RESEARCH ARTICLE

Group comparison of individuals with and without irritable bowel syndrome in terms of psychological and lifestyle-related factors

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ABSTRACT

Objective: In this study, we intended to explore group differences between individuals with and without irritable bowel syndrome (IBS) in terms of psychological (i.e., perceived stress, internalizing problems, and difficulties in emotion regulation) and lifestyle-related factors (i.e., health-promoting behaviors and the frequency of smoking and alcohol consumption).

Method: The data were collected using an online survey packet comprising demographic information form, Rome III Criteria for IBS, Health-Promoting Life-Style Profile II, Perceived Stress Scale, Brief Symptom Inventory, and Difficulties in Emotion Regulation Scale. The study sample consisted of 105 individuals who met IBS based on Rome III Criteria and 105 healthy individuals.

Results: The group comparisons showed that IBS is positively associated with being female, perceived stress level, internalizing problems (i.e., depression, anxiety, and somatization), and some difficulties in emotion regulation (i.e., strategy and impulse). However, IBS was not associated with age, perceived income level, the frequency of smoking and alcohol consumption, and health-promoting behaviors (i.e., physical activity and nutrition).

Conclusion: Overall, the results suggest that IBS might be more related to psychological factors than healthy lifestyle factors. Thus, assessing psychological factors in IBS interventions might be helpful in the prevention and treatment of IBS.

Keywords: Anxiety, depression, difficulties in emotion regulation, irritable bowel syndrome (IBS), perceived stress

INTRODUCTION

Irritable bowel syndrome (IBS) is a chronic gastrointestinal functional disorder characterized by abdominal pain, constipation, and diarrhea (1). Although its global prevalence rate is around 11%, this rate might change between 1% and 45% depending on the country, age, and used diagnostic criteria (2). This highly prevalent disorder results in direct and indirect costs regarding increased health care usage and work absenteeism (3,4). Also, it affects patients' quality of life negatively; people with IBS experience many problems in social functioning, physical functioning, and vitality (5) due to fatigue, pain, and the other symptoms of IBS (6).

Although there is no detectable organic cause of IBS, several biopsychosocial factors were suggested to play a role in the onset and maintenance of IBS (7). One of these factors is gender; females are more likely to have IBS than males (8). Stress is considered a trigger of IBS

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and contributes to its symptomology maintenance (9). Studies showed that IBS is associated with stressful life events such as the loss of important ones (10), daily hassles (9), and job stress (11). IBS is also highly associated with internalizing disorders, namely depression, anxiety (12), and somatization (13,14). Furthermore, albeit there is no consistency (15,16), some findings supported the negative associations of IBS symptoms with smoking (17) and alcohol consumption (18). Beyond all these factors, there is some evidence that IBS might be associated with physical activity and healthy eating habits (19). Although the findings mentioned above advanced our knowledge regarding the biopsychological correlates of IBS, the etiological factors of IBS are not well understood yet. Thus, there is still a need for investigation of these factors (i.e., gender, perceived stress, depression, anxiety, somatization, health-promoting behaviors, and frequency of smoking and alcohol consumption) in relation to IBS.

The comorbidity of IBS with emotional problems is remarkable; it has been reported that IBS patients experience a higher level of depression or anxiety than healthy controls (20). In their experimental study, Kano et al. (21) showed a positive link between high sensitivity to colonic stimulation and alexithymia, which is typically characterized by difficulty in identifying, describing, and experiencing emotions. Consistently, it was found that IBS patients have more alexithymia symptoms than healthy controls (22). In a similar vein, many studies indicated a significant association between emotional processing and IBS symptoms (e.g., 23,24). These findings increase the likelihood that IBS patients have more emotion regulation difficulties than healthy controls. However, there is no research in the literature specifically comparing individuals with and without IBS in terms of the difficulties they experience in emotion regulation. Therefore, in this study, we examined these difficulties as potential risk factors of IBS.

