A study of sociodemographic factors and anxiety: depressive disorders among irritable bowel syndrome patients

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Received 17 October 2016
Accepted 3 November 2016

Egyptian Journal of Psychiatry
2017, 38:97–104

Background
Irritable bowel syndrome (IBS) is a highly prevalent functional gastrointestinal disorder. Psychiatric disorders are common among IBS patients and it differs among different cultures. This study was carried out to assess sociodemographic variables and determine the magnitude of anxiety–depressive disorders among IBS patients for proper management.

Patients and methods
In a cross-sectional study, 73 IBS patients were diagnosed (using the criteria of Rome III) from among 400 serial patents attending the gastroenterology clinic at Islamic University Medical Centre (IUMC), Al-Medina Almounawarrha, KSA, in the period from January to December 2015 and were assessed for sociodemographic variables and anxiety–depressive disorders by psychometric tests, the Arabic version of 'Taylor Manifest Anxiety Scale' and 'Beck Depression Inventory Scale', compared with 73 non-IBS patients.

Results
Of 400 patients who participated in this study, 73 (18.25%) were diagnosed with IBS and 327 (81.75%) were non-IBS patients. In terms of sociodemographic data, IBS patients were matched with non-IBS patients for age, race (different races from different countries), and living condition. Female sex was predominant as regard sex, family history of IBS, emotional stress and traveler's diarrhea with statistically significant difference. These variables were statistically significant in our study. In terms of lifestyle factors, both groups were matched for smoking and caffeine intake, but IBS patients experienced food hypersensitivity with a tendency to have normal body weight, and to have poor physical exercise and poor quality of sleep with a statistically significant difference compared with the non-IBS patients. For psychometric tests, 46 (63%) out of 73 patients were diagnosed with anxiety–depressive disorders; 16 (22%) had pure anxiety disorders, 18 (24.6%) had depressive disorders, and 12 (26.4%) had comorbid anxiety–depressive disorders.

Conclusion
The high prevalence of anxiety–depressive disorders among IBS patients led us to perform a psychiatric assessment as an important part of the management plan for IBS patients.

Keywords:
anxiety, depression, irritable bowel syndrome

Egypt J Psychiatr 38:97–104

1110-1105

Introduction

Irritable bowel syndrome (IBS) is a highly prevalent functional gastrointestinal disorder, with a high health burden and economic expenditure, characterized by chronic abdominal pain accompanied by altered bowel habits (Doshi *et al.*, 2014a, 2014b; Stasi *et al.*, 2014; Lee *et al.*, 2016). IBS is a painful condition associated with significant psychological distress and psychiatric comorbidities, such as higher levels of anxiety or depression and suicidal ideation, with a negative impact on quality of life (Canavan *et al.*, 2014; Stasi *et al.*, 2014). Its consequences are measured in direct costs (medical treatment and procedures) and indirect costs (reduced productivity) (Doshi *et al.*, 2014a, 2014b). Rome III diagnostic criteria are the current gold standard for the diagnosis of IBS patients. According to these criteria, IBS is defined as recurrent abdominal pain or discomfort at least 3 days/month in the last 3 months (with symptom onset at least 6 months before diagnosis) associated with two or more of the following: (a) improvement with defecation, (b) onset associated with a change in the frequency of stool, and (c) onset associated with a change in the form (appearance) of stool. IBS can be subtyped into categories on the basis of the main bowel habit: IBS with constipation (IBS-C),

 DOI: 10.4103/1110-1105.209680

IBS with diarrhea (IBS-D), mixed IBS (IBS-M), and unsubtyped IBS (IBS-US) (Longstreth *et al.*, 2006). Depending on the diagnostic criteria used (Manning, Rome I, Rome II, and Rome III), IBS is estimated to affect ~11% of the global population. A recent meta-analysis shows the lowest occurrence in South Asia (7%) and the highest occurrence in South America (21%) (Lovell and Ford, 2012). IBS is reported more frequently by women than men in Western countries, the female–male odds ratio being 2 : 1, and seems to be more common in individuals between 20 and 40 years of age. On the basis of the different symptoms observed, the researchers speculated that sex hormones may alter the regulatory mechanisms of the brain–gut–micro biota axis involved in the pathophysiology of IBS (Mulak *et al.*, 2014).

