

Epidemiological features of irritable bowel syndrome and its subtypes among Iranian adults

Ammar Hassanzadeh Keshteli^{a,b}, Babak Dehestani^a, Hamed Daghighzadeh^a, Peyman Adibi^a

Isfahan University of Medical Sciences, Isfahan, Iran; University of Alberta, Edmonton, Canada, USA

Abstract

Background The epidemiological features of irritable bowel syndrome (IBS) have not been properly investigated in Iran. Also, worldwide there is limited knowledge about the characteristics of IBS subtypes. The aim of the study was to explore the epidemiological features of IBS and its subtypes among Iranian adults.

Methods This is a cross-sectional study in Iranian adults living in Isfahan province. Demographic characteristics and common gastrointestinal symptoms were assessed using a self-administered modified Persian version of the Rome III questionnaire.

Results In 4763 subjects aged 19-70 years the overall prevalence of IBS was 21.5%. IBS was more prevalent in women than men (24.0 vs. 18.3%, $P < 0.001$). In multivariate analysis, being married was associated with 27% increased odds of IBS (95% confidence interval: 1.03-1.57, $P < 0.05$). However, IBS was not associated with age ($P = 0.71$) or educational attainment ($P = 0.61$). Constipation-predominant IBS (IBS-C) was the most prevalent subtype of IBS followed by mixed IBS (IBS-M), diarrhea-predominant IBS (IBS-D), and unsubtyped IBS. Female gender was associated with IBS-C while male gender was associated with IBS-D and IBS-M.

Conclusion IBS is highly prevalent among Iranian adults, affecting particularly women in whom IBS-C is the most prevalent subtype.

Keywords Irritable bowel syndrome, subtypes, prevalence, Iran

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Introduction

Irritable bowel syndrome (IBS) is a common functional gastrointestinal disorder (FGID), characterized by abdominal pain or discomfort and alteration in bowel habits [1]. Altered gastrointestinal motility, visceral hypersensitivity, post-infectious reactivity, brain-gut interactions, alteration in gut microbiota, food sensitivity, dietary intakes, and intestinal inflammation have been linked to the pathogenesis of IBS [2].

IBS affects as many as 5-20% of individuals worldwide. It is more prevalent in women than men, and is more commonly diagnosed in patients younger than 50 years of age [3].

IBS imposes a significant burden on patients and healthcare systems due to its prevalence and lack of successful treatments [4]. It is one of the most common outpatient diagnoses in primary care and gastroenterology [5]. In addition, it is associated with an increased number of unnecessary medical tests and procedures, including abdominal surgeries [6]. In-patient costs associated with IBS contribute significantly to the total healthcare bill [7]. The impact of socioeconomic status on IBS is controversial and warrants future studies [8].

A recent systematic review reported that the prevalence of IBS in Iran varies from 1.1 to 25% based on studies surveyed among different populations using various IBS definitions [9]. Most of the previous Iranian studies were conducted in much selected populations with small sample size. In addition, IBS subtypes were assessed only in few of them. Therefore, the present study was carried out to explore the epidemiological features of IBS and its subtypes in a large sample of Iranian adults.

^aIntegrative Functional Gastroenterology Research Center, Isfahan University of Medical Sciences, Isfahan, Iran (Ammar Hassanzadeh Keshteli, Babak Dehestani, Hamed Daghighzadeh, Peyman Adibi);

^bDepartment of Medicine, University of Alberta, Edmonton, Canada (Ammar Hassanzadeh Keshteli)

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Correspondence to: Prof. Peyman Adibi, Integrative Functional Gastroenterology Research Center, Isfahan University of Medical Sciences, Hezarjarib street, Isfahan, Iran, Tel.: +98 311 7923060, e-mail: adibi@med.mui.ac.ir