While researchers have considered adaptive emotion regulation strategies (i.e., acceptance, problem-solving, and cognitive reappraisal) necessary for good mental health, they have evaluated that emotion regulation difficulties might have detrimental effects on mental health (25,26). In other words, individuals with emotion regulation difficulties have been assumed to be more vulnerable to psychopathological outcomes. In this sense, Gratz and Roemer (27) identified six emotion regulation difficulties: difficulties in (i) being aware (i.e., awareness) and (ii) clear of (i.e., clarity) own

emotions, (iii) accepting them (i.e., acceptance), (iv) controlling the impulsive behaviors related with the present emotions (i.e., impulse control) and (v) pursuing their life goals, and (vi) accessing effective emotion regulation strategies (i.e., strategy) in the presence of emotions.

Detrimental effects of the emotion regulation difficulties on psychological health have been supported by previous research; emotion regulation difficulties were found associated with borderline personality disorder (28), depression (29), suicide ideation (30), chronic worry and anxiety (31), and somatic symptoms (32). Besides, regarding the focus of the present study, a limited number of studies showed a positive relationship between emotion regulation difficulties and gastrointestinal symptoms (e.g., 24,33). However, research on group differences between individuals with and without IBS regarding emotion regulation difficulties has been neglected in the literature. Thus, to expand the findings of prior research, we aimed to explore if individuals with IBS experience more emotion regulation difficulties than those without IBS.

In light of the literature above, in the present study, we mainly aimed to explore the association of IBS with demographic, psychological, and lifestyle-related factors. We operationally defined the demographic variables as gender, age, and socioeconomic status; the psychological factors as perceived stress, internalizing disorders, and emotion regulation difficulties; and lifestyle-related factors as the frequency of smoking and alcohol consumption and health-promoting behaviors (i.e., nutrition and physical activity). Since studies put some evidence showing that IBS is more common among women (8), we hypothesized that there would be a significant gender difference between individuals with and without IBS; more female participants than male participants would meet the diagnostic criteria for IBS (H_1). Considering the findings showing that younger age is a risk factor for IBS diagnosis (2), we hypothesized that participants with IBS would significantly differ from those without IBS in terms of age; participants in the IBS group would be younger than those in the healthy control group (H_2). As there have been inconsistent findings regarding lifestyle factors stated above (15,16), we hypothesized that the IBS and healthy control groups would not differ on the health-promoting behaviors (H_{3a}) and the frequency of smoking (H_{3b}) and alcohol consumption (H_{3c}). Considering that stress is associated with activation and maintenance of IBS (9,10), we hypothesized that the IBS and healthy control groups would differ on

perceived stress; the IBS group would significantly report greater perceived stress than the healthy control group (H_4). In the literature, it has been found that IBS patients are more vulnerable to experiencing internalizing problems (20,21). Thus, we hypothesized that participants with IBS would significantly differ from those without IBS on depression, anxiety, and somatization scores; the IBS group would significantly report higher scores on the scales of depression (H_{5a}), anxiety (H_{5b}), and somatization (H_{5c}) compared with the healthy control group. While adaptive emotion regulation has been considered one of the protective factors against psychological problems, emotion regulation deficiency has been seen as a vulnerability factor in the psychology literature (25,26). Studies consistently showed that difficulties in emotion regulation are positively related to various psychological problems (29,31,32). Besides, a limited number of studies demonstrated the positive relationship between emotion regulation difficulties and gastrointestinal symptoms (24,33). Therefore, we hypothesized that participants with IBS would report higher emotion regulation difficulties than those without IBS (H_6).

METHOD

Participants

Although 829 individuals completed the study questionnaires, considering the inclusion (i.e., being between the ages of 18 and 65 years) and exclusion criteria (i.e., being diagnosed with diabetes mellitus, epilepsy, thyroid diseases, heart diseases, sclerosis, and hypoglycemia) and multivariate outliers, we excluded 37 of them at the initial phase. Then, using the Rome III Criteria, we assigned the participants to either IBS (n=105, 13.3%) or healthy groups (n=687, 86.7%). As there was a notable difference in the size of the groups, we also randomly selected 105 participants from the healthy group via an Internet-based randomization service (www.randomizer.org). Thus, in the final phase, the study sample consisted of 105 participants with IBS (i.e., IBS group) and 105 participants without IBS (i.e., healthy group).

