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Effect of Psychological Stress during the COVID-19 on Patients with Irritable Bowel Syndrome in Saudi Arabia

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Abstract

This study aims to assess the impact of psychological stress during the COVID-19 pandemic on patients with irritable bowel syndrome in the Saudi Arabia. We used an online questionnaire survey shared on social media to collect data. The cross-sectional study was conducted in Saudi Arabia from 1 June 2020 to 31 August 2020. Inclusion criteria were Saudi citizens aged 18 years and above. The exclusion criteria were Saudi citizens under 18 years. The data were analyzed using the SPSS program. The study included 413 participants; 53.3% of participants were affected by IBS. Severe levels of stress, anxiety, and depression were reported in 10.4%, 11.1%, and 8.4% of participants, respectively. There was a significant association between stress level and IBS symptoms based on Rome IV criteria, including frequent abdominal pain (P <0.000) more than 3 bowel movements per day (P <0.025), and less than 3 bowel movements per week (P <0.001). Anxiety level showed a significant association (P <0.000) between the last IBS symptoms, in addition to abnormal stool appearance. A significant association was also reported between depression level and frequent abdominal pain and abdominal bloating (P <0.000). The relationship between IBS medications and other factors that influence IBS symptom development was also considered. The COVID-19 pandemic has affected the psychological state of many individuals, which has led to the triggering of symptoms in IBS patients. Attending to healthy habits and lifestyle, in addition to emotional and psychological support, may decrease the occurrence of IBS symptoms.

Keywords: IBS, COVID-19, Pandemic, DASS-21

Introduction

Irritable bowel syndrome (IBS) is a functional gastrointestinal disorder (FGID), characterized by a group of symptoms that affect the digestive system chronically, resulting in the reduction of life quality. IBS manifestations include abdominal pain, bloating, as well as alternating diarrhea and constipation (Saha, 2014). These symptoms are collectively known as the Rome IV criteria for IBS diagnosis. The worldwide prevalence of IBS is estimated to be 12% (Lacy & Patel, 2017). In another study, published in 2019, the authors found that 22.9% of the Saudi population is affected by IBS (Zacharakis & Nikolaidis, 2019). Psychological stress has an impact on the triggering of bowel distress, and evidence from clinical studies has revealed that psychological stress is strongly correlated with the development of IBS symptoms. Managing stress is an important factor for patients with IBS. Psychological stress can affect intestinal sensitivity, motility, and excretion of the colon, in turn affecting the central and peripheral nervous system (Qin *et al.*, 2014). The goal of comprehensive treatment in irritable bowel syndrome (IBS) patients should be the improvement of symptoms and life quality. There are many effective treatment options in the symptomatic management of IBS. The choice of treatment should be based on the predominant symptoms of each patient.

Coronavirus disease 2019 (COVID-19) was declared as a pandemic by the World Health Organization on March 11; the outbreak originated in China and it caused an international health crisis (Alduhisa & Demayo, 2019; Algahtani, 2020; Hanawi *et al.*, 2020). The virus appears to be easily transmitted among people with close contact—within 6 feet, or 2 meters. Although most people who were affected by COVID-19 have mild to moderate symptoms, the disease can cause severe medical complications and even death in individuals with previous chronic disease. As such, several countries enforced lockdown and household quarantine to control the outbreak (Qin *et al.*, 2014). Public health emergencies, such as COVID-19, can affect people mentally; they may cause stress, sadness, frustration, and feelings of guilt about the inability to accomplish normal work. Our study aims to assess the impact of psychological stress during the COVID-19 pandemic on patients with irritable bowel syndrome in Saudi Arabia.

Materials and Methods

The cross-sectional study was based on a questionnaire distributed among different groups in Saudi Arabia from 1 June 2020 to 31 August 2020. Ethical approval granted by The

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Biomedical Research Ethics Committee, Ministry of Higher Education, King Abdulaziz University, Faculty of Medicine (Reference Number 642-20). The survey was composed of questions to obtain demographic data from participants; we asked the participants about their nationality, age, gender, and education level, in addition to other several questions related to the study. Our study was built on around 548 people in Saudi Arabia. The questionnaire survey was shared on social media. Volunteers who agreed to participate were asked to review and sign a consent form. All participants' data were handled confidentially.

