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The Efficacy of Cognitive Behavioral Therapy on Health Anxiety, Perceived Stress, and Pain Self-Efficacy in Females with Irritable Bowel Syndrome

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ABSTRACT

Aims: The present study aimed to examine the effectiveness of cognitive behavioral therapy (CBT) on health anxiety, perceived stress, and pain self-efficacy among women with Irritable Bowel Syndrome (IBS).

Method and Materials: This study utilized a quasi-experimental pretest–posttest design with a control group and included 36 patients with IBS who were referred by gastroenterologists in Ardabil Province in 2025. Participants were selected through purposive sampling and randomly assigned to either the intervention group (n = 18) or the control group (n = 18). The intervention group attended eight 90-minute Cognitive Behavioral Therapy sessions. Data were collected using the Short Health Anxiety Inventory, the Perceived Stress Scale, and the Pain Self-Efficacy Questionnaire. Data analysis was conducted using multivariate analysis of covariance in SPSS version 27.

Findings: The results demonstrated that CBT significantly decreased illness likelihood (F=60.92), illness severity (F=58.61), body vigilance (F=64.91), perceived stress (F=72.86), and increased pain self-efficacy (F=69.23) in females with IBS(P< 0.001).

Conclusion: The findings of the present study underscore the profound impact of CBT on psychological and functional outcomes in females with IBS. By significantly reducing health anxiety and perceived stress, and by enhancing pain self-efficacy, CBT addresses the cognitive, emotional, and behavioral mechanisms that perpetuate symptom severity and functional impairment in IBS.

Keywords: Cognitive Behavioral Therapy, Health Anxiety, Perceived Stress, Pain Self-Efficacy, Irritable Bowel Syndrome

Introduction

Females with irritable bowel syndrome (IBS) often experience a range of gastrointestinal symptoms influenced by both biological and psychosocial factors [1]. IBS is diagnosed more frequently in women than in men, suggesting sex-related differences in gut sensitivity and motility [2]. Hormonal fluctuations, particularly in estrogen and progesterone, can affect bowel function and pain perception, contributing to symptom variation across the menstrual cycle [3]. As a result, many women report increased abdominal pain, bloating, constipation, or diarrhea at certain times of the month [4]. In addition to physical symptoms, IBS can have a considerable psychological and social impact on females [5]. Women with IBS commonly report higher levels of anxiety, stress, and emotional distress, which may further aggravate gastrointestinal symptoms through the gut–brain axis [6].

Health anxiety significantly influences the experience and severity of IBS, as individuals with high health anxiety often excessively monitor bodily sensations and interpret normal or mild gastrointestinal symptoms as indicators of serious illness [7]. In patients with IBS, this heightened vigilance can amplify the perception of abdominal pain, bloating, and bowel irregularities, leading to increased symptom reporting and distress [8]. As IBS is a functional disorder without clear structural pathology, uncertainty about symptoms often fuels health-related fears [9]. Repeated worry and catastrophic thinking activate the stress response system, increasing autonomic nervous system

arousal and altering gut motility and sensitivity[10]. This bidirectional relationship means that gastrointestinal discomfort increases anxiety, while anxiety further worsens gastrointestinal functioning [11].

Perceived stress is closely linked to the onset, severity, and progression of IBS [12]. Individuals with IBS often report higher stress levels than healthy populations, and stressful life events are commonly associated with symptom exacerbations [13]. Perceived stress reflects how overwhelming and uncontrollable individuals appraise their life circumstances, which directly influences physiological stress responses relevant to gastrointestinal functioning [14]. These stress-related changes can increase intestinal permeability, disrupt gut microbiota, and heighten visceral hypersensitivity [15]. Consequently, patients experience greater abdominal pain and discomfort even in response to normal digestive processes [16]. Stress also negatively impacts sleep and dietary habits, further aggravating IBS symptoms [12].

