<sup>[2]</sup>, usually varying significantly between countries according to the diagnostic criteria used<sup>[3]</sup>. Various diagnostic tools have been employed for the detection of IBS, including the Manning criteria, Rome I criteria and Rome II criteria<sup>[2]</sup>. Currently, the Rome III criteria are the most common method for diagnosing IBS<sup>[4]</sup>. Based on the Rome III criteria, the prevalence of IBS has been estimated to range from 10% to 15% in Western countries, whereas that reported in Asian countries ranged from 1% to 10%<sup>[5]</sup>.

IBS is highly influenced by demographic factors, particularly sex and age. IBS is more prevalent in females than in males and has an onset between late teens to twenties, decreasing with age<sup>[6,7]</sup>. Women from developed countries are 2-4 times more likely to have IBS than men<sup>[7,8]</sup>. Furthermore, evidence suggests a genetic role in the etiology of IBS, with 33% of patients with IBS reporting a positive family history<sup>[6]</sup>. In addition to a genetic predisposition, IBS has also been linked to several dietary habits and to psychological factors such as stress and anxiety<sup>[5,6]</sup>. Although IBS is not a grave condition, it does however considerably reduce the quality of life of people afflicted with this syndrome. It interferes with their education, working ability and social life<sup>[9]</sup>. Moreover, IBS poses an economic burden to a country's health care system; the annual cost of diagnosing, treating and managing IBS in the United States being between \$1.7 and \$10 billion in direct costs (e.g., from office visits, medications), and up to \$20 billion in indirect costs (e.g., through work absenteeism and reduced productivity)<sup>[10]</sup>.

Most studies conducted in both developed and developing countries have focused on samples from adolescents and university students. For example, the prevalence of IBS was found to be 5.7% among Korean college students<sup>[11]</sup>. A study in China found that medical students had a higher risk of functional bowel disorders than science and engineering students<sup>[12]</sup>. Little is known about IBS prevalence in Arab countries and specifically among university students, including in Lebanon, a small middle-income country of the Middle East and North Africa (MENA) region. The sample population chosen is significant because of the lifestyle characteristics that this population experience. Not only are university students relatively restricted in terms of access to a variety of foods but are also exposed to a stress load that accompanies examinations and monetary limitations, thereby potentially exacerbating the onset of IBS symptoms. As a result, an epidemiological study investigating IBS among university students in Lebanon is warranted. Using the Rome III criteria to determine IBS, this study is the first to examine the prevalence and factors associated with IBS among a large sample of university students in Lebanon. The objectives of this study are: (1) to determine the prevalence of IBS among university students in Lebanon; and (2) to investigate the role of socioeconomic and behavioral factors on IBS prevalence in this group of individuals.

## MATERIALS AND METHODS

### *Study design, sample and procedures*

This study used a cross-sectional design and was conducted in the Spring semester (February 3-June 2) of the academic year 2013-2014 in Lebanon. According to the Central Administration of Statistics (2011) in

Lebanon, 180850 students were enrolled in higher education institutions in Lebanon during 2009-2010, of which 45.7% were males and 54.3% females. Of the 29 licensed universities in Lebanon, 72530 students (40.2%) were attending the Lebanese University vs 108037 (59.8%) attending private universities<sup>[13]</sup>. The study was conducted at five large universities located within the Greater Beirut area, which includes more than 50% of university students in Lebanon. Using a convenience sampling method, participants were recruited from four major private universities, the faculties of which were located in a single campus, and one public university, namely the Lebanese University. Four out of the five private universities approached consented to participate in the study; seven out of nine faculties approached at the Lebanese University, each with its own campus, agreed to participate.

Participants were recruited throughout the semester up until 2 wk prior to the final exam period. Flyers inviting participants to partake in this study were distributed in each of the campuses of the participating universities. To be included in the study, participants had to be between 18-29 years of age and enrolled as undergraduate students in one of the five universities. Students were excluded if they had a history of receiving medication for peptic ulcers or inflammatory bowel disease, such as ulcerative colitis or Crohn's disease. Students who were interested in participating in the study were invited to meet in a large classroom or an auditorium where they were informed about the purpose of the study and were invited to participate in the survey. Participation in the study was voluntary, and did not involve financial or any other compensation. After being screened for inclusion/exclusion criteria, students were then asked to complete a self-administered anonymous questionnaire. During this time, a research assistant was constantly present in the classroom to answer students' questions. The questionnaire required less than 15 minutes to be completed, and included items related to socio-demographic and behavioral characteristics as well as variables pertaining to diagnosis of IBS such as bowel habit and food hypersensitivity. Informed consent of the participants was obtained and all completed questionnaires were anonymous and confidential. Approval to conduct the present study was granted by the administrations of all participating universities. This research was reviewed and approved by the institutional review board at the Lebanese University.