Sampling Design

Data collection for this observational study was conducted by an online questionnaire survey. **Inclusion criteria** are Saudi citizens aged 18 years and above. **Exclusion criteria** are Saudi citizens under 18 years.

Validity and Reliability

In terms of reliability, Cronbach's alpha coefficient was used to measure the internal consistency of the measurement scale DASS-21 scores, using SPSS; the internal consistency of the items in the scale was α=0.940.

Statistical Analysis

The data were analyzed using the Statistical Package for the Social Sciences (SPSS) program. A p-value < 0.05 was considered for significant difference.

Results and Discussion

A survey was taken by 413 participants. The web-based questionnaire was divided into three sections, the first of which was aimed at obtaining demographic data shown in **(Table 1)**. The number of female respondents was greater than (n = 351) the number of male respondents (n = 62). The great bulk of Saudi participants (n = 394) represented the majority of the population, whereas fewer participants (n =19) were of different nationalities. The percentage of the participants from the age group 18-29 reached 54.2%, 45.3% were from the age group 30-63, and only 0.5% were ≥64. Participants who were diagnosed with irritable bowel syndrome in the study represented 53.3% and 46.7% of participants were shown to be healthy. We also asked the participants whether they were diagnosed with a mental illness before, only n = 6 answered "yes," whereas n = 407 answered "no." The number of participants who were affected by COVID-19 was only n = 2.

The second section of the questionnaire was based on the Depression Anxiety Stress Scale-21 (DASS-21) as shown in **(Table 2)** Our results in respect to depression level showed that n = 47 were extremely severely depressed during the outbreak of COVID-19, n = 35 were severe, n = 73 were moderate, n = 32 were mild, and n = 192 were normal. Concerning anxiety level, n = 39 were suffering from extremely severe anxiety, n = 46 with severe anxiety, n = 73 with mild anxiety, and finally, n=223 were normal. With regards to stress levels, n = 8 were extremely stressed, n = 43 were suffering from severe stress, n = 44 were moderate, n = 53 were mildly stressed, and finally, n = 265 individuals did not suffer from any stress during the quarantine.

The third section of the questionnaire was to evaluate the frequency of irritable bowel syndrome flares and the management of symptoms during quarantine enforcement in patients with IBS. The evaluation was based on Depression Anxiety Stress Scales-21 (DASS-21) and Rome IV criteria for the diagnosis of IBS. The overall prevalence of IBS was 53.3% (n = 220), with a higher prevalence among females (45.27%, n = 187) **(Table 1).** Our results showed a significant correlation between flare frequency of IBS symptoms and psychological distress, as shown in **(Table 3)**. A significant difference between frequent abdominal pain and stress level was found (P = 0.000). Moreover, a significant difference (P = 0.025) with bowel movements that were more than 3 per day, (P = 0.001) with bowel movements that were fewer than 3 per week, and no significant difference was found between abnormal stool appearance and stress level (P = 0.145). Nevertheless, a statistical difference of P = 0.001 was found between abdominal bloating and stress level.

Table 1. Socio-demographic characteristics of the respondents.

	Number	Percentage (%)
Total	413	100%
Gender		
Male	62	15%
Female	351	85%
Age		
18-29	224	54.2%
30-41	118	28.6%
42-51	49	11.9%
52-63	20	4.8%
≥ 64	2	0.5%
Nationality		
Saudi	394	95.4%
Non-Saudi	19	4.6%
COVID-19		
Yes	2	.5%0
No	411	99.5%
IBS		
Yes	220	53.3%
No	193	46.7%
Mental Illness		
Yes	6	1.5%
No	407	98.5%

Table 2. DASS-21 score.

Psychological State	Number	Percentage (%)
Stress Level		
Normal	265	64.2%
Mild	53	12.8%
Moderate	44	10.7%
Sever	43	10.4%
Extremely Severe	8	1.9%
Anxiety Level		
Normal	223	54%
Mild	32	7.7%

Moderate	73	17.7%
Sever	46	11.1%
Extremely Severe	39	9.4%
Depression Level		
Normal	192	46.5%
Mild	66	16%
Moderate	73	17.7%
Sever	35	8.5%
Extremely Severe	47	11.4%
Total	413	100%

Regarding anxiety level and IBS symptoms, a statistical difference of $P = 0.000$ was found.