Pain self-efficacy refers to an individual's belief in their ability to carry out daily activities despite experiencing pain [17]. In IBS, it is a crucial psychological factor affecting symptom impact and functional disability [18]. Patients with higher pain self-efficacy generally report better adjustment, lower symptom-related interference, and greater participation in daily activities despite abdominal discomfort [19]. Conversely, low pain self-efficacy is linked to increased pain intensity, heightened emotional distress, and avoidance behaviors [20]. When individuals doubt their ability to cope with pain, they may limit physical activity, social participation, and work-related tasks, which can lead to deconditioning and reduced quality of life [21].

Cognitive Behavioral Therapy (CBT) is widely recognized as an effective psychological intervention for managing IBS [22]. Given the strong interaction between psychological processes and gastrointestinal functioning, CBT targets maladaptive thoughts, emotions, and behaviors that contribute to symptom perception and distress [23]. By addressing dysfunctional beliefs related to pain, illness, and bodily sensations, CBT helps patients reinterpret gastrointestinal symptoms in a less threatening manner, thereby reducing symptom-related anxiety and discomfort[24]. One of the primary mechanisms through which CBT exerts its effects in IBS is the modification of cognitive distortions such as catastrophizing, hypervigilance to bodily sensations, and fear of symptom exacerbation[25]. These cognitive patterns are known to amplify visceral sensitivity and pain perception[26]. Through cognitive restructuring, patients learn to challenge negative automatic thoughts and develop more adaptive interpretations of their symptoms[27]. This cognitive shift is often accompanied by a reduction in emotional distress and improved symptom control[28].

In addition to cognitive changes, CBT emphasizes behavioral strategies that promote adaptive coping and functional improvement[29].Techniques such as exposure to feared situations, activity pacing, relaxation training, and stress management are commonly used to reduce avoidance behaviors and enhance self-efficacy [30]. By gradually re-engaging in daily activities, patients gain confidence in their ability to manage symptoms, which contributes to long-term improvements in quality of life and functional outcomes [31]. Furthermore, empirical evidence consistently supports the efficacy of CBT in reducing IBS symptom severity and associated psychological distress [32]. Randomized controlled trials have demonstrated that CBT leads to significant and sustained improvements in abdominal pain, bowel habits, anxiety, and depression compared to usual medical care [33]. Importantly, the benefits of CBT often persist beyond the end of treatment, highlighting its role as a durable and cost-effective intervention for individuals with IBS [34].

IBS is one of the most common functional gastrointestinal disorders, characterized by chronic, recurrent symptoms that substantially impair quality of life. It is more prevalent in females and is often accompanied by psychological difficulties, including health anxiety, elevated perceived stress, and reduced pain self-efficacy. These factors can exacerbate gastrointestinal symptoms and

hinder effective disease management and long-term adaptation. Despite advances in pharmacological treatments, many patients continue to experience persistent symptoms, highlighting the limitations of medical approaches alone. Traditional treatments often overlook the cognitive, emotional, and behavioral processes that maintain symptoms. Accordingly, the present study aimed to examine the efficacy of CBT on health anxiety, perceived stress, and pain self-efficacy in females with IBS.

Method and Materials

This study employed a randomized controlled clinical trial design with a pretest–posttest structure with a control group. The study population consisted of patients with IBS referred to gastroenterologists in Ardabil Province of Iran between May and July 2025. From 36 eligible patients, 18 were randomly assigned to either the intervention or control group using block randomization with a 1:1 allocation ratio to ensure equal group sizes. Allocation concealment was maintained through sealed, opaque envelopes to minimize selection bias. The sample size was calculated using G*Power software based on previous studies, assuming an effect size of 1.50, a power (β) of 0.96, and a significance level (α) of 0.05. Participants were included based on a specialist's diagnosis and had to meet the following criteria: provide informed consent, have experienced IBS within the past two years, present with psychological issues, and refrain from using tobacco or alcohol. Exclusion criteria were incomplete questionnaire responses, missing more than two therapy sessions, or experiencing increased pain during the intervention.