The average age of the sample was 22.43 years (SD=4.55), ranging from 18 to 47 years. Of the subjects, 88 (41.9%) were males, and 122 (58.1%) were females. While most of them were students (n=196, 93.3%), the rest were either employees (n=11, 5.2%) or had other occupations (n=3, 1.4%). Regarding perceived income level, 83.3% (n=175) had middle, 11.4% (n=175) had low, and the rest (n=11, 5.2%) had high-income levels.

Materials

Demographic Information Form

We used this form to attain participants' demographic information, namely gender, age, perceived income level, occupational status, and medical diagnosis. This form also included two questions (i.e., How often do you smoke? and How often do you consume alcohol?) to assess the smoking and alcohol consumption habits of participants. Participants rated these questions on a 5-point Likert-type scale ranging from 1 (never) to 5 (always).

Rome III Criteria for IBS

Rome III classification system was developed to classify functional gastrointestinal disorders such as functional constipation and IBS (34). Uran et al. (35) adapted Rome III Criteria for IBS to Turkish. The negative and the positive predictor values of this scale in diagnosing IBS were 84.6% and 76.3%, respectively. When expert assessment and Rome III Criteria were compared, the compliance rate for the diagnostic sensitivity was 78.6%. In the present study, we assigned participants to IBS and control groups using the Rome III Criteria for IBS.

Health-Promoting Life-Style Profile II (HPLP II)

HPLP II (36), a 52-item scale, is used to measure the level of health-promoting behaviors. It includes six subscales: nutrition, physical activity, health responsibility, stress management, interpersonal support, and self-actualization. A 4-point Likert-type scale ranging from 1 (never) to 4 (routinely) is used to rate the items of the instrument. Bozo et al. (37) adapted HPLP II to Turkish, and the internal consistency coefficient of the Turkish HPLP II was 0.93. In the current study, only the subscales of nutrition and physical activity were used, and the Cronbach's alpha coefficients of them were 0.71 and 0.82, respectively.

Perceived Stress Scale, 10-Item Version (PSS-10)

PSS-10 (38) assesses the general stress level. It includes ten items and two subscales, i.e., perceived helplessness and perceived deficiency in self-efficacy. A 5-point Likert-type scale ranging from 0 (never) to 4 (very often) is used to rate its items. Thus, higher scores obtained on it reflect higher perceived stress. The Turkish adaptation study of PSS-10 was conducted by Örücü and Demir (39), and the internal consistency reliability of the Turkish PSS-10 was 0.71 for perceived deficiency in self-efficacy, 0.83 for perceived helplessness, and 0.84 for the whole scale. As we were interested in the general stress level of participants in the current study, we used the total score of PSS-10, and its internal consistency reliability was 0.87.

Brief Symptom Inventory (BSI)

BSI (40), a 53-item scale, is the shorter version of SCL-90-R. Şahin and Durak (41) adapted BSI into Turkish, and the Turkish BSI includes five subscales: depression, anxiety, somatization, hostility, and negative self. Respondents rate BSI items on a 5-point Likert-type scale ranging from 0 (not at all) to 4 (extremely). Therefore, the higher scores obtained on BSI reflect higher symptomology. In the adaptation study (41), the internal consistency reliability of its subscales ranged from 0.70 (for the depression subscale) to 0.88 (for the somatization subscale). In the current study, we used BSI to assess the severity of depression, anxiety, and somatic symptoms of the participants, and their internal consistency reliability was 0.92, 0.91, and 0.85, respectively.

Difficulties in Emotion Regulation Scale (DERS)

DERS, a 36-item scale, is used to measure emotion regulation difficulties (27). It includes six subscales related to emotion regulation deficits, namely, lack of acceptance, goal, impulse control, strategy, clarity, and awareness. Respondents rate its items using a 5-point Likert-type scale ranging from 1 (almost never) to 5 (almost always). Higher scores on its subscales reflect higher emotional regulation difficulties. The Turkish adaptation study of DERS was carried out by Rugancı and Gençöz (42), and the internal consistency reliability of Turkish DERS was 0.94. In the current study, the internal consistency reliability of its subscales were 0.71 for awareness, 0.86 for clarity, 0.88 for acceptance, 0.89 for impulse, and 0.90 for strategy and goal.