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Materials and methods

Study population

This cross-sectional study was carried out in April-May 2010 as a part of the Study on the Epidemiology of Psychological, Alimentary Health and Nutrition (SEPAHAN). SEPAHAN aimed to investigate the epidemiology of FGIDs and their relationship with different lifestyle and psychological factors. The study design, sample selection, characteristics of study participants and details on data collection methods are presented in detail elsewhere [10]. In summary, this study was performed among apparently healthy Iranian adults who were non-academic staff of Isfahan University of Medical Sciences (IUMS) working in 50 different health centers and administrative units in Isfahan province, central part of Iran. They were selected based on a non-random convenience sampling method. Academic staff, students and staff in most University hospitals were excluded from the study. To increase participation rate and accuracy of collected data, we decided to distribute the questionnaires in two “waves” with a short period between them (3-4 weeks). In the first phase of the project, validated self-administered questionnaires were used to capture demographic, medical, dietary and other lifestyle related factors. Assessment of gastrointestinal and psychological profile of subjects using validated self-administered questionnaires was the main focus of the project's second phase. In total, 8691 (response rate: 86.2%) and 6239 (response rate: 64.6%) participants returned completed questionnaires in the first and second phase of the project, respectively. Finally, we could match 4763 questionnaires in phase 2, with its equivalent questionnaire in phase 1. The Bioethics Committee of IUMS approved the study protocol.

Assessment of IBS

In SEPAHAN, assessment of various gastrointestinal symptoms was done using a validated self-administered Persian version of the Rome III questionnaire [11] after considering some minor modifications to the original Persian questionnaire. For instance, instead of using a seven-item rating scale to assess the frequency of common gastrointestinal symptoms (i.e. never, less than one day per month, one day per month, two to three days per month, one day per week, more than one day per week, every day) we applied a four-item rating scale (i.e. never or rarely, sometimes, often, always). Participants were also asked about the presence of each symptom in the previous three months and the questions about experiencing symptoms for 6 months or longer were deleted. In addition, severity of each symptom was assessed (mild, moderate, severe or very severe). To prepare the Persian version of the questionnaire, recommendation from the Rome Foundation has been followed similar to other investigators [12]. Face and content validity of the revised questionnaire was found to be acceptable.

According to Rome III criteria, IBS is defined as recurrent abdominal pain or discomfort at least 3 days per month in the

last 3 months associated with two or more of the following: 1) improvement with defecation; 2) onset associated with a change in frequency of stools; and 3) onset associated with a change in form (appearance of stool). Also, these criteria should be fulfilled for the last 3 months with symptom onset at least 6 months before diagnosis [13,14]. Based on the previously mentioned modifications in SEPAHAN's questionnaires, we defined IBS as recurrent abdominal pain or discomfort at least sometimes (about 25% of the time) in the previous 3 months associated with two or more of the following criteria: 1) improvement with defecation at least sometimes; 2) pain onset associated with a change in stool frequency; and 3) pain onset associated with a change in form (appearance) of stool at least sometimes. IBS was classified into four subtypes: constipation-predominant IBS (IBS-C) was defined as having IBS and both of the following 1) hard or lumpy stools at least sometimes, and 2) lack of loose, mushy or watery stools; diarrhea-predominant IBS (IBS-D) was defined as having IBS and both of the following 1) lack of hard or lumpy stools, and 2) loose, mushy or watery stools at least sometimes; mixed IBS (IBS-M) was defined as having IBS and both of the following 1) hard or lumpy stools at least sometimes, and 2) loose, mushy or watery stools at least sometimes; and unsubtyped IBS (IBS-U) was defined as having IBS and both of the following 1) lack of hard or lumpy stools, and 2) lack of loose, mushy or watery stools.

Other variables

Assessment of demographic variables including age, gender, educational level, and marital status was done by means of self-administered questionnaires.

Statistical analysis

Quantitative and qualitative variables were presented as mean \pm SD and number (percent, 95% confidence interval [CI] if necessary), respectively. To explore the association between IBS and qualitative demographic factors chi-square test was used as univariate analysis. A Student's *t* test was used to assess differences between quantitative variables across different groups. A binary logistic regression was used for the multivariate analysis to assess the association of IBS with different independent variables (gender, age categories, educational levels, and marital status). All statistical analyses were performed using SPSS version 16 (SPSS Corp., Chicago, IL, USA), and *P* value less than 0.05 was considered statistically significant.