The following instruments were used in this study:

Short Health Anxiety Inventory (SHAI): The SHAI, developed by Salkovskis et al. [36], assesses exaggerated perceptions of the likelihood and severity of serious illness. The 18-item short form of the original 64-item scale evaluates three dimensions: likelihood of illness (10 items), severity of illness (4 items), and bodily vigilance (3 items). Each item is scored from 0 to 3, with total scores ranging from 0 to 54; higher scores indicate greater health anxiety. The first factor measures concern about developing a disease, the second assesses perceived seriousness if illness occurs, and the third evaluates attention to bodily sensations. The scale has demonstrated satisfactory convergent, discriminant, and predictive validity through significant correlations with illness attitudes, anxiety sensitivity, intolerance of uncertainty, general anxiety, and social interaction anxiety. In this study, the SHAI showed good internal consistency (Cronbach's α = 0.85).

Perceived Stress Scale (PSS): The 14-item PSS, developed by Cohen et al. [37], assesses general perceived stress over the past month, including feelings of control, coping, and stress. Items are rated on a 5-point Likert scale from 0 (never) to 4 (always), with higher scores indicating greater perceived stress. Items 4, 5, 6, 7, 9, and 10 are reverse-scored. Total scores range from 0 to 56. Cohen et al. reported internal consistency coefficients of 0.84–0.86, with Cronbach's α for the total score at 0.85.

Pain Self-Efficacy Questionnaire (PSEQ): The PSEQ, developed by Nicholas [38] based on Bandura's self-efficacy theory, evaluates confidence in performing daily activities despite pain. It contains 10 items scored on a 7-point Likert scale from 0 (not at all confident) to 6 (completely confident), yielding total scores of 0–60. Higher scores reflect greater pain self-efficacy, while lower scores indicate lower confidence in coping with pain. The questionnaire has demonstrated satisfactory validity and internal consistency (Cronbach's α = 0.81), and in this study, reliability was high (α = 0.89).

Cognitive–Behavioral Therapy Protocol: In this study pretest questionnaires were administered before the intervention. Eighteen females with IBS in the intervention group received eight 90-minute CBT sessions over two months, delivered by a trained therapist [39]. For ethical reasons, the 18 females in the control group were informed they would receive the same intervention after a one-month waiting period and were advised to continue routine medical treatments. Posttest assessments were

completed by all participants following the intervention. Strategies to minimize attrition included emphasizing session attendance during initial interviews, reinforcing commitment throughout the program, and fostering group cohesion. A summary of the CBT sessions for females with IBS is provided in Table 1.

Table 1) Overview of Cognitive–Behavioral Therapy (CBT) Sessions for Females with IBS (39)

Session	Target
1	Introduction to CBT, explanation of basic principles and core concepts, establishment of session structure and schedule, and discussion of group rules.
2	Agenda setting, assessment and evaluation of participants' problems, case formulation and conceptualization, and completion of the formulation worksheet.
3	Agenda setting, identification and selection of therapeutic goals, collaborative goal setting with group members, and preparation of therapy notebooks for activity planning.
4	Agenda setting, identification and recognition of automatic thoughts, training in thought recording, and assignment of thought records as homework.
5	Cognitive restructuring, modification of dysfunctional thoughts, training in generating rational alternatives, and introduction of the weekly activity log as homework.
6	Identification of cognitive distortions, examination of evidence for and against beliefs, and preparation of coping (confrontation) cards.
7	Design of graded tasks and application of imagery-based exposure (visual confrontation techniques).
8	Review of incomplete activities, homework assignments, and therapy notebooks; addressing participants' questions; and summarizing treatment content.

Statistical Analyses

Data were analyzed using descriptive statistics (means and standard deviations) and inferential statistics, including analysis of covariance, after verifying the necessary assumptions. All analyses were performed in SPSS version 27, with a significance level of 0.05. The normality of variable distributions in both groups was assessed using the Shapiro–Wilk test, which indicated non-significant results for all variables (P> 0.05), confirming the assumption of normality. To examine the effect of CBT on health anxiety, perceived stress, and pain self-efficacy, a multivariate analysis of covariance (MANCOVA) was conducted.

Findings

The mean ± SD age of participants was 21.87 ± 4.36 years in the intervention group and 22.50±4.91 years in the control group. Table 2 shows the means and standard deviations of pretest and posttest scores for health anxiety, perceived stress, and pain self-efficacy in both groups. The table also presents the Shapiro–Wilk test results, confirming that all variables were normally distributed (P> 0.05).