To date, the etiology of IBS remains unclear, without confirmed known causes. However, multiple factors have been considered such as dysregulation of the brain–gut axis, hypothalamic–pituitary–adrenal axis, altered gastrointestinal motility, visceral hypersensitivity, infectious factors, enhanced immunological reactivity, genetic susceptibility, and psychosocial factors (Posserud *et al.*, 2004; Barbara *et al.*, 2011). Stress often worsens the symptoms of patients with IBS. Hyperactivation of the hypothalamic–pituitary–adrenal axis may be involved in IBS pathophysiology (Dinan *et al.*, 2006). Over the past several years, considerable research has evaluated the relationship between IBS and psychiatric disorders. Rates of comorbidity with psychiatric disorders range from 54 to 94% in treatment-seeking patients with IBS (Whitehead *et al.*, 2002; Roy-Byrne *et al.*, 2008).

IBS symptoms seem to be influenced by anxiety and mood disorders (Surdea-Blaga *et al.*, 2012). They may contribute toward predisposition, precipitation, and maintenance of IBS symptoms, and they also influence the clinical outcome (Canavan *et al.*, 2014). One study examined the relationship between IBS and generalized anxiety disorder among IBS patients and healthy individuals and found that 32% of patients with IBS presented with generalized anxiety disorder symptoms compared with other psychological manifestations (Mayer *et al.*, 2001). Also, depression is one of the most diagnosed psychiatric disturbances in IBS patients (Singh *et al.*, 2012). Psychiatric interventions (pharmacologic or psychotherapy) have been proven to be effective in the management of IBS patients' functioning. Selective serotonin reuptake inhibitors used for anxiety disorders and/or depression can improve the outcome of patients with IBS and associated psychiatric disorders, particularly for the constipation-predominant IBS form (Vaiopoulou *et al.*, 2014).

Aim of the study

This study was carried out to assess sociodemographic variables and determine the magnitude of anxiety–depressive disorders among IBS patients for proper IBS management.

Patients and methods

A cross-sectional study was carried on 73 consecutively diagnosed IBS patients (using Rome III criteria) (Longstreth *et al.*, 2006; NICE, 2008) from among 400 attendants of the gastroenterology and general medicine clinics at Islamic University Medical Centre, Al-Medina Almounawarrha, Kingdom of Saudi Arabia in the period from January to December 2015.

Inclusion criteria

(1) Age: 20–50 years old.
(2) Fulfilling Rome III criteria.
(3) Willing to enroll in the research.

Exclusion criteria

(1) Those older than 50 years of age with recent onset of symptoms (less than 6 months), including a change in bowel habit or those with any red-flag criteria.
(2) Those with coexisting diseases (e.g. intestinal para sites, malignancy, diabetes mellitus cardiovascular, pulmonary, hepatic, or renal disorder).
(3) Those with a family history of colorectal cancer.
(4) Language barrier.

The study was carried out on approval from the Ethics Committee and after obtaining written consents from patients. According to Rome III criteria, IBS patients were categorized into four groups as follows: constipation-predominant IBS (IBS-C), diarrhea-predominant IBS (IBS-D), mixed-IBS (IBS-M), and nonspecified IBS.

IBS patients were subjected to further evaluations including the following:

Full assessment of history

(1) Personal and sociodemographic data, such as age, sex (both men and women), and race (Islamic University including different races).
(2) Family history of IBS.

(3) *Red-flag items*: Referring to the guidelines for IBS recommended by the American Gastroenterological Association, seven red-flag items are used to distinguish organic intestinal disease from IBS: drastic weight loss, a history of organic bowel disease, a history of digestive surgery, blood in stool, awakening because of abdominal pain during the night, anemia, fever, or arthralgia.
(4) *Lifestyle*: Number of sleeping hours, smoking habit, exercise, and so on.
(5) Food Frequency Questionnaire inquiring about the frequency of use of different food items such as milk, yogurt, low-fat food, fish, and so on.
(6) Traveler's diarrhea and whether its presence triggered the first onset of IBS.
(7) Emotional stress in the 6-month period preceding the study: loss of a family member, close friend, and so on.

Clinical examinations (to exclude)

(1) Temperature (fever).
(2) Complexion (pallor or jaundice).
(3) Body weight (significant weight loss).
(4) Abdominal examination (scar of a previous operation, palpable abdominal mass, and examination of the preanal region and rectum in those with rectal bleeding, with possible local pathology including colitis, hemorrhoids, or rectal cancer to be excluded).