Procedure

After the Human Research Ethics Review Board of Middle East Technical University approved its protocol, the study was announced in the general psychology course at the university and on Facebook. Once potential participants clicked on the study web link presented in the announcements, they were first informed that participation is voluntary, their responses will be anonymous, and they are free to refuse and withdraw from the study at any time without stating any reason. After their consent was obtained, participants were automatically directed to study questionnaires that were presented in a counterbalanced order. Filling out the questionnaires took about 15 min. Students, who completed the questionnaires, were given an extra 0.5 course credit to compensate for their time and participation.

Data Analysis

We firstly conducted Pearson's zero-order correlation analyses to examine bivariate correlations among the study variables. Then, we conducted two Chi-squared tests to see if IBS is associated with gender and perceived income level and run a series of independent samples t-tests to find out if IBS and healthy groups were significantly different from each other in terms of age, the frequency of smoking and alcohol consumption, and perceived stress level. Finally, we performed three separate one-way between-subjects multivariate analysis of variance (MANOVA) to investigate if IBS and healthy groups were different from each other in terms of health-promoting behaviors (i.e., nutrition and physical activity), internalizing problems (i.e., depression, anxiety, and somatization), and difficulties in emotion regulation (i.e., goal, strategy, clarity, nonacceptance, awareness, and impulse).

RESULTS

Descriptive statistics of the study variables and bivariate correlations between them are presented in Table 1. Based on the Rome III Criteria, 105 (13.3%) participants met the IBS diagnostic criteria. The background characteristics of them (i.e., IBS group) and those randomly selected among participants without IBS (i.e., healthy control group) and statistics on the comparison of these two groups are shown in Table 2.

We conducted two separate Chi-squared tests to examine if IBS diagnosis is related to one's gender and perceived income level. The results of the first Chi-squared test showed that IBS diagnosis is significantly associated with the gender of participants, χ^2 (1, n=210)=6.44, p=0.01; females were more likely than males to meet IBS diagnosis criteria. In terms of perceived income level, the Chi-squared test result was not significant, χ^2 (2, n=210)=0.81, p=0.667, indicating that meeting IBS diagnostic criteria was not associated with the perceived income level of the participants. The independent samples t-test analyses demonstrated that IBS and healthy control groups were not different from each other in age [t(208)=-1.08, p=0.283] and the frequency of smoking [t(208)=0.15, p=0.881] and alcohol consumption [t(208)=-0.46, p=0.645]. On the other side, for perceived stress level, the independent samples t-test results showed a significant group difference, t(208)=-2.73, p=0.007. Participants with IBS had significantly higher scores on perceived stress (mean [m]=33.84, SD=5.73) than those without IBS (m=31.59, SD=6.20).

Table 1: Means, standard deviations, skewness and kurtosis values of the study variables, and the correlations among them (N=210)