### Data collection and measures

**Definition of IBS and other covariates:** Data on IBS was collected using a validated questionnaire with a reported sensitivity of 65%<sup>[14]</sup>: the Rome III criteria. These criteria consist of a standardized self-reported questionnaire, which has been developed by the Rome Foundation Board to identify FGIDs<sup>[15]</sup> and is widely

used. The clinical diagnostic criteria defines IBS as recurrent abdominal pain or discomfort for at least 3 d/mo during last 3 mo associated with at least two or more of the following features: (1) improvement after defecation; (2) onset associated with a change in frequency of bowel movement; and/or (3) onset associated with a change in form (appearance) of stools. The diagnosis of IBS can reasonably be made by using the Rome III criteria as long as the patient does not have red flag symptoms like fever, vomiting, rectal bleeding, weight loss, or other findings that may suggest other diagnoses. The classification of IBS subtypes was based on the predominant stool pattern. IBS with constipation (IBS-C) was defined as having hard or lumpy stools at least 25% of the time and loose (mushy) or watery stools in less than 25% of bowel movements. IBS with diarrhea (IBS-D) was defined as having loose (mushy) or watery stools at least 25% of the time and hard stools in less than 25% of bowel movements. Mixed IBS (IBS-M) was defined as having hard or lumpy stool at least 25% of bowel movements and loose (mushy) or watery stool in at least 25% of bowel movements. Un-subtyped or unknown IBS (IBS-U) was defined as an insufficient abnormality of stool consistency to meet the criteria of the other three subtypes.

Socio-demographic, individual and health behavior characteristics were also collected at baseline. These included: sex, age, living condition (at home vs away from home: with a family, in a private house or in the school dormitory), income (US\$ 500-1200; 1300-2000, > 2000), engaging in regular physical activity (yes, no), cigarette smoking (current, not current), and foods that triggered abdominal pain or diarrhea (yes, no; if yes, specify).

### Statistical analysis

All eligible questionnaires were coded. Descriptive analyses were performed to determine frequencies of categorical variables and the prevalence of IBS and its subtypes. A  $\chi^2$  test was used to determine differences in categorical variables to assess the association between IBS and socio-demographic and behavioral indicators. Multivariate logistic regression was also conducted to predict the independent relationship between each of the socio-demographic and behavioral characteristics as well as family history of IBS, and the risk of IBS. Adjusted odds ratios (ORs) and their 95% confidence intervals are reported. Statistical significance was defined as a *P* value < 0.05, and SPSS 18.0 software package was used for the analyses (IBM Corp., Armonk, NY, United States).

## RESULTS

A total of 1000 students were approached to participate in this study; analysis was restricted to 813 participants (325 male, 488 females for whom we

**Table 1** Prevalence of irritable bowel syndrome and its subtypes and contributory foodstuffs *n* (%)

Variable	With IBS <sup>1</sup> ( <i>n</i> = 163/813)
IBS	163 (20.0)
IBS subtypes	
IBS constipation	60 (36.8)
IBS diarrhea	25 (15.4)
IBS mixed	73 (44.8)
IBS unknown	5 (3.06)
Foods that trigger hypersensitivity <sup>2</sup>	
Yes <sup>3</sup>	34 (20.9)
No	129 (79.1)
Beans	8 (23.5)
Milk	4 (11.8)
Sweets	1 (2.94)
Fatty food (beef and fast foods)	4 (11.8)
Coffee	5 (14.7)
Carbonated beverages	1 (2.94)
Spicy foods	5 (14.7)
Fruits (banana, watermelon)	2 (5.88)
Vegetables (tomato)	2 (5.88)
Parsley	2 (5.88)