Laboratory investigations

(1) Stool analysis: to exclude intestinal parasites and stool occult blood.
(2) Full blood count: ordered in all older patients at first presentation and those with recent onset of symptoms.
(3) Erythrocyte sedimentation rate and C-reactive protein in all those with recent onset of IBS-D.
(4) Endomysial or tissue transglutaminase antibodies especially in IBS-D students from areas of high incidence of celiac disease such as the UK to be excluded.

As there is no identifiable organic cause for IBS, there is a lack of specific diagnostic markers; guideline development groups [for NICE Clinical and The British Society of Gastroenterology's IBS guidance (Piller *et al.*, 2007; NICE, 2008)] suggest that a positive diagnosis of IBS may generally be made in primary care on the basis of the patient's symptoms, a lack of alarm features, and minimal laboratory tests (e.g. a full blood count and tests to exclude inflammation and celiac disease).

Study tools

Rome III criteria (criteria fulfilled for the past 3 months with symptom onset at least 6 months before diagnosis) (Longstreth *et al.*, 2006; NICE, 2008)

IBS diagnosis was made on the basis of the English version of 'Rome III criteria'. Rome III criteria can rationally diagnose IBS in the absence of red flag symptoms. Rome III criteria in the absence of red flag symptoms have a sensitivity of 65%, a specificity of 100%, a positive predictive value of 100%, and a negative predictive value of 76% (NICE, 2008).

Rome III diagnostic criteria for irritable bowel syndrome:

Recurrent abdominal pain or 'discomfort' ('discomfort' means an uncomfortable sensation not described as pain) at least 3 days a month in the past 3 months, associated with two or more of the following:

(1) Improvement with defecation.
(2) Onset associated with a change in the frequency of stool.
(3) Onset associated with a change in the form (appearance) of stool.

Psychiatric assessment

Judgment on the psychiatric state of the studied IBS patients was carried out using the Arabic version of 'Taylor Manifest Anxiety Scale' and 'Beck Depression Inventory (BDI) Scale'.

The 'Taylor Manifest Anxiety Scale', often shortened to 'TMAS', is a test of anxiety as a personality trait and was created by Janet Taylor in 1953 to identify patients who would be useful in the study of anxiety disorders (Taylor, 1953). The TMAS originally consisted of 50 true or false questions that a patient answered by reflecting on themselves to determine their anxiety level. Janet Taylor spent her career in the field of psychology studying anxiety and sex development (O'connor *et al.*, 1956). Her scale has often been used to differentiate normal participants from those considered to have pathological anxiety levels. The TMAS has been shown to have high test–retest reliability.

The 'BDI Scale', created by Aaron T. Beck, is a 21-question multiple-choice self-report inventory, one of the most widely used psychometric tests to measure the severity of depression. Its development marked a shift among mental health professionals, who had, until then, viewed depression from a psychodynamic

perspective, instead of considering it as being rooted in the patient's own thoughts. The original BDI, first published in 1961 (Beck *et al.*, 1961), consisted of 21 questions on how the patient has been feeling in the last week. Each question has a set of at least four possible responses differing in intensity. The test was also shown to have a high 1-week test–retest reliability (Pearson r=0.93), suggesting that it was not overly sensitive to daily variations in mood (Beck *et al.*, 1996a, 1996b). The test also has high internal consistency (α=0.91) (Beck *et al.*, 1996a, 1996b).

Definitions of psychiatric state assessment of the IBS patients:

(1) *Normal*: Patients with a Taylor Manifest Anxiety score below 16 and BDI score below 10.
(2) *Depression*: Patients with BDI scores of 10 or more.
(3) *Anxiety*: Patients with Taylor Manifest Anxiety scores of 16 or more.
(4) *Comorbid*: Having both anxiety and depression criteria simultaneously.

IBS patients with (2), (3), and (4) were assessed through psychiatric interviews for appropriate treatment.

Statistical analysis

We used descriptive tools for prevalence analysis, χ^2-test for comparing qualitative variables. P-values less than 0.05 were considered statistically significant.