Concerning depression level and IBS flares, a significant association was found ($P = 0.00$) between frequent abdominal pain and abdominal bloating, and $P = 0.007$ between depression and bowel movements that were fewer than 3 per week, $P = 0.022$ for abnormal stool appearance, and, finally, $P = 0.026$ between depression and bowel movement that was more than 3 per day.

We asked the participants whether they used any of the following medications to relieve IBS symptoms during the quarantine: antidiarrheals, anti-constipation, antispasmodics, fiber supplements, probiotics, or any other medications. We found a significant association between psychological distress in IBS patients and medication used to relieve symptoms as shown in **(Tables 4 and 5)**, in terms of frequent abdominal pain, anti-constipation ($P = 0.001$), and ($P = 0.000$) of anti-spasmodic, ($P = 0.031$) of antacid, ($P = 0.008$) of probiotics, and, finally, ($P = 0.000$) of other medication used to relieve their symptoms.

In terms of bowel movements that were more than 3 per day, the only variable significantly associated was the use of antispasmodics ($P = 0.001$).

Regarding bowel movements that were fewer than 3 per week, a significant association was found with the use of anti-constipation medication ($P = 0.009$), and of antispasmodics ($P = 0.004$), in addition to other medication used to relieve IBS symptoms ($P = 0.002$).

In patients with abnormal stool appearance, a significant association was found between the usage of all medications except for anti-foaming. In Patients with abdominal bloating, we found a significant association between IBS symptoms and all medications, except for anti-diarrheal and anti-constipation medications, as no correlations were found.

We asked the participants about other factors associated with the development of IBS symptoms during the outbreak of COVID-19, such as smoking, eating habits, or a particular diet they followed to prevent or relieve IBS symptoms. As data shown in **(Table 6)**, we found a significant correlation between Low-FODMAP diet and frequent abdominal pain ($P = 0.013$), and abdominal bloating ($P = 0.006$); concerning the change in eating habits during the quarantine, we found a significant correlation with frequent abdominal pain ($P = 0.045$).

Table 3. Correlation between irritable bowel syndrome symptoms and psychological stress.

	Frequent Abdominal Pain				**Movement Per Day**			**Movement Per Week**			**Abnormal Stool**			**Abdominal Bloating**			**Did not Suffer from Any Symptoms**		
	Yes	No	Sometime	**P-value**	**Yes**	**No**	**P-value**	**Yes**	**No**	**P-value**	**Yes**	**No**	**P-value**	**Yes**	**No**	**P-value**	**Yes**	**No**	**P-value**
Stress																			
Normal	59	121	85		55	210		37	228		48	217		115	150		109	156	
Mild	25	11	17		14	39		18	35		15	38		32	21		11	42	
Moderate	23	4	17	**.000**	14	30	**.025**	15	29	**.001**	14	30	.145	29	15	**.001**	9	35	**.000**
Sever	24	7	12		17	26		8	35		11	32		30	13		5	38	
Extremely Sever	6	1	1		4	4		2	6		1	7		5	3		0	8	
Anxiety																			
Normal	40	117	66		33	190		27	196		27	196		85	138		109	114	
Mild	15	6	11		10	22		10	22		7	25		15	17		9	23	
Moderate	32	11	30	**.000**	29	44	**.000**	16	57	**.001**	24	49	**.000**	56	17	**.000**	8	65	**.000**
Sever	26	6	14		14	32		16	30		20	26		25	21		6	40	
Extremely Severe	24	4	11		18	21		11	28		11	28		30	9		2	37	
Depression																			
Normal	45	92	55		36	156		24	168		32	160		82	110		87	105	
Mild	19	24	23		16	50		16	50		11	55		26	40		22	44	
Moderate	27	18	28	**.000**	22	51	**.026**	15	58	**.007**	19	54	**.022**	48	25	**.000**	14	59	**.000**
Sever	17	3	15		12	23		9	26		13	22		24	11		5	30	
Extremely Severe	29	7	11		18	29		16	31		14	33		31	16		6	41	

Table 4. Demonstrate the relationship between IBS medications that are commonly used among IBS patients and IBS symptoms based on the Roma IV criteria.