<sup>1</sup>Irritable bowel syndrome (IBS) was defined according to Rome III criteria as recurrent abdominal pain or discomfort for at least 3 d per month during the past 3 mo, associated with two or more of the following features: (1) improvement with defecation; (2) onset associated with a change in frequency of bowel movement; and/or (3) onset associated with a change in form (appearance) of stools; <sup>2</sup>In the form of abdominal pain or diarrhea; <sup>3</sup>Distribution of specific food categories among IBS cases (*n* = 34) triggering hypersensitivity.

had complete data on the primary outcome, IBS prevalence. No major differences between those with complete information on IBS prevalence and those with incomplete information existed. The mean age of the study sample was 22.7 years (standard deviation, 1.39 years) with a larger proportion of females than males (488 vs 325; 60% vs 40%). Table 1 details IBS prevalence, its subtypes, and the foods that triggered IBS symptoms among the cases. Of 813 participants, 163 fulfilled the Rome III criteria for a diagnosis of IBS, yielding a prevalence of 20.05% (95%CI: 18.95-21.15). Sixty respondents (36.8%) were classified as IBS-C and 25 (15.4%) as IBS-D. The majority (44.8%) of respondents were classified as IBS-M, while the remaining 3% of students fell into the IBS-U subgroup. Almost a quarter (20.9%) of IBS positive cases reported identifying foods that triggered diarrhea or abdominal pain.

Table 2 outlines the characteristics of the overall study population and of students with IBS as well as the results of the regression analysis. These associations remained statistically significant before and after adjustment. The risk of having IBS was significantly higher among females than males (OR = 0.40; 95%CI: 0.26-0.61), those aged ≤ 22 years (OR = 0.53; 95%CI: 0.35-0.79), and those who were living in a private house or school dormitory on their own compared to those who were living with their family (OR = 2.84; 95%CI: 1.94-4.16). The majority of participants had a relatively low to middle income level,

with IBS being significantly higher among subjects with higher income levels (OR = 5.72; 95%CI: 3.36-9.71). In contrast, students who performed regular physical activity had a 53% reduction in IBS prevalence compared to those who did not perform regular physical activity (95%CI: 0.35-0.79). Over 50% of students who reported having IBS were in the Faculty of Medical Sciences and had majors such as medicine, pharmacy, and dentistry, although this was not statistically significant. Furthermore, the majority of respondents with IBS did not report a family history of IBS.

## DISCUSSION

The prevalence of IBS reported in this study was relatively high at 20%. This is similar to the estimate found in industrialized countries (2%-19%)<sup>[5]</sup>. Almost a quarter of IBS cases reported identifying foods that triggered diarrhea or abdominal pain. The risk of having IBS was significantly higher among females than males, those aged 22 years or younger, and those who were living in a private house or school dormitory on their own, and among subjects with middle to high income levels, after adjustment for the effect of other covariates. This study also suggested that engaging in regular physical activity, was a protective factor for IBS. A positive family history of IBS, albeit non-significant, had a protective effect against having IBS.

While the 20% prevalence rate of IBS among university students in Lebanon is relatively higher than that found in Western countries, it is similar to that reported by other countries in the region. IBS affects about 10%-15% of adults in North America<sup>[14]</sup>. Consistent with the prevalence rate obtained in this study, a study conducted among medical students at the University of Western Ontario in Canada, found that the prevalence of IBS among preclinical and clerkship students was 19.1% and 22.0%, respectively<sup>[16]</sup>. However, in Asian countries a highly variable range of IBS prevalence has been observed (2.3%-34%)<sup>[11]</sup>. Studies in the MENA region are scarce and mostly restricted to special groups of students or among patients in hospital settings<sup>[3,17,18]</sup>. A study conducted among secondary school male students in Al-Jouf Province in Saudi Arabia showed a 9.2% prevalence of IBS<sup>[19]</sup>. Another study conducted among medical students and interns at the King Abdulaziz University in Jeddah, found a prevalence of 31.8% according to the Rome III criteria<sup>[18]</sup>, while Naeem and colleagues<sup>[20]</sup>, also using the Rome III criteria, reported a 28.3% prevalence of IBS among medical students in Karachi, Pakistan. Abdulmajeed *et al*<sup>[3]</sup> found a prevalence of 34.2% using the Rome II criteria in a study of 117 primary health care center attendees at Suez governorate in Egypt.