Table 2) Descriptive Statistics and Normality of Study Variables in the Intervention and Control Groups

Variables		Groups	Mean	SD	S-W	P
Illness likelihood	Pre-test	Intervention	11.33	1.02	0.103	0.068
		Control	11.05	0.99	0.114	0.052
	Post-test	Intervention	8.67	1.64	0.098	0.059
		Control	11.77	1.01	0.095	0.070
Illness severity	Pre-test	Intervention	10.38	0.97	0.100	0.051
		Control	10.66	0.98	0.096	0.062
	Post-test	Intervention	7.66	1.68	0.115	0.073
		Control	11.16	1.09	0.094	0.052
Body vigilance	Pre-test	Intervention	13.67	1.37	0.090	0.059
		Control	13.94	1.16	0.103	0.061
	Post-test	Intervention	10.27	1.56	0.107	0.068
		Control	14.16	1.50	0.097	0.053
Perceived Stress	Pre-test	Intervention	38.72	1.40	0.105	0.061
		Control	38.50	1.29	0.092	0.059
	Post-test	Intervention	34.23	2.23	0.119	0.077
		Control	39.22	1.76	0.094	0.065
Pain Self-Efficacy	Pre-test	Intervention	36.67	2.01	0.089	0.052
		Control	36.77	1.92	0.109	0.070
	Post-test	Intervention	40.27	2.61	0.102	0.069
		Control	35.38	1.88	0.114	0.056

The Levene's test confirmed the homogeneity of variances for health anxiety, perceived stress, and pain self-efficacy across groups ($P > 0.05$). The Box's M test indicated that the covariance matrices of the dependent variables were equal between the intervention and control groups (Box M = 45.60, F = 1.25, P = 0.507), supporting this assumption. Additionally, the Chi-square Bartlett's test showed a significant relationship among health anxiety, perceived stress, and pain self-efficacy ($\chi^2 = 143.19$, df = 21, $P < 0.01$). The homogeneity of regression slopes, another key assumption of MANCOVA, was examined by testing the interaction between the independent variable (intervention) and pretest scores. The interaction was not significant, indicating that this assumption was satisfied. With all assumptions met, a MANCOVA was conducted to examine group differences (see Table 3).

Table 3) MANCOVA Results for Post-Test Mean Scores

Test	Value	F	df	Error df	P	Effect Value
Pillai's Trace	0.782	17.894	5	25	<0.001	0.78
Wilks Lambda	0.218	17.894	5	25	<0.001	0.78
Hotelling Trace	3.579	17.894	5	25	<0.001	0.78
Roy's Largest Root	3.579	17.894	5	25	<0.001	0.78

Calculating the frequency of use, thirty percent took the tablet once every cycle, usually on day one of their period. Nearly fourteen percent took it more than once every cycle and nearly half the population consumed the drug foreseeing any major event, under spells of psychological stress or in an unprecedented situation. Women on the above medications also complained to have experienced side effects post consumption, with 8 individuals having encountered nausea and vomiting, 12 with gastritis and 2 of the responders reported to have an exaggerated pain in the cycle that succeeded (Table 4).

Table 4) ANCOVA Results for Post-Test Mean Scores of Dependent Variables in Intervention and Control Groups

Variables	SS	SS Error	DF	MS	MS Error	F	P	Effect Value
Illness likelihood	90.56	43.11	1	90.56	1.48	60.92	<0.001	0.67
Illness severity	104.21	51.55	1	104.21	1.77	58.61	<0.001	0.66
Body vigilance	108.06	48.27	1	108.06	1.66	64.91	<0.001	0.69
Perceived Stress	217.39	86.52	1	217.39	2.98	72.86	<0.001	0.72
Pain Self-Efficacy	215.58	90.17	1	215.58	3.10	69.33	<0.001	0.70

As presented in Table 4, the F-values for illness likelihood (F = 60.92), illness severity (F = 58.61), bodily vigilance (F = 64.91), perceived stress (F = 72.86), and pain self-efficacy (F = 69.23) were all significant at $p < 0.001$, indicating significant differences between the intervention and control groups. The effect sizes show that 67% of illness likelihood, 66% of illness severity, 69% of bodily vigilance, 72% of perceived stress, and 70% of pain self-efficacy are attributable to the intervention. These results suggest that CBT significantly reduces illness likelihood, illness severity, bodily vigilance, and perceived stress, while enhancing pain self-efficacy in females with IBS.