	Anti-diarrhea			**Anti- constipation**			**Anti-spasmodic**			**Antacid**			**Anti-foaming**		
	Yes	**No**	**P-value**	**Yes**	**No**	**P-value**	**Yes**	**No**	**P-value**	**Yes**	**No**	**P-value**	**Yes**	**No**	**P-value**
Frequent Abdominal Pain															
Yes	4	133		15	122		59	78		9	128		**3**	**134**	
No	2	142	.677	5	139	**.001**	16	128	**.000**	1	143	**.031**	1	143	.439
Sometimes	3	129		2	130		32	100		5	127		1	131	
Movement Per Day															
Yes	4	100	.178	8	96	.214	40	64	**.001**	7	97	.051	**1**	**103**	.788
No	5	304		14	295		67	242		8	301		4	305	
Movement Per Week															
Yes	2	78	.827	9	71	**.009**	31	49	**.004**	3	77	.950	**2**	**78**	.240
No	7	326		13	320		76	257		12	321		3	330	
Abnormal Stool															
Yes	6	83	**.001**	11	78	**.001**	42	47	**.000**	7	82	**.016**	**2**	**87**	.313
No	3	321		11	313		65	259		8	316		3	321	
Abdominal Bloating															
Yes	6	205	.345	14	197	.226	78	133	**.000**	12	199	**.023**	**5**	**206**	**.028**
No	3	199		8	194		29	173		3	199		0	202	

Additionally, we asked the participants several questions about their psychological state during the pandemic and how many times they experienced flares as follows: In general, did fear and anxiety due to the outbreak of COVID-19 affect your IBS symptoms negatively? About 94 of the participants answered "yes," and n = 26 said that one or more of their family members were diagnosed with COVID-19. Additionally, we asked the participants whether they were worried that a member of their family may get affected by the coronavirus; n = 284 of our sample answered "yes." Regarding mental illness, 1.5% of participants said that they had been diagnosed with a mental illness before the pandemic.

Table 5. Demonstrate the relationship between IBS complementary medications that are commonly used among IBS patients and IBS symptoms base on the Roma IV criteria.

	Fiber supplement			**Probiotic**			**Other for IBS**			**None for IBS**		
	Yes	**No**	**P-value**	**Yes**	**No**	**P-value**	**Yes**	**No**	**P-value**	**Yes**	**No**	**P-value**
Frequent Abdominal Pain												
Yes	10	127		11	126		39	98		56	81	
No	3	141	.067	1	143	**.008**	10	134	**.000**	119	25	**.000**
Sometimes	4	128		5	127		25	107		83	49	
Movement Per Day												
Yes	7	97	.121	5	99	.682	25	79	.060	52	52	**.002**
No	10	299		12	297		49	260		206	103	
Movement Per Week												
Yes	5	75	.285	4	76	.658	24	56	**.002**	34	46	**.000**
No	12	321		13	320		50	283		224	109	
Abnormal Stool												
Yes	8	81	**.009**	9	80	**.001**	28	61	**.000**	32	57	**.000**
No	9	315		8	316		46	278		226	98	
Abdominal Bloating												

Yes	14	197	**.008**	14	197	**.008**	56	155	**.000**	101	110	**.000**
No	3	199		3	199		18	184		157	45	

Table 6. Factors associated with the development of IBS symptoms.