Less than a quarter of positive IBS cases reported having food hypersensitivity by identifying foods that triggered diarrhea or abdominal pain. Reported

**Table 2** Distribution of baseline socio-demographic and behavioral characteristics and factors associated with irritable bowel syndrome prevalence *n* (%)

Variable	Total ( <i>n</i> = 813)	With IBS ( <i>n</i> = 163)	<i>P</i> value	Unadjusted		Adjusted <sup>1</sup>	
				OR	95%CI	OR	95%CI
Sex							
Female	488 (60.0)	122 (25.0)	< 0.001	1.00		1.00	
Male	325 (40.0)	41 (12.6)		0.43 <sup>a</sup>	0.29-0.64	0.40 <sup>a</sup>	0.26-0.61
Age							
≤ 22 yr	539 (66.3)	118 (21.9)	0.039	1.00		1.00	
> 22 yr	274 (33.7)	45 (16.4)		0.7	0.48-1.02	0.53 <sup>a</sup>	0.35-0.79
Faculty							
Sciences and humanities	113 (13.9)	22 (19.5)	0.975	1.00		1.00	
Medical sciences <sup>2</sup>	431 (53.0)	89 (20.6)		0.98	0.53-1.85	0.80	0.45-1.42
Engineering	140 (17.2)	27 (19.3)		1.07	0.64-1.81	1.06	0.53-2.11
Business and economics	129 (15.9)	25 (19.4)		0.99	0.52-1.80	0.94	0.47-1.89
Living condition							
With family	517 (63.6)	75 (14.5)	< 0.001	1.00		1.00	
School dormitory or private house	296 (36.4)	88 (29.7)		2.49 <sup>a</sup>	1.76-3.54	2.84 <sup>a</sup>	1.94-4.16
Family income (US\$)							
500-1200	241 (29.6)	28 (11.6)	< 0.001	1.00		1.00	
1300-2000	369 (45.4)	64 (17.3)		1.60	0.99-2.57	1.86 <sup>a</sup>	1.13-3.06
> 2000	203 (25.0)	71 (35.0)		4.09 <sup>a</sup>	2.51-6.68	5.72 <sup>a</sup>	3.36-9.71
Cigarette smoking							
Not current	716 (88.1)	144 (20.1)	0.514	1.00		1.00	
Current	97 (11.9)	19 (19.6)		0.97	0.56-1.60	0.95	0.43-1.72
Regular physical activity							
No	474 (58.3)	113 (23.8)	0.001	1.00		1.00	
Yes	339 (41.7)	50 (14.7)		0.55 <sup>a</sup>	0.38-0.80	0.53 <sup>a</sup>	0.35-0.79
Family history of IBS							
No	754 (92.7)	154 (20.4)	0.401	1.00		1.00	
Yes	59 (7.3)	9 (15.3)		0.70	0.34-1.46	0.49	0.22-1.08

<sup>1</sup>Adjusted for all variables listed in the table; <sup>2</sup>Includes medicine, dentistry, pharmacy, public health, medical lab technology, and physiotherapy. <sup>a</sup>*P* < 0.05 vs control. OR: Odds ratio; CI: Confidence interval.

perceived triggers included carbohydrates and fatty foods, together with caffeine, alcohol and spices. To date, few studies have examined the dietary intakes of IBS patients to identify dietary changes or potential nutrient deficiencies<sup>[21]</sup>. This was consistent with findings from a cross-sectional study across a large sample of Iranian adults which found that women with high consumption of spicy foods had a 2-fold increased risk of developing IBS compared with women who reported not consuming any spicy foods<sup>[22]</sup>. On the other hand, the frequency of meals per day and frequency of flour intake were not associated with IBS, similar to findings reported by Ibrahim *et al*<sup>[18]</sup> among medical students in King Abdulaziz University in Jeddah. The results above underline the need for further studies to characterize potential relationships between diet-related practices and the risk of FGID, in order to design appropriate and effective diet-based interventions.