Variables	M	SD	Skew.	Kurtosis	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1. Age	22.43	4.55	–	–															
2. Perceived income level	1.94	0.40	–	–	0.03														
3. Frequency of smoking	2.19	1.38	–	–	0.14*	-0.07													
4. Frequency of alcohol consumption	2.04	0.75	–	–	0.11	0.03	0.43**												
5. Perceived stress	32.71	6.06	-0.02	-0.22	-0.10	-0.04	0.00	0.05											
6. Depression	21.71	10.82	0.30	-0.51	-0.08	-0.19**	0.12	0.11	0.67***										
7. Anxiety	17.56	10.87	0.68	-0.09	-0.05	-0.12	0.11	0.08	0.53***	0.83***									
8. Somatization	10.60	7.09	0.68	-0.29	-0.06	-0.16*	0.12	0.03	0.40***	0.72***	0.83***								
9. Goal	17.08	4.64	-0.11	-0.71	-0.10	-0.08	0.04	-0.02	0.44***	0.50***	0.43***	0.35***							
10. Strategy	21.39	7.42	0.26	-0.84	-0.14*	-0.10	0.09	0.05	0.60***	0.65***	0.66***	0.51***	0.65***						
11. Nonacceptance	13.22	5.29	0.79	0.24	-0.09	-0.06	0.03	0.05	0.31***	0.31***	0.42***	0.28***	0.29***	0.59***					
12. Impulse	15.02	5.57	0.40	-0.58	-0.05	-0.10	0.06	0.03	0.58***	0.60***	0.64***	0.54***	0.63***	0.80***	0.51***				
13. Clarity	11.93	3.93	0.50	-0.31	-0.11	-0.05	0.03	-0.08	0.42***	0.41***	0.33***	0.27**	0.19**	0.37***	0.25***	0.36***			
14. Awareness	13.21	3.27	0.19	0.01	-0.06	-0.04	0.00	-0.04	0.19**	0.12	0.13	0.15*	-0.06	0.16*	0.26***	0.15*	0.49***		
15. Physical activity	13.65	4.28	0.85	0.38	-0.14*	0.02	-0.15*	0.02	-0.06	-0.11	-0.03	-0.04	-0.22**	-0.10	-0.08	-0.09	0.06	-0.03	
16. Nutrition	18.97	4.49	0.20	-0.13	0.03	0.03	-0.22**	-0.11	-0.06	-0.02	0.03	0.00	-0.01	-0.01	-0.01	-0.02	-0.04	-0.15*	0.42***

*: P<0.05; **: P<0.01; ***: P<0.001; M: Mean; SD: Standard deviation; Skew: Skewness.

Table 2: Background characteristics of the IBS and healthy control groups and statistics on group differences

	IBS group (n=105)						Healthy control group (n=105)						Statistics on group differences
	m	SD	n	%	Min.	Max.	m	SD	n	%	Min.	Max.	
Gender													$X^2(2)=6.44, p=0.01$
Male			24	22.9					64	61.0			
Female			81	77.1					41	39.0			
Age	22.77	5.10			18	47	22.10	3.93	105		18	40	$t(208)=-1.08, p=0.283$
Profession													
Student			98	93.3					98	93.3			
Employee			5	4.8					6	5.7			
Others			2	1.9					1	1.0			
Perceived income level													$X^2(2)=0.81, p=0.667$
Low			14	13.3					10	9.5			
Middle			86	81.9					89	84.8			
High			5	4.8					6	5.7			
Perceived stress	33.84	5.73					31.59	6.20					$t(208)=-2.73, p=0.007$
The frequency of smoking	2.17	1.30					2.20	1.46					$t(208)=0.15, p=0.881$
The frequency of alcohol consumption	2.07	0.76					2.02	0.73					$t(208)=-0.46, p=0.645$
Health-promoting behaviors													Multivariate $F(2, 206)=0.70, p=0.301$; Wilks' Lambda=0.99, $\eta^2_p=0.01$
Internalizing problems													Multivariate $F(3, 206)=10.67, p<0.001$; Wilks' Lambda=0.87, $\eta^2_p=0.14$
Depression	24.40	10.72					19.02	10.28					$F(1, 208)=13.78, p<0.001, \eta^2_p=0.06$
Anxiety	20.58	11.15					14.54	9.74					$F(1, 208)=17.47, p<0.001, \eta^2_p=0.08$
Somatization	13.17	7.09					8.02	6.13					$F(1, 208)=31.77, p<0.001, \eta^2_p=0.08$
Difficulties in emotion regulation													Multivariate $F(6, 203)=2.43, p<0.001$; Wilks' Lambda=0.93, $\eta^2_p=0.07$
Goal	17.81	4.32					16.34	4.84					$F(1, 208)=5.37, p=0.022, \eta^2_p=0.03$
Strategy	23.15	7.34					19.63	7.11					$F(1, 208)=12.49, p=0.001, \eta^2_p=0.06$
Nonacceptance	13.91	5.28					12.53	5.23					$F(1, 208)=3.63, p=0.058, \eta^2_p=0.02$
Impulse	16.19	5.36					13.85	5.55					$F(1, 208)=9.69, p=0.002, \eta^2_p=0.05$
Clarity	11.97	3.76					11.90	4.12					$F(1, 208)=0.02, p=0.889, \eta^2_p=0.00$
Awareness	13.30	3.20					13.12	3.34					$F(1, 208)=0.16, p=0.689, \eta^2_p=0.00$

SD: Standard deviation; Min: Minimum; Max: Maximum.