	Frequent Abdominal Pain				**Movement Per Day**			**Movement Per Week**			**Abnormal Stool**			**Abdominal Bloating**		
	Yes	**No**	**Sometime**	**P-value**	**Yes**	**No**	**P-value**	**Yes**	**No**	**P-value**	**Yes**	**No**	**P-value**	**Yes**	**No**	**P-value**
Smoking																
Yes	25	25	15	.242	20	45	.258	10	55	.376	16	49	.513	29	36	.255
No	112	119	117		84	264		70	278		73	275		182	166	
Low-FODMAP diet																
Yes	22	11	26	**.013**	19	40	.180	11	48	.879	16	43	.261	40	19	**.006**
No	115	133	106		85	269		69	285		73	281		171	183	
Changing in eating habits																
Yes	83	66	68	**.045**	60	157	.224	47	170	.216	47	170	.955	117	100	.226
No	54	78	64		44	152		33	163		42	154		94	102	
Stress and IBS symptoms																
Yes	132	91	119	**.000**	98	244	**.000**	72	270	.058	83	259	**.003**	197	145	**.000**
No	5	53	13		6	65		8	63		6	65		14	57	
symptoms and quarantine																
Yes	112	19	72	**.000**	78	125	**.000**	55	148	**.000**	60	143	**.000**	146	57	**.000**
No	25	125	60		26	184		25	185		29	181		65	145	

Our study aimed to assess the impact of psychological stress on patients with IBS during the COVID-19 pandemic. According to our hypothesis, people with IBS were expected to experience worsening symptoms due to the psychological impact of the outbreak of COVID-19. Our results showed 10.4% of respondents suffered from a severe level of stress, 11.1% reported a severe level of anxiety, whereas a severe level of depression was expressed by 8.4%, which indicated that the presence of psychological symptoms was a normal response during the pandemic. People had to deal with such lockdown rules as keeping social distance and avoiding physical contact, as well as the huge number of infected people and the deaths. Our results are supported by a previous study on the Saudi Arabian population that concerned the effect of the COVID-19 pandemic on their psychological state and reported nearly identical results, with 13.7%, 13.9%, and 16.4% respondents reporting severe level of stress, anxiety, and depression, respectively (Alkhamees *et al*., 2020).

The main findings **(Table 3)** showed that the presence of stress, anxiety, and depression are associated with the presence of IBS symptoms (frequent abdominal pain, more than 3 movements per day, less than 3 movements per week, abnormal stool appearance, and abdominal bloating) in which there was a highly significant correlation between these variables. According to previous studies, IBS and other gastrointestinal disorders are sensitive to psychological stressors, as the hypothalamic-pituitary-adrenal (HPA) axis plays a major role in the body's response to stress by reciprocal interaction between the brain and gut. The mirror image of a distressed, anxious, and hyper-vigilant brain is considered to be a reactive, sensitive, irritable bowel, and the opposite is true, as reported by (Outhoff, 2016).

Another study concerned with stress as a risk factor for IBS reported a high prevalence level of IBS among medical students, ranging from 9.3% to 35.5% in China and Japan, 20.61% in Canada, 16.5% in India, whereas Pakistan showed 28.3% for three medical colleges, and last, 31.8% of medical students and interns in Jeddah; they suggested that the high level of prevalence may be due to their study environment, which is considered to be stressful (Ibrahim, 2016). Moreover, an alternative or additional IBS therapy suggested is emotional schemes therapy (EST), which reduces the psychological symptoms of those patients and reflects a good life quality (Erfan *et al.*, 2018).

Irritable bowel syndrome imposes a huge burden on the healthcare system globally; healthcare is being used by 30,000 IBS patients in France alone (Sabaté *et al.*, 2019). In general, IBS affects around 11% of the population globally (Canavan *et al.*, 2014); the prevalence of IBS in Saudi Arabia was reported to be 22.9% (Zacharakis & Nikolaidis, 2019). All food intolerance, anxiety, depression, and family history were predictors of IBS; because this disorder is idiopathic, it is challenging to manage its symptoms (Soares, 2014).

IBS is characterized by several common symptoms, according to Roma lll criteria, including recurrent abdominal pain for a minimum of 3 days per month for 3 successive months (Vork *et al.*, 2018). More than half of the participants in this study met Roma lll criteria (n=264, 63%). Commonly, an IBS patient takes one or more medications to relieve their symptoms. These medications include anti-diarrheal, anti-constipation, and, antispasmodic medications, as well as antacids, and defoamer agents; probiotics and fiber supplements were used as complementary therapies (Malone *et al.*, 2018). Hence, we asked the participants whether they were taking any of these medications to manage their symptoms, and surprisingly, (n = 258, 62.5%) were not using any medications with a statistical difference of ($P < 0.000$) between all symptoms, and ($P < 0.002$) for patients who were having more than 3 bowel movement per day. Only about 30% of patients who experience IBS symptoms consult a physician for their symptoms true (Canavan *et al.*, 2014)