We found that the risk of having IBS was significantly greater among females than males. This finding is in concordance with the established association between female sex and IBS<sup>[23]</sup>. In fact, most studies conducted in Western countries showed that IBS affected women more than men<sup>[24]</sup>. A systematic review pooling the results of 80 studies showed that the prevalence of IBS was significantly higher for women than men (overall OR = 1.67); these

included 55 studies that mostly reported a positive association between IBS and female sex<sup>[25]</sup>. Similar results were also found in countries of the MENA region where a systematic review on the prevalence and risk factors of IBS in the Republic of Iran showed that more than half of the reviewed studies showed that the prevalence of IBS was significantly correlated with female sex<sup>[26]</sup>. However, the reason behind the sex difference in IBS prevalence remains uncertain. A possible explanation for this might lie in the differences in socio-cultural features such as health care seeking behavior between men and women or it may be due to actual biological differences. For example, although gastrointestinal symptom changes related to the menstrual cycle are common in women in general, those who have IBS are significantly more likely to report an exacerbation of bowel symptoms during menses<sup>[27]</sup>.

Interestingly, living arrangements or conditions were associated with IBS prevalence in our sample. The proportion of students with IBS who were living away from home was higher than that of students living at home. A possible explanation might lie in the fact that life away from home may have an influence on lifestyle behaviors including irregular dietary habits and poor stress management, thereby influencing the manifestation of IBS symptoms. This possibility was demonstrated by Mansour-Ghanaei *et al*<sup>[28]</sup> who

reported that Iranian students living at a distance from their families had significantly higher rates of IBS compared to others. The effect of stress as a major moderator in IBS development has been previously explored and established<sup>[29]</sup>, yet the exact mechanism of how psychological stress induces abdominal symptoms has not been elucidated, despite many studies reporting a bidirectional relationship between the central nervous system and the digestive tract<sup>[30]</sup>. Since stress and other psychological factors are associated with IBS, living away from home may act as a potential stressor, affecting the onset and severity of IBS among vulnerable students.

The role of a subject's socioeconomic status (SES) may also play a possible role in IBS development. Studies have demonstrated a link between affluent childhood SES and adult Manning criteria for IBS<sup>[31,32]</sup>. An association between a higher socioeconomic environment and IBS was also noted in our sample. A significant proportion of students who lived away from home, in a private apartment or house, had middle to high family income. Moreover, *post hoc* analysis showed that over 50% of IBS positive cases living away from home had middle to high family income. A possible explanation for this association lies in the "hygiene hypothesis" proposed by Gwee<sup>[33]</sup>. Children from a high social class are less likely to live in highly crowded environments and as a result, are less exposed to enteric pathogens at an early stage of life. These pathogens result in the development of immune tolerance by protecting against the development of post-infectious IBS through increased exposure to intestinal organisms leading to lower risk of adult IBS<sup>[33]</sup>.

Regarding behavioral risk factors, the results of the present study showed that IBS prevalence was higher among students who did not engage in physical exercise. These results are similar to those obtained by Kim *et al.*<sup>[34]</sup> who reported a higher prevalence of IBS among Korean university students who did not exercise. Similarly, Dong *et al.*<sup>[11]</sup> found that low exercise levels indicated a high risk of IBS among Chinese university students. Increased physical activity has been shown to improve IBS symptoms whereby physically active IBS patients have less symptom exacerbation compared with physically inactive patients<sup>[35]</sup>. Physical activity also has a well-known role in stress management; therefore, it is possible that patients with IBS who did not exercise might have been less able to cope with a stressful factor in their lives, be it personal or socioeconomic, in addition to the university experience being itself an additional stressor, thereby exacerbating IBS symptoms.

### Strengths

Despite the relatively high prevalence of IBS in Asia in general and in the Middle East in particular, few studies in the region have examined the prevalence in this

area. Therefore, this study is unique in its nature, as it is the first study in Lebanon to analyze the predictors of IBS among university students at the multivariate level. The sample size of the study was heterogeneous (private and public universities), and not restricted to one university, reflecting the socioeconomic diversity of all university students in Lebanon. Moreover, the ROME III criteria have been shown to be a reliable and valid tool to diagnose and obtain estimates of FGIDs based on symptoms for various gastrointestinal conditions<sup>[15]</sup>.

### Limitations

Findings from this study should be interpreted with consideration of some limitations. Data in the study were self-reported with no verification performed, incurring a possibility of information bias. Also, misclassification bias of the dependent variable might have occurred because of the use of self-completed questionnaires. However, because the questionnaires were anonymous, the likelihood of misclassification bias was minimized. Selection bias may have been possible since the sample was not random and may not be representative of the whole university student population in Lebanon, and so our results cannot be generalized to this target population. Moreover, given the exploratory nature of the study, certain confounders were not controlled for, possibly introducing some confounding bias. Finally, due to the cross-sectional nature of our data, we cannot infer causality from these findings.