Results

Of 400 patients who participated in this study, 73 (18.25%) were diagnosed with IBS and 327 (81.75%) were non-IBS patients. The mean age of the IBS patients was 32.9±26.8 years and 57.5% of the patients were between 20 and 29 years old. IBS was more common among women, 60.3%, with a statistically significant difference. IBS was common among Saudi people (38.4%), married individuals (50.7%) and university students (53.4%) with good income in 74%. There was a positive family history of IBS, emotional stress, and traveler's diarrhea preceding the onset of IBS in 82.2, 54.8, and 65.8% of patients, respectively, with a statistically significant difference (Table 1).

In terms of the lifestyle factors among IBS patients, 63% had normal BMI, 64.4% had poor physical exercise, 56.2% had poor sleep quality, and 71.2% had food hypersensitivity; all showed a statistically significant difference, whereas no statistical association was found between smoking, consumption of caffeine, and IBS (Table 2).

Psychometric tests showed that 46 IBS patients (63%) had psychiatric problems, 18 IBS patients (24.6%) had depression, 16 IBS patients (22%) had anxiety and comorbid depression, and 12 IBS patients (16.4%) had anxiety, with no statistically significant difference (Table 3).

Table 1 Sociodemographic factors among irritable bowel syndromeS

	IBS (n=73) (18.25%) [n (%)]	Non-IBS (n=327) (81.75%) [n (%)]	χ^2-Test	
			P	χ^2
Age (mean±SD) (years)		32.9±26.8		
20–29	42 (57.5)	177 (54.1)	0.318	0.853
30–39	19 (26)	89 (27.2)		
40–50	12 (16.4)	61 (18.7)		
Sex				
Male	29 (39.7)	213 (65.1)	16.126	<0.001*
Female	44 (60.3)	114 (34.9)		
Race				
Arabian	23 (31.5)	115 (35.2)	3.262	0.660
Saudi	28 (38.4)	143 (43.7)		
African	9 (12.3)	25 (7.6)		
White	5 (6.8)	16 (4.9)		
Asian	5 (6.8)	20 (6.1)		
European	3 (4.1)	8 (2.4)		
Marital status				
Single	31 (42.5)	108 (33)	8.981	0.011*
Married	37 (50.7)	213 (65.1)		
Separated	5 (6.8)	6 (1.8)		
Level of education				
University student	39 (53.4)	159 (48.6)	6.971	0.031*
Less than university	20 (27.4)	134 (41)		
University or above	14 (19.2)	34 (10.4)		
Living condition				
With family (home)	33 (45.2)	181 (55.4)	4.944	0.084
Rented residence	15 (20.5)	74 (22.6)		
University campus	25 (34.2)	72 (22)		
Income				
Enough and exceeds	13 (17.8)	66 (20.2)	10.171	0.006*
Enough	41 (56.2)	223 (68.2)		
Not enough	19 (26)	38 (11.6)		
Family history of IBS				
Yes	60 (82.2)	51 (15.6)	132.008	<0.001*
No	13 (17.8)	276 (84.4)		
Emotional stress				
Yes	48 (65.8)	173 (52.9)	3.984	0.046*
No	25 (34.2)	154 (47.1)		
Traveler's diarrhea				
Yes	40 (54.8)	53 (16.2)	49.795	<0.001*
No	33 (45.2)	274 (83.8)		

IBS, irritable bowel syndrome. *Level of significance.

Table 2 Lifestyle factors among irritable bowel syndrome

	IBS (n=73) [n (%)]	Non-IBS (n=327) [n (%)]	c2-Test	
			P	c2
BMI				
Normal	46 (63)	97 (29.7)	30.471	<0.001*
Overweight	16 (21.9)	144 (44)		
Obese	9 (12.3)	81 (24.8)		
Morbidly obese	2 (2.7)	5 (1.5)		
Yes	26 (35.6)	40 (12.2)	23.685	<0.001*
No	47 (64.4)	287 (87.8)		
Smoking				
Yes	17 (23.3)	54 (16.5)	1.876	0.171
No	56 (76.7)	273 (83.5)		
Yes	54 (74)	258 (78.9)	0.844	0.358
No	19 (26)	69 (21.1)		
Yes	52 (71.2)	9 (2.8)	216.539	<0.001*
No	21 (28.8)	318 (97.2)		
Poor	41 (56.2)	11 (15.1)	26.882	<0.001*
Good	32 (43.8)	62 (84.9)		

IBS, irritable bowel syndrome. *Level of significance.

In terms of IBS symptom subtypes, IBS-C was the most frequent subtype among IBS patients (49.3%). There were no statistically significant differences between all symptom subgroups in terms of age, sex, race, and psychometric tests ($P>0.05$) (Table 4).