Results

In total, 4763 individuals participated in this study. There were 2657 (55.8%) women and 2106 (44.2%) men (Table 1). Their mean age was 36.58 \pm 8.09 (range: 19-70) years. Women

Table 1 Frequency of irritable bowel syndrome and its subtypes across categories of demographic characteristics among Iranian adults

	IBS subtypes (%)					
	Total n (%)	IBS n (%)	IBS-C n (%)	IBS-D N (%)	IBS-M n (%)	IBS-U N (%)
Gender						
Female	2657 (55.8)	638 (24.0) ¹	252 (9.5) ¹	111 (4.2)	95 (3.6)	180 (6.8) ²
Male	2106 (44.2)	386 (18.3)	96 (4.6)	96 (4.6)	98 (4.7)	96 (4.6)
Age groups						
≤30 years	890 (21.5)	188 (20.6)	67 (7.3)	37 (3.8)	34 (3.3)	50 (6.1)
31-40 years	1984 (47.8)	456 (23.6)	160 (8.3)	87 (4.6)	87 (4.8)	122 (5.9)
41-50 years	1066 (25.7)	220 (20.6)	66 (6.2)	47 (4.4)	44 (4.1)	63 (5.9)
>50 years	207 (5)	39 (18.8)	14 (6.8)	7 (3.4)	9 (4.3)	9 (4.3)
Educational level						
Less than high school diploma	638 (13.8)	143 (22.4)	51 (8.0)	28 (4.4)	23 (3.6)	41 (6.4)
High school diploma	1348 (29.1)	297 (22.0)	89 (6.6)	60 (4.5)	71 (5.3)	77 (5.7)
Above diploma but less than bachelor's degree	801 (17.3)	166 (20.7)	59 (7.4)	32 (4.0)	21 (2.6)	54 (6.7)
Bachelor's degree	1537 (33.2)	326 (21.2)	120 (7.8)	61 (4.0)	64 (4.2)	81 (5.3)
Master's degree or above	312 (6.7)	65 (20.8)	22 (7.1)	21 (6.7)	7 (2.2)	15 (4.8)
Marital status						
Single/divorced or widowed	874 (18.8)	169 (19.3)	66 (7.6)	31 (3.5)	34 (3.9)	38 (4.3) ³
Married	3776 (81.2)	838 (22.2)	274 (7.3)	174 (4.6)	156 (4.1)	234 (6.2)

¹Chi square P value<0.001, ²Chi square P value<0.01, ³Chi square P value<0.05, IBS, irritable bowel syndrome; IBS-C, constipation-predominant IBS; IBS-D, diarrhea-predominant IBS; IBS-M, mixed IBS; IBS-U, unsubtyped IBS

were younger than men (35.16±7.39 vs. 38.59±8.61 years, P<0.001). Fifty-seven percent of participants had educational level above high school diploma. Women were more educated than men so that while the minimum educational level was a bachelor's degree in 47.1% of women, 36.7% of men had a bachelor's degree or more than that (P<0.001). The frequency of being married was more in men than women (88.1 vs. 75.7%, P<0.001).

The prevalence of IBS in the study population was 21.5% (95% CI: 20.3-22.7%). The prevalence in women and men was 24.0 (95% CI: 22.3-25.7%) and 18.3% (95% CI: 16.7-20.0%), respectively (Odds ratio [OR]: 1.41, 95% CI: 1.22-1.62). Mean age of individuals with or without IBS was comparable (36.27±7.80 vs. 36.66±8.17 years, P=0.2). Although married individuals had a slightly increased odds ratio of IBS than non-married ones (OR: 1.19, 95% CI: 0.99-1.43), the difference was not statistically significant (P=0.07) (Table 1). In multivariate analysis, IBS prevalence was significantly associated with female gender (OR: 1.49, 95% CI: 1.27-1.76, P<0.001) and being married (OR: 1.27, 95% CI: 1.03-1.57, P<0.05). IBS prevalence was not associated with age (P=0.71) (based on age categories) and educational attainment (P=0.61) either in univariate or multivariate analysis.

The prevalence of IBS subtypes across different categories of demographic characteristics is presented in Table 1. The prevalence of IBS-C, IBS-D, IBS-M, and IBS-U among the 4763 participants was 7.3, 4.3, 4.1, and 5.8%, respectively. In multivariate analysis, marital status was not associated with any

IBS subtypes except for IBS-U, in which married individuals were more likely to have IBS-U than those not married (OR:1.45, 95% CI: 1.02-2.07). Age and educational attainment were not related to the prevalence of IBS subtypes. Frequency of IBS subtypes in men and women with IBS is shown in Fig. 1. IBS subtypes were distributed equally in men. In comparison to men, women with IBS were more likely to have IBS-C (OR: 2.1, 95% CI: 1.5-2.9). However, women with IBS were less likely to have IBS-D (OR: 0.6, 95% CI: 0.4-0.9) or IBS-M (OR: 0.5, 95% CI: 0.3-0.7) compared with men.