In conclusion, IBS presents a major public health concern worldwide due to its negative impact on health-related quality of life and high health care expenditure. This is the first study to describe the nature of IBS among young adults in Lebanon. Our study found that the prevalence of IBS in a large population of Lebanese students was higher than rates reported in the West. This study showed that proportionately more women suffered from IBS than men and that social as well as health behavioral factors have significant influences on the presence and progression of IBS. As a result, multifaceted interventions should be considered when aiming to reduce symptoms of IBS such as dietary education, and encouragement to change lifestyles in order to control stress.

The findings of this study also have important implications for IBS screening and management, as they highlight the importance of engaging in healthy behaviors such as physical activity to minimize IBS symptoms and enhance quality of life. It is worthwhile to note that Lebanon has continuously been facing insecurity and political conflict. These factors are not present in countries where other studies have been conducted and such contextual factors are expected to have an adverse effect on physical and mental health and so any intervention that targets Lebanese youth should be tailored to suit the environment and barriers

found in this country. More studies are needed to fully explore the factors related to symptoms of FGIDs in Lebanon. Future studies that include objective measurement of dietary factors and habits, exercise and psychological factors are needed to add to the understanding of the scope and dimensions of IBS in this population.

## COMMENTS

### Background

Irritable bowel syndrome (IBS) is a significant public health issue and is considered to be prevalent in the general population, but no data on bowel habits and IBS among young adults exists in Lebanon.

### Research frontiers

The objective of this study was to describe the lifestyle and other factors associated with IBS prevalence among university students in Lebanon.

### Innovations and breakthroughs

This is the first published paper describing the nature of IBS among young adults in Lebanon. The prevalence of IBS among university students in our sample was higher than that reported in the West. This study shows that proportionately more women suffered from IBS than men and that lifestyle factors were significantly associated with IBS.

### Applications

Findings from this study have important implications for programs intended to improve academic performance, stress management and quality of life among students suffering from IBS.

### Peer-review

The manuscript investigates the nature of IBS among young adults in Lebanon. The topic of the paper is interesting and important.