Discussion

The present study showed that the prevalence of IBS among attendants of internal medicine and gastroenterology clinics at Islamic University, Al-Medina Almounawarrha (KSA) was 18.25%, which is considered a moderate prevalence of IBS. A recent meta-analysis showed the lowest occurrence in South Asia (7%) and the highest occurrence in South America (21%) (Lovell and Ford, 2012). Such differences may be attributed to the type of target population, ethnic variations between target populations, and work load.

Our findings showed that women had a higher prevalence; the difference was statistically significant. This is similar to the results of many studies (Hungin *et al.*, 2003; Abdulmajeed *et al.*, 2011; Okami *et al.*, 2011). Results of a systematic review from Iran (Jahangiri *et al.*, 2012), showed that more than half of the reviewed studies reported that the prevalence of IBS had statistically a significant correlation with female sex.

Our results found that age, nationality, and living condition were not associated with IBS, which is in agreement with the results of the study in Jeddah (Ibrahim *et al.*, 2013).

Table 3 Psychometric tests among irritable bowel syndrome patients and age-matched, sex-matched, and race-matched nonirritable bowel syndrome controls

	IBS (*n*=73) [*n* (%)]	Non-IBS control (*n*=73) [*n* (%)]	χ^2-Test	
			P	χ^2
Normal	27 (37)	56 (76.7)	23.482	<0.001*
Depression	18 (24.6)	6		
Mild	8 (44.4)	4 (66.7)	2.159	0.540
Moderate	5 (27.8)	2 (33.3)		
Severe	4 (22.2)	0 (0)		
Very severe	1 (5.6)	0 (0)		
Anxiety	16 (22)	9		
Mild	8 (50)	5 (55.6)	0.614	0.893
Moderate	5 (31.3)	3 (33.3)		
Severe	2 (12.5)	1 (11.1)		
Very severe	1 (6.3)	0 (0)		
Comorbid	12 (16.4)	2 (2.7)	7.900	0.005*

IBS, irritable bowel syndrome. *Level of significance.

There was an association between poor physical exercise and IBS in the current study. The results from a recent systematic review of 16 studies carried out among medical students showed that some studies found protective effects of physical activities, whereas other studies did not find such an association (Ibrahim, 2016).

The current results do not show any association between smoking and IBS. This is in line with the results of Chirila *et al.* (2012) from Romania. Similarly, our study showed that there is no significant association between IBS and caffeine.

Our findings indicated the presence of a statistical association between the prevalence of IBS and food hypersensitivity. This result is in agreement with the results from Jeddah (Ibrahim *et al.*, 2013), and many studies in a systematic review (Ibrahim, 2016), and with results from Italy (Carroccio *et al.*, 2011). In the current study, the majority of IBS patients (82.2%) had a family history of IBS with a statistically significant difference. This is similar to the findings of Saito *et al.* (2010) from the USA and the results of many studies on medical students described in a systematic review (Ibrahim, 2016). Similarly, another review published in 2016 reported the presence of an inherited component in IBS, which was confirmed in twin and family studies (Henstrom and D'Amato, 2016).

Studies have reported that IBS is associated with emotional and psychological stress (Savas *et al.*, 2009; Naeem *et al.*, 2012). In the present study, emotional stress was evident in 65.8% of IBS patients. Al-Turki *et al.* (2011) found that the presence of psychological stress was much higher