The predominant stool pattern allows for the classification of IBS into four clinical variants: with constipation, with diarrhea, mixed, and unsubtyped. Regarding medications **(Table 4)**, only 2.2% of participants used anti-diarrheal medications, which are widely used among IBS with diarrhea (IBS-D) patients. There was a significant association between abnormal stool appearance and the consumption of anti-diarrheal medications, which is because anti-diarrheal medications work by bulking up the stool, leading to an increasing volume. Data showed that 5.3% of participants used anti-constipation medications that most IBS with constipation (IBS-C) patients use; there was a significant association between anti-constipation medications and frequent abdominal pain ($P < 0.001$), which is a common side effect of laxatives, as along with abnormal stool appearance ($P < 0.001$), as it tends to become watery.

Antispasmodics are smooth muscle relaxants and reliable therapeutic options for IBS symptom relief; they are the most commonly prescribed drug for IBS patients. In 2011, about 142,738 adults received ≥1 prescription for antispasmodics in Scotland (McTaggart *et al.*, 2014). In our study, (n = 107) used antispasmodics. Patients who did not use antispasmodics suffered from frequent abdominal pain (n = 78), whereas (n = 100) reported that they felt abdominal pain sometimes during the quarantine ($P < 0.000$), and (n = 133) who did not use the medication reported frequent abdominal bloating during quarantine ($P < 0.000$).

Several studies reported an overlap between functional heartburn (FH) and IBS (de Bortoli *et al.*, 2016) FH is defined as an episodic retrosternal burning in the absence of pathological gastroesophageal reflux, pathology-based motility disorders, or structural alterations FH prevalence was reported to be 39% among patients with IBS who met Roma III criteria (Lee *et al.*, 2009); antacids, which neutralize stomach acid to cut down on heartburn, are commonly administered to people who are suffering from FH. Patients who fulfilled the criteria for IBS had a high tendency to self-treat their GI symptoms. The usage of acid-suppressive agents was common among patients. Around one-third of patients self-treated GI symptoms inappropriately (Niknam *et al.*, 2016).

In the current study, only (n = 9) who used acid-suppressive reported frequent abdominal pain, whereas (n = 128) who did not them reported frequent abdominal pain during the quarantine ($P <$ 0.031).

The sensation of bloating is prevalent among IBS patients, regardless of bowel habits; all patients reported a significant increase in bloating ($P < .0001$). Hence, antiflatulents agents are administrated orally to relieve or prevent gas formation in the stomach and intestines (Houghton *et al.*, 2006). In our study, (n = 211, 51.1%) reported frequent abdominal bloating during the period of quarantine. Only (n = 5) felt abdominal bloating while using antiflatulents to relieve their symptoms, whereas (n = 206) felt frequent abdominal bloating and did not use any antiflatulents ($P < 0.028$); no statistical difference was found between all other symptoms, including abdominal pain and antiflatulents.

Many studies have suggested that probiotics are effective in the treatment of IBS; probiotics are used to improve IBS symptoms through manipulation of the gut microbiota. In the last five years, several studies (63.6%) reported that supplementation with probiotics significantly improved symptoms of IBS patients, compared to placebo (Dale *et al.*, 2019).

In the current study **(Table 5)**, only (n = 17) used probiotics as a complementary treatment. We found a significant association between frequent abdominal pain ($P < 0.008$), abdominal bloating ($P < 0.008$), and abnormal stool appearance ($P < 0.001$).

Complementary medications, such as fiber supplements and probiotics, are frequently used among IBS patients. Fiber supplements are administered to patients with constipation, which affects more than half of patients with IBS. These supplements have bulking-laxation effects, which is helpful in the elevation of constipation (Muir, 2019). Seventeen participants reported using fiber supplements, of which (n = 8) suffered from abnormal stool appearance; on the other hand, (n = 81) suffered from abnormal stool appearance, but did not use fiber supplements ($P < 0.009$). Regarding other IBS symptoms, (n = 197) did not use fiber supplements, but suffered from abdominal bloating, relative to patients (n = 3) who consumed fiber supplements and suffered from abdominal bloating ($P<0.008$).