Discussion

The present study aimed to evaluate the effectiveness of CBT on health anxiety, perceived stress, and pain self-efficacy in females with IBS. The findings indicate that CBT significantly reduced health anxiety in this population. Health anxiety involves excessive worry about serious illness, heightened bodily vigilance, and catastrophic interpretations of normal bodily sensations. CBT targets these cognitive distortions by helping participants identify and restructure maladaptive beliefs, promoting more realistic and adaptive appraisals of bodily symptoms[30].

By reducing the perception of threat associated with gastrointestinal sensations, CBT decreases hypervigilance and anticipatory anxiety, which are central features of health anxiety in IBS [31]. One mechanism through which CBT reduces

health anxiety is through psychoeducation and cognitive restructuring. Participants learn to differentiate between normal bodily fluctuations and pathological signs, which diminishes the habitual overestimation of illness likelihood and severity [23]. Additionally, CBT encourages the use of evidence-based reasoning to challenge catastrophic thoughts, replacing them with adaptive interpretations[33]. This process reduces the emotional intensity of worry and enables participants to engage with their symptoms without excessive fear or rumination. Behavioral components of CBT also play a role in reducing health anxiety. Techniques such as exposure to feared bodily sensations or medical contexts help participants confront and tolerate uncertainty, thereby breaking the cycle of avoidance and reassurance-seeking [29]. By gradually increasing confidence in coping with symptoms, CBT strengthens self-efficacy in managing health-related concerns. Together, these cognitive and behavioral strategies provide a comprehensive framework that explains the significant reduction in health anxiety observed in the study [25].

The results showed that CBT effectively lowered perceived stress among females with IBS. Chronic stress is a major factor that exacerbates IBS symptoms through its influence on the gut–brain axis, including dysregulation of autonomic nervous }system activity and increased visceral hypersensitivity. CBT targets both the psychological and physiological components of stress, teaching participants skills to manage emotional reactivity and physiological arousal in response to perceived threats or discomfort [31]. CBT reduces stress by equipping participants with adaptive coping strategies. Relaxation techniques, diaphragmatic breathing, and mindfulness exercises enable patients to modulate physiological stress responses, thereby reducing the sympathetic nervous system activation that can trigger gastrointestinal discomfort [28]. Additionally, cognitive interventions help participants reframe stress-inducing thoughts and reinterpret challenging situations, which lowers subjective perceptions of stress and improves overall emotional regulation [29]. Furthermore, CBT fosters a sense of mastery and control over one's environment, which is crucial for reducing perceived stress [22]. Patients learn to anticipate stressors, plan adaptive responses, and engage in problem-solving rather than avoidance[25]. In the context of IBS, this enhanced self-regulation reduces both the psychological burden and the frequency of symptom exacerbations caused by stress, explaining why participants reported lower levels of perceived stress after the intervention [39].

The present study also found that CBT significantly increased pain self-efficacy in females with IBS. Pain self-efficacy refers to the belief in one's ability to function and cope despite experiencing pain, which is a critical determinant of functional outcomes in chronic conditions. CBT strengthens this belief by combining cognitive strategies that alter pain-related appraisals with behavioral techniques that promote active engagement in daily activities despite discomfort. One mechanism of effect is the use of graded exposure and activity pacing, which helps patients gradually confront situations they previously avoided due to fear of pain [39]. As participants experience success in managing pain without catastrophic outcomes, their confidence in handling discomfort grows. Cognitive interventions further enhance self-efficacy by restructuring beliefs such as "I cannot function if I feel pain" into more adaptive interpretations like "I can manage activities even if discomfort occurs." CBT also improves self-efficacy by integrating problem-solving and coping skills training, which empowers participants to anticipate and manage pain triggers proactively [25]. By developing personalized strategies for symptom management, patients experience a sense of