Table 4 Irritable bowel syndrome subtypes

	IBS-C (36, 49.3%) [*n* (%)]	IBS-D (10, 13.7%)		IBS-M (20, 27.4%) [*n* (%)]	IBS-US (7, 9.6%) [*n* (%)]	χ^2-Test	
		P	χ^2			*P*	χ^2
Age (mean±SD) (years)				32.9±26.8			
18–29	19 (52.8)	7	70%	11 (55)	5 (71.4)	3.167	0.788
30–39	12 (33.3)	1	10%	5 (25)	1 (14.3)		
40–50	5 (13.9)	2	20%	4 (20)	1 (14.3)		
Sex							
Male	16 (44.4)	4	40%	7 (35)	3 (42.9)	0.488	0.922
Female	20 (55.6)	6	60%	13 (65)	4 (57.1)		
Race							
Arabian	10 (27.8)	4	40%	8 (40)	1 (14.3)	15.111	0.443
Saudi	12 (33.3)	6	60%	7 (35)	3 (42.9)		
African	4 (11.1)	0	0%	4 (20)	0 (0)		
White	4 (11.1)	0	0%	0 (0)	1 (14.3)		
Asian	4 (11.1)	0	0%	0 (0)	1 (14.3)		
European	2 (5.6)	0	0%	1 (5)	1 (14.3)		
Psychometric							
Normal	15 (41.7)	4	40%	4 (20)	4 (57.1)	4.074	0.254
Depression	12 (33.3)	1		4	1		
Mild	6 (50)	1	100%	2 (66.7)	1 (100)	2.621	0.977
Moderate	3 (25)	0	0%	1 (33.3)	0 (0)		
Severe	2 (16.7)	0	0%	0 (0)	0 (0)		
Very severe	1 (8.3)	0	0%	0 (0)	0 (0)		
Anxiety	5 (13.9)	4		5	2		
Mild	3 (60)	2	50%	3 (60)	1 (100)	0.833	0.991
Moderate	1 (20)	1	25%	1 (20)	0 (0)		
Severe	1 (20)	1	25%	1 (20)	0 (0)		
Very severe	0 (0)	0	0%	0 (0)	0 (0)		
Comorbid	4 (11.1)	1	10%	7 (35)	0 (0)	7.439	0.059

IBS, irritable bowel syndrome; IBS-C, IBS with constipation; IBS-D, IBS with diarrhea; IBS-M, mixed IBS; IBS-US, unsubtyped IBS.

among students who had IBS in King Saud University, Riyadh, Saudi Arabia. Psychosocial stress and psychopathology are increased in functional disorders, but not in all individuals, and is generally considered to be a cause rather than the consequence of functional disorders (Barsky and Borus, 1999).

In the current study, 54.8% of IBS patients had a history of traveler's diarrhea with a statistically significant difference. Recent studies have suggested that patients who experience an episode of infectious diarrhea may develop new IBS at a relatively high rate (Park *et al.*, 2005).

Poor sleep quality in the current study was present in 56.2% of IBS patients compared with non-IBS patients, with a statistically significant difference. Poor sleep may be a hazardous stress issue that can influence gastrointestinal function, cognition, emotion, and somatic reaction. It may disrupt the biological rhythm and hence alter gut motility (Ibrahim, 2016). This is in agreement with the results of many other studies (Ibrahim *et al.*, 2013; Ibrahim, 2016). Similarly, another study carried out among healthy nurses in Singapore founded that poor sleep quality could affect bowel functions even in healthy individuals (Gwee, 2011).

Studies with an adequate number of patients and a standardized psychiatric interview indicated that 50–60% of IBS patients in gastroenterology clinics have psychiatric disorders. The proportion is similar to patients entering treatment trials for IBS symptoms (Carroccio *et al.*, 2011). In this study, the prevalence of anxiety–depressive disorders in IBS patients was 63%: depression was present in 24.6%, anxiety was present in 22%, and comorbid depression–anxiety disorder was present in 16.4%, with no statistically significant difference. American studies have found that anxiety disorders were highly prevalent in IBS outpatients (39.7–52.4%) (Blanchard *et al.*, 2001). This discrepancy may be related to the research methodology, study population, measuring tools, sampling, and sample sizes, which may influence the outputs of surveys. The high prevalence of anxiety and depression in the local general population (20.8 and 21%, respectively) (Noorbala *et al.*, 2004) must be considered an important factor in the higher

prevalence of these diseases in the IBS patients studied. IBS patients with anxiety disorder or depression had more severe symptoms and poor health outcomes (Thijssen *et al.*, 2010).

Conclusion

This study found a high prevalence (18.25%) of IBS among attendants of internal medicine and gastroenterology clinics in Islamic University in Al-Medina, KSA. Female sex, family history of IBS, presence of emotional stress, traveler's diarrhea, and poor sleep quality were evident in IBS patients. Because of the high prevalence of anxiety–depressive disorders among IBS patients, psychiatric assessments should be performed as an important part of the management plan for IBS patients.

Recommendations

Psychological assessment should be recommended in patients with functional bowel disorders. The screening of patients for anxiety and depression can be performed easily through a patient questionnaire and this is the basis of and justification for additional therapeutic interventions, which have been shown to be effective in improving gastrointestinal symptom severity and quality of life of IBS patients.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

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