## REFERENCES

- 1 **Miwa H.** Prevalence of irritable bowel syndrome in Japan: Internet survey using Rome III criteria. *Patient Prefer Adherence* 2008; **2**: 143-147 [PMID: 19920955]
- 2 **Shen L, Kong H, Hou X.** Prevalence of irritable bowel syndrome and its relationship with psychological stress status in Chinese university students. *J Gastroenterol Hepatol* 2009; **24**: 1885-1890 [PMID: 19780881 DOI: 10.1111/j.1440-1746.2009.05943.x]
- 3 **Abdulmajeed A, Rabab MA, Sliem HA, Hebatallah NE.** Pattern of irritable bowel syndrome and its impact on quality of life in primary health care center attendees, Suez governorate, Egypt. *Pan Afr Med J* 2011; **9**: 5 [PMID: 22145053]
- 4 **Thomaidis T, Goetz M, Gregor SP, Hoffman A, Kouroumalis E, Moehler M, Galle PR, Schwarting A, Kiesslich R.** Irritable bowel syndrome and organic diseases: a comparative analysis of esophageal motility. *World J Gastroenterol* 2013; **19**: 6408-6415 [PMID: 24151359 DOI: 10.3748/wjg.v19.i38.6408]
- 5 **Chang FY, Lu CL, Chen TS.** The current prevalence of irritable bowel syndrome in Asia. *J Neurogastroenterol Motil* 2010; **16**: 389-400 [PMID: 21103420 DOI: 10.5056/jnm.2010.16.4.389]
- 6 **Whitehead WE, Drossman DA.** Validation of symptom-based diagnostic criteria for irritable bowel syndrome: a critical review. *Am J Gastroenterol* 2010; **105**: 814-20; quiz 813, 821 [PMID: 20179688 DOI: 10.1038/ajg.2010.56]
- 7 **Choung RS, Locke GR.** Epidemiology of IBS. *Gastroenterol Clin North Am* 2011; **40**: 1-10 [PMID: 21333897 DOI: 10.1016/j.gtc.2010.12.006]
- 8 **Chang L, Heitkemper MM.** Gender differences in irritable bowel syndrome. *Gastroenterology* 2002; **123**: 1686-1701 [PMID: 12404243 DOI: 10.1053/gast.2002.36603]
- 9 **Gralnek IM, Hays RD, Kilbourne AM, Chang L, Mayer EA.** Racial differences in the impact of irritable bowel syndrome on health-related quality of life. *J Clin Gastroenterol* 2004; **38**: 782-789 [PMID: 15365405 DOI: 10.1097/01.mcg.0000140190.65405.fb]
- 10 **Nellesen D, Yee K, Chawla A, Lewis BE, Carson RT.** A systematic review of the economic and humanistic burden of illness in irritable bowel syndrome and chronic constipation. *J Manag Care Pharm* 2013; **19**: 755-764 [PMID: 24156644]
- 11 **Dong YY, Zuo XL, Li CQ, Yu YB, Zhao QJ, Li YQ.** Prevalence of irritable bowel syndrome in Chinese college and university students assessed using Rome III criteria. *World J Gastroenterol* 2010; **16**: 4221-4226 [PMID: 20806442 DOI: 10.3748/wjg.v16.i33.4221]
- 12 **Chu L, Zhou H, Lü B, Li M, Chen MY.** [An epidemiological study of functional bowel disorders in Zhejiang college students and its relationship with psychological factors]. *Zhonghua Nei Ke Zazhi* 2012; **51**: 429-432 [PMID: 22943750]
- 13 **Center for Educational research and development, Beirut, Lebanon.** [List of Universities in Lebanon, 2011]. Accessed September 08, 2014. Available from: URL: <http://www.crdp.org/>
- 14 **Saito YA, Schoenfeld P, Locke GR.** The epidemiology of irritable bowel syndrome in North America: a systematic review. *Am J Gastroenterol* 2002; **97**: 1910-1915 [PMID: 12190153 DOI: 10.1111/j.1572-0241.2002.05913.x]
- 15 **Drossman DA, Corazziari E, Delvaux M, Spiller RC, Talley NJ, Thompson WG, Whitehead WE, Editors.** Rome III: The Functional Gastrointestinal Disorders, Third Edition. McLean, VA: Degnon Associates, Inc., 2006
- 16 **Wells M, Roth L, McWilliam M, Thompson K, Chande N.** A cross-sectional study of the association between overnight call and irritable bowel syndrome in medical students. *Can J Gastroenterol* 2012; **26**: 281-284 [PMID: 22590702]
- 17 **Harfoushi K.** Women with irritable bowel syndrome according to Rome II criteria in Jordan. *Pakistan J Med Sci* 2008; **24**: 136
- 18 **Ibrahim NK, Battarjee WF, Almeahadi SA.** Prevalence and predictors of irritable bowel syndrome among medical students and interns in King Abdulaziz University, Jeddah. *Libyan J Med* 2013; **8**: 21287 [PMID: 24054184 DOI: 10.3402/ljm.v8i0.21287]
- 19 **Alhazmi AH.** Irritable bowel syndrome in secondary school male students in AlJouf Province, north of Saudi Arabia. *J Pak Med Assoc* 2011; **61**: 1111-1115 [PMID: 22125990]
- 20 **Naem SS, Siddiqui EU, Kazi AN, Memon AA, Khan ST, Ahmed B.** Prevalence and factors associated with irritable bowel syndrome among medical students of Karachi, Pakistan: a cross-sectional study. *BMC Res Notes* 2012; **5**: 255 [PMID: 22624886 DOI: 10.1186/1756-0500-5-255]
- 21 **Park HJ, Jarrett M, Heitkemper M.** Quality of life and sugar and fiber intake in women with irritable bowel syndrome. *West J Nurs Res* 2010; **32**: 218-232 [PMID: 20040735 DOI: 10.1177/0193945909349116]
- 22 **Esmailzadeh A, Keshteli AH, Hajishafiee M, Feizi A, Feinle-Bisset C, Adibi P.** Consumption of spicy foods and the prevalence of irritable bowel syndrome. *World J Gastroenterol* 2013; **19**: 6465-6471 [PMID: 24151366 DOI: 10.3748/wjg.v19.i38.6465]
- 23 **Tzouvala M.** Definition, epidemiology, natural history and diagnosis of IBS. *Annals Gastroenterol* 2002; **15**: 228-233
- 24 **Longstreth GF, Thompson WG, Chey WD, Houghton LA, Mearin F, Spiller RC.** Functional bowel disorders. *Gastroenterology* 2006; **130**: 1480-1491 [PMID: 16678561 DOI: 10.1053/j.gastro.2005.11.061]
- 25 **Lovell RM, Ford AC.** Global prevalence of and risk factors for irritable bowel syndrome: a meta-analysis. *Clin Gastroenterol Hepatol* 2012; **10**: 712-721.e4 [PMID: 22426087 DOI: 10.1016/j.cgh.2012.02.029]
- 26 **Jahangiri P, Jazi MS, Keshteli AH, Sadeghpour S, Amini E, Adibi P.** Irritable Bowel Syndrome in Iran: SEPAHAN Systematic Review No. 1. *Int J Prev Med* 2012; **3**: S1-S9 [PMID: 22826748]
- 27 **Lee OY, Mayer EA, Schmulson M, Chang L, Naliboff B.** Gender-related differences in IBS symptoms. *Am J Gastroenterol* 2001; **96**: 2184-2193 [PMID: 11467651 DOI: 10.1111/j.1572-0241.2001.03961.x]
- 28 **Mansour-Ghanaei F, Fallah MS, Heidarzadeh A, Jafarshad R, Joukar F, Ghasemipour R, Arami M, Keyhanian S, Keyhanian M.** Prevalence and characteristics of irritable bowel syndrome (IBS) among medical students of Gilan Northern Province of Iran. *Middle East J Dig Dis* 2011; **1**: 100-105