Discussion

In the present study, we showed a considerably high prevalence of IBS among Iranian adults. IBS-C was the most prevalent IBS subtype while IBS-M was the least common subtype of IBS in our study. According to multivariate analysis, female gender and being married were associated with increased prevalence of IBS. This is among the few studies that have precisely assessed epidemiology of IBS and its subtypes in a large sample of Iranians.

As indicated in this study, one fifth of the study population was found to have IBS, being one of the highest rates reported in Iran. In previous studies in Iran, IBS prevalence was reported to vary from 1.1 to 21.9%. Khoshkrood-Mansoori *et al* estimated the prevalence of IBS in four cities of Tehran province using

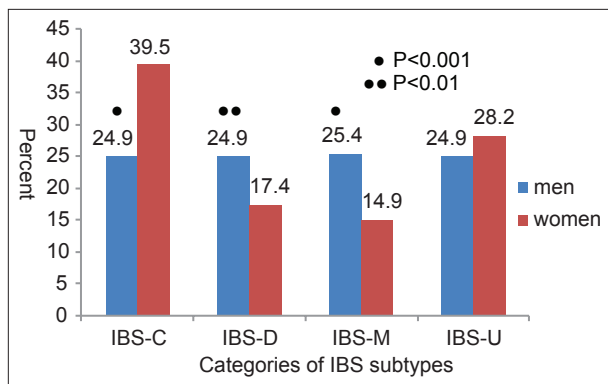


Figure 1 Frequency of different irritable bowel syndrome (IBS) subtypes in men and women with IBS. Among IBS cases, while IBS-C was more prevalent in women than men, IBS-D and IBS-M were more frequent in men than women

IBS-D, diarrhea predominant IBS; IBS-M, mixed IBS; IBS-U, unsubtyped IBS

Rome III criteria and found it to be as low as 1.1% [15]. However, the prevalence of IBS among a large sample of Iranian adults referring to an outpatient gastrointestinal clinic was reported to be 21.9% [16]. So far, the epidemiology of IBS in the Middle East has not been studied widely. The prevalence of IBS in Pakistan was reported to be 13% in a low-income inner city area in Karachi, Pakistan [17]. Another study from Pakistan estimated IBS prevalence to be 28% among medical students [18]. In Suez, Egypt, the prevalence of IBS was estimated to be 34% among adults using Rome II criteria [19]. IBS prevalence was found to be 10% in Southeastern Anatolia, Turkey using Rome II criteria [20]. About 32% of medical students in Saudi Arabia were indicated to have IBS [21]. IBS has a prevalence of 5-6% in Chinese population [22]. A population-based study indicated IBS prevalence to be 16% in central Mexico [23]. Most estimates based on population-based studies place the IBS prevalence rate as between 10-15% in North America [2]. IBS is reported by more than 20% of adults in New Zealand [24]. A survey of 42000 Europeans found the overall prevalence of IBS across Europe to be 11.5% with prevalence rates ranging from 6.2-12% by the eight studied countries [25]. A recent web-based survey among the general Danish population aged 18-50 years estimated its prevalence to be 16% [26]. Another recent study among Swedish adults reported that IBS was prevalent at 26% and 15% of the participants using Abdominal Symptom Questionnaire and Rome III criteria, respectively [27]. The difference in socio-demographic characteristics of study populations as well as using different diagnostic tools to determine the presence of IBS are the main reasons of discrepancy in the prevalence of IBS in various studies.

In the present study, the prevalence of IBS in women and men was 24 and 18.3%, respectively. Based on multivariate analysis results, women were 50% more likely than men to have IBS. It is suggested that FGIDs are more common in women than men. A recent well-designed systematic review of 55 studies containing 162243 subjects showed that the pooled prevalence of IBS was higher in women than men (14.0 vs.

8.9%; OR: 1.7, 95% CI: 1.5-1.8). However, IBS prevalence was not higher in women than men in South Asian, South American, or African studies [28]. Although the reason why IBS is more prevalent in women is as yet not well understood, sex hormones and psychological factors may play a role [29].