We performed MANOVA to investigate group differences in terms of two health-promoting behaviors: nutrition and physical activity. The result was not significant: multivariate $F(2, 206)=0.70$, $p=0.301$; Wilks' Lambda=0.99, $\eta^2_p=0.01$, indicating that the IBS and healthy control groups were not significantly different from each other on the patterns of health-promoting behaviors.

When we used internalizing problems as the outcome variable, we found that participants with and without IBS were different on the linear combination of depression, anxiety, and somatization, Multivariate $F(3, 206)=10.67$, $p<0.001$; Wilks' Lambda=0.87, $\eta^2_p=0.14$. According to the univariate analysis, the group difference was significant in terms of depression [$F(1, 208)=13.78$, $p<0.001$, $\eta^2_p=0.06$], anxiety [$F(1, 208)=17.47$, $p<0.001$, $\eta^2_p=0.08$], and somatization [$F(1, 208)=31.77$, $p<0.001$, $\eta^2_p=0.08$]. More precisely, participants with IBS reported significantly more symptoms of depression (m=24.40, SD=10.72), anxiety (m=20.58, SD=11.15), and somatization (m=13.17, SD=7.09) as compared with those without IBS (m=19.02, SD=10.28; m=14.54, SD=9.74; m=8.02, SD=6.13, respectively).

Regarding difficulties in emotion regulation, the MANOVA results indicated a significant group difference on the linear combination of these difficulties: multivariate $F(6, 203)=2.43$, $p<0.001$; Wilks' Lambda=0.93, $\eta^2_p=0.07$. According to univariate analysis, there were significant group differences in terms of difficulties in strategy [$F(1, 208)=12.49$, $p=0.001$, $\eta^2_p=0.06$] and impulse [$F(1, 208)=9.69$, $p=0.002$, $\eta^2_p=0.05$] but not in goal (p=0.022), nonacceptance (p=0.058), awareness (p=0.689), and clarity (p=0.889). Participants with IBS reported significantly more difficulties in strategy (m=23.15, SD=7.34) and impulse (m=16.19, SD=5.36) than those without IBS (m=19.63, SD=7.11; m=13.85, SD=5.55, respectively).

DISCUSSION

In this study, we examined the association of IBS with psychological (i.e., perceived stress, internalizing problems, and difficulties in emotion regulation) and lifestyle-related factors (i.e., health-promoting behaviors and the frequency of smoking and alcohol consumption) by comparing the individuals who met IBS diagnosis based on ROME III Criteria and healthy control groups. We also examined the relationship between the background characteristics of the

participants (i.e., age, gender, and perceived income level) and IBS. In general, our findings indicated that individuals with IBS tend to experience higher perceived stress, internalizing problems, and difficulties in emotion regulation as compared with healthy controls. Nonetheless, the results did not support the association between the lifestyle-related variables and IBS.

For our sample, the prevalence rates of IBS were 7.9% for males, 16.6% for females, and 13.3% for the overall sample at the initial phase. The overall prevalence rate was compatible with rates reported in previous studies with Turkish samples, which ranged between 6.3% and 19.1% (2). However, this finding should be evaluated with caution as most of our participants were university students. Given that the stress level is closely related to IBS and university students have higher stress levels than the general population (43), the prevalence rate of IBS might be overestimated in this study. The present finding indicating a higher prevalence rate of IBS in females was in line with the literature suggesting that females are 2.2 times more likely to have IBS than males (for a meta-analysis, see 44).