- 29 **van Tilburg MA**, Palsson OS, Whitehead WE. Which psychological factors exacerbate irritable bowel syndrome? Development of a comprehensive model. *J Psychosom Res* 2013; **74**: 486-492 [PMID: 23731745 DOI: 10.1016/j.jpsychores.2013.03.004]
- 30 **Jafri W**, Yakoob J, Jafri N, Islam M, Ali QM. Frequency of irritable bowel syndrome in college students. *J Ayub Med Coll Abbottabad* 2005; **17**: 9-11 [PMID: 16599025]
- 31 **Howell S**, Talley NJ, Quine S, Poulton R. The irritable bowel syndrome has origins in the childhood socioeconomic environment. *Am J Gastroenterol* 2004; **99**: 1572-1578 [PMID: 15307879 DOI: 10.1111/j.1572-0241.2004.40188.x]
- 32 **Chitkara DK**, van Tilburg MA, Blois-Martin N, Whitehead WE. Early life risk factors that contribute to irritable bowel syndrome in adults: a systematic review. *Am J Gastroenterol* 2008; **103**: 765-774; quiz 775 [PMID: 18177446 DOI: 10.1111/j.1572-0241.2007.01722.x]
- 33 **Gwee KA**. Irritable bowel syndrome in developing countries - a disorder of civilization or colonization? *Neurogastroenterol Motil* 2005; **17**: 317-324 [PMID: 15916618 DOI: 10.1111/j.1365-2982.2005.00627.x]
- 34 **Kim YJ**, Ban DJ. Prevalence of irritable bowel syndrome, influence of lifestyle factors and bowel habits in Korean college students. *Int J Nurs Stud* 2005; **42**: 247-254 [PMID: 15708012 DOI: 10.1016/j.ijnurstu.2004.06.015]
- 35 **Johannesson E**, Simrén M, Strid H, Bajor A, Sadik R. Physical activity improves symptoms in irritable bowel syndrome: a randomized controlled trial. *Am J Gastroenterol* 2011; **106**: 915-922 [PMID: 21206488 DOI: 10.1038/ajg.2010.480]

**P- Reviewer:** Guo YM, Rodrigo L **S- Editor:** Qi Y  
**L- Editor:** Cant MR **E- Editor:** Wang CH





Published by **Baishideng Publishing Group Inc**

8226 Regency Drive, Pleasanton, CA 94588, USA

Telephone: +1-925-223-8242

Fax: +1-925-223-8243

E-mail: [bpgoffice@wjgnet.com](mailto:bpgoffice@wjgnet.com)

Help Desk: <http://www.wjgnet.com/esps/helpdesk.aspx>

<http://www.wjgnet.com>



ISSN 1007-9327



9 771007 932045