In the present study, IBS-C and IBS-M were the most and least prevalent subtypes of IBS in the study population, respectively. There was a gender-related difference in the distribution of IBS subtypes so that in men, each IBS subtype accounted for 25% of IBS cases. However, in women, IBS-C was the most prevalent subtype (40%) and IBS-M was the least prevalent one (15%). In addition, while IBS-D accounted for 24.9% of IBS cases in men, it was found in 17.4% of women with IBS. A systematic review of population-based studies reported the pooled prevalence of IBS-C in women with to be 40% compared with 21.3% in men with IBS (OR: 2.4, 95% CI: 1.5-3.9) [29]. Similar to the results of the current study, female gender was found to be related to decreased odds ratio of IBS-D compared with men (OR: 0.5, 95% CI: 0.3-0.7). Although, in the systematic review of population-based studies, the prevalence of IBS-M was not different in men and women (25.0 vs. 25.8%, respectively) we found a higher prevalence of IBS-M in men than women (25.4 vs. 14.9%, respectively). However, it should be noted that in most previous studies the prevalence of IBS-U was not investigated. According to a recent meta-analysis, in studies that also reported the prevalence of IBS-U, the prevalence of IBS according to each of the four subtypes was more evenly distributed [8]. The pooled prevalence of IBS-U in those studies was 22.2% (95% CI: 6.7-43.3%).

We did not find any significant association between age and IBS prevalence, in agreement with previous studies [17,20,26,30,31]. In the meta-analysis of cross-sectional studies among adults, IBS prevalence appeared to decline modestly with increasing age, although the differences observed were not statistically significant. However, the odds ratio of IBS was 25% lower in those aged 50 years or older, compared with those aged younger than 50 [8].

No relationship was found between educational level and prevalence of IBS in the current study. The association between education and IBS is a controversial issue. While Lee *et al* indicated tertiary education to be associated with increased IBS prevalence among ethnic Malays [32], IBS was associated with few years of education in Pakistan [17], China [31], and Turkey [33]. Similar to our findings, IBS was not related to the educational level among Chinese [30], Iranian [34], and Korean [35] adults.

Married individuals were found to be 27% more likely to have IBS in the present study, which is in agreement with previous studies in Korea [35], Pakistan [17], and Turkey [20]. However, marital status was not related to IBS in other studies [34,36]. Also, Andrews *et al* showed a lower prevalence of IBS in married individuals in US [37]. Moreover, Lee *et al* found that married people especially females had a higher prevalence of functional dyspepsia [38]. The relationship between marital status and IBS prevalence has not been studied widely and requires further investigation.

Summary Box

What is already known:

- Irritable bowel syndrome (IBS) is a common functional gastrointestinal disorder, characterized by abdominal pain or discomfort and alteration in bowel habits
- IBS affects as many as 5-20% of individuals worldwide
- Prevalence of IBS in Iran varies from 1.1 to 25% based on studies surveyed among different populations using various IBS definitions

What the new findings are:

- Overall prevalence of IBS was 21.5% in our current study
- Constipation-predominant IBS (IBS-C) was the most prevalent subtype of IBS followed by mixed IBS (IBS-M), diarrhea-predominant IBS (IBS-D), and unsubtyped IBS in Iran
- Female gender was associated with IBS-C while male gender was associated with increased rates of IBS-D and IBS-M

Our study has some limitations. It was a symptom-based investigation and no clinical evaluation was done in order to rule out structural conditions. Another potential limitation of this study is selection bias; we studied a sample of non-academic staff of a medical university. The sampled population might be at higher risk of FGIDs and the estimated prevalence of different FGIDs including IBS cannot be extrapolated to the Iranian adult population. However, the large sample size allowed us to categorize participants into different groups based on demographic variables and to calculate OR adjusted for major confounders. The other major limitation of this study is its cross-sectional nature, which hinders exploring causal relationships. Besides, our relatively young studied population (mean age 36.5 years) was another pivotal limitation because this might have biased the high prevalence of IBS reported in the current study.

In conclusion, we found that IBS was highly prevalent in this sample of Iranian adults. Female gender and being married were associated with an increased prevalence of IBS. IBS-C was found to be to most frequent subtype, followed by IBS-M, IBS-D, and IBS-U. Due to the high prevalence of IBS in the studied sample of Iranians, its risk factors, underlying pathophysiological mechanisms, and natural history should be investigated in future studies. And last but not least, pinpointing different subtypes of IBS in further investigations may help establish more targeted treatments and improve quality of life of IBS patients.

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