The findings did not yield a group difference in terms of age, perceived income level, the frequency of smoking and alcohol consumption, and health-promoting behaviors. Although the previous studies revealed that being under 50 years old is one of the risk factors for IBS (2), the current results did not support the association between age and IBS, as none of our participants among comparison groups were older than the age of 50 years. Our finding regarding the association between perceived income levels and IBS diagnosis was consistent with the previous findings (2). The insignificant group difference in the frequency of smoking was in the same line with the findings of most of the prior research (15,16). On the other hand, the lack of association between alcohol consumption might be related to the mode of the alcohol consumption (i.e., the frequency) assessed in the current study. Even though inconsistent findings regarding the association between alcohol consumption and IBS were present in the literature (15), a limited number of studies yielded a positive relationship between heavy drinking and IBS symptoms (15,45). Thus, to advance our understanding of the alcohol use–IBS relation, further studies including other modes of alcohol consumption (e.g., the amount of alcohol drunken at a time and type of alcoholic beverages consumed) are suggested. In the current study, health-promoting behaviors, i.e., nutrition and

physical activity, were not different across the IBS and healthy groups. This conflicts with the findings of a study conducted in Japan, showing that individuals with IBS do less exercise and have less healthy eating habits than healthy controls (19). However, unlike the current study, Miwa (19) used a single question to measure each health-promoting behavior (e.g., eating regularly, the level of appetite, the frequency of consuming vegetables, and engaging in exercise behaviors) instead of using multiple question scales. Therefore, the inconsistency between the findings might be because of the possibility that individuals with and without IBS might not differ on more general health-promoting behaviors (e.g., healthy eating) but might differ on particular ones (e.g., the frequency of consuming vegetables).

For the perceived stress, we found that the IBS group had a significantly higher perceived stress level than the healthy control group. This finding is consistent with the previous findings indicating that stress might trigger or exacerbate the symptoms of IBS (9,46). In the literature, the link between stress and IBS has been generally explained based on the brain–gut axis, a connection between the central nervous system and the enteric nervous system. Accordingly, this connection plays a critical role in the regulation of intestinal functions (47,48). However, stress leads to some disruptions on the brain–gut axis by inducing alterations in the central nervous system, peripheral neurons, mucosal immune system, and gastrointestinal microbiota. As a result of these alterations, the IBS symptoms develop or exacerbate (48). In light of this information, it can be suggested that higher stress scores of IBS patients might be a reflection of the pathway along which stress induces physiological changes in the brain–gut axis, and these changes trigger IBS symptoms. Thus, psychological interventions that include stress management components might be useful in the prevention and treatment of IBS.

The IBS group reported significantly higher scores on internalizing problems, i.e., depression, anxiety, and somatization, as compared with the healthy control group. Considering a large body of research establishing high comorbidity rates between these problems and IBS (49; see also 50,51 for the review), this result is not surprising. According to the literature, a high level of depressive and anxiety symptoms is a risk factor for the development of IBS (51,52). Similarly, it has been well known that IBS is associated with various somatic problems such as chronic fatigue, back pain, headache

(53,54), and fibromyalgia (55). Thus, considering the current and previous findings showing the association of IBS with depression, anxiety, and somatization, mental health professionals are suggested to assess and treat these internalizing problems in IBS patients.

For the emotion regulation difficulties, compared with the healthy group, the IBS group reported more problems in engaging in practical strategies to cope with emotions and controlling impulsive behaviors related to emotions. On the other hand, no group difference was present for awareness, acceptance, and clarification of emotions and behaving in the direction of desired goals in the presence of negative emotions. In general, these findings suggested that IBS is more associated with difficulties in managing emotions than being aware of which emotions are present. Therefore, it can be put forward that in the treatment of IBS, helping individuals in gaining skills to cope with these emotions might be more important than introducing these emotions. Nevertheless, when interpreting these findings, it should be considered that this study is the first one examining these associations, and it has a cross-sectional nature. Thus, to draw a firm conclusion about the associations between IBS and emotion regulation difficulties, further studies employing longitudinal or/and experimental designs are needed.