Factors other than psychological stress and medications may influence the development of or relieve IBS symptoms **(Table 6)**. Some food and dietary products are believed to serve as a trigger for IBS patients who consume them; these include dairy products, fried and fatty foods (Böhn *et al.*, 2013). Many studies have reported an improvement in gastrointestinal symptoms in IBS patients who have adopted the low FODMAP diet (De Roest, 2013). In a study aimed to assess symptom severity concerning the low FODMAP diet, using IBS symptom severity scoring (IBS-SSS), the score was reduced in IBS patients due to a modulation in histamine levels and the microbiota that may alter symptoms (McIntosh *et al.*, 2017). Hence, we asked the

participants whether they were following this diet; (14.3%, n = 59) answered "yes," and a significant association was found between people who were following the FODMAP diet and reported that they did not suffer from any IBS symptoms (P = 0.002). Surprisingly, (n = 22) reported frequent abdominal pain with a statistical difference of $P < 0.013$ and (n = 40) reported frequent abdominal bloating with a statistical difference of $P <$ 0.006, although they were following this diet to reduce these particular symptoms.

Another factor that may be involved in the pathogenesis of IBS is smoking. A study investigated the association between smoking and the development of functional gastrointestinal symptoms in a Swedish population-based cohort of middle-aged to elder subjects. The study found an association between former and current smoking and functional abdominal pain. Former smoking was associated with functional bloating and functional constipation (Lundström *et al.*, 2016). We asked the participants about their smoking habits: (15.7%, n = 65) were smokers, although the association between smoking and IBS is controversial, as some studies have reported smoking as a risk factor for IBS (Spiller & Garsed, 2009), whereas others have reported that smoking is not associated with IBS. In the current study, we found no significant association between any IBS symptoms and smoking (Locke *et al.*, 2000).

The COVID-19 pandemic had a huge impact on public health. One of the consequences of this pandemic is the shift of eating habits and fitness, which may be exaggerated by the imposed quarantine. Additionally, certain emotional feelings, such as anxiety and hypochondria, have left people to consume more comfort food and feel inclined to increase food intake to feel better. Accordingly, we asked the participants whether their eating habits had changed negatively during the quarantine, such as eating more fatty food, simple carbohydrates, processed and refined sugars, and whether they demonstrated excessive consumption of caffeine, and ate meals in quantities bigger than usual. About (n = 217, 52.5%) responded "yes," and (n = 196, 47.5%) responded "no." No significant associations were found between changes in eating habits and IBS symptoms according to Roma lll criteria, except for frequent abdominal pain ($P < 0.045$). According to a study aimed to assess psychological aspects and eating habits during COVID-19 home confinement among the Italian population, 48.7% of the population uses food in response to anxious feelings, and 55.1% needed to increase food intake to feel better. Both unhealthy eating habits and psychological stress affected IBS patients, as well as non-IBS patients, by increasing emotional hunger during the COVID-19 pandemic.

As we mentioned above, psychological stress plays a major role in the pathogenesis of IBS. We asked the participants whether they felt that their IBS symptoms worsened due to anxiety and stress during the quarantine. About n = 203 responded positively, with a significant association of ($P < 0.000$) with all IBS symptoms. This was expected because the majority of our participants responded positively (n = 342, 82.8%) when we asked them whether they felt that stress and anxious times irritate their IBS symptoms in general.

Conclusion

The worldwide outbreak of COVID-19 in 2020 had many impacts on people and health, as well as social and economic states. The World Health Organization and governments had to increase their precautionary measures to maximum levels to minimize pressure on health care providers, as hospitals were overcrowded with COVID-19 patients in severe states. With the lockdown that was imposed in most countries, Saudi Arabia among them, people had to change many of their life routines, and that resulted in many complications. Emotional stress, depression, and anxiety were some of the psychological disorders people experienced during that period. In our study, it was observed that such complications negatively increased symptoms of IBS in people affected by this disorder. It was also observed that changes in lifestyle, caused by emotional distress, during the pandemic, and the failure to use relieving medications were the reasons for increased IBS cases in the studied population.

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