The group difference between individuals with and without IBS in terms of emotion regulation difficulties has not been specifically studied in the literature to the best of our knowledge; yet, our findings can be considered in line with some previous ones. For instance, some research showed that individuals with IBS had higher alexithymia scores than control groups (21,22). Also, Holmes and colleagues (56) and Thakur and colleagues (57) established that brief emotion-focused psychological therapy, including emotional awareness and emotional expression training, improves IBS statistically and clinically. Our findings, indicating that individuals with IBS have difficulties in using adaptive strategies to cope with emotions and controlling impulsive behaviors related to emotions as compared with the control group, both supported the previous findings pointing out possible emotion regulation deficiencies in IBS and expanded their findings by showing which emotion regulation difficulties are more salient in IBS. Based on the current and the previous findings, it can be put forward that individuals who do not have adequate adaptive strategies to cope with their emotions or who

react to emotions impulsively are more likely to experience IBS. Thus, psychological interventions to provide adaptive strategy skills for emotion regulation and prevent impulsive behaviors related to emotions can be considered a treatment option for IBS.

The current findings also have some clinical implications. First, this study showed that individuals with IBS have experienced greater depression, anxiety, somatization symptoms, perceived stress, and emotion regulation difficulties (i.e., lack of strategy and impulse control) than healthy controls. Therefore, it may be beneficial for individuals with IBS to seek psychological help in addition to medical treatment. Thus, the physicians dealing with IBS patients are suggested to recommend their patients psychological help, as well. Second, regular assessment of these psychological variables during medical and/or psychological treatment of IBS can be helpful for physicians and psychologists in determining the focus of treatment. Third, some contemporary psychological therapy approaches targeting emotional regulation difficulties (e.g., rumination, avoidance, rigid and reactive emotion responses), such as acceptance commitment therapy (58) and emotion regulation therapy (59), provided promising effects in preventing and treating various psychopathological consequences (60,61). Also, some findings showed that IBS patients might benefit from emotion-focused psychological interventions (56,57). Thus, the use of such emotional regulation-focused psychological therapy approaches or the inclusion of psychological therapy techniques targeting emotion regulation difficulties may increase the success of IBS treatments.

This study has some limitations. First, we used the Rome III Criteria but did not utilize anamnesis and physical examination to assign participants to IBS and healthy control groups. Although the Turkish version of Rome III Criteria showed a good compliance rate with expert assessments in terms of diagnostic sensitivity (35), given some evidence in the literature indicating the poor validity of Rome III Criteria (62), using only these criteria might have led to some false positives or negatives in the categorization of the participants. Also, even though we excluded participants with diabetes mellitus, epilepsy, thyroid diseases, heart diseases, sclerosis, and hypoglycemia to eliminate false positives, the fact that we did so based on participants' self-reports rather than on their medical history or physical examination might have led us to overlook some diseases with IBS-like symptoms and categorize the participants with them

as having IBS. For these reasons, in further studies, as suggested by Lacy and Patel (63), it is strongly recommended to include medical history, physical examination, and measurement of IBS's warning signs (e.g., unintentional weight loss and anemia) in addition to the Rome III Criteria to be able to make more accurate assignments of the participants to IBS and healthy control groups. Second, the generalizability of our findings is limited because a large proportion of the participants were university students. Therefore, we suggest further studies using population-based representative samples to achieve more generalizable findings. Third, as a cross-sectional design was used in this study, our findings did not put forward cause–effect links between IBS and study variables. Thus, longitudinal studies are necessary to expand our findings, especially regarding the associations between IBS and emotion regulation difficulties.

To conclude, this study showed that IBS is closely associated with gender and psychological variables but not with healthy lifestyle factors as well as age and perceived income levels. Specifically, the finding suggesting that participants with IBS had more emotion regulation difficulties than healthy controls made a unique contribution to the extant literature. If further studies support this finding, assessing IBS patients' emotion regulation difficulties and providing intervention targeting these difficulties might be helpful to achieve better outcomes in the management of IBS.

Contribution Categories		Author Initials
Category 1	Concept/Design	K.S., O.B.
	Data acquisition	K.S., O.B.
	Data analysis/Interpretation	K.S., O.B.
Category 2	Drafting manuscript	K.S.
	Critical revision of manuscript	O.B.
Category 3	Final approval and accountability	K.S., O.B.
Other	Supervision	O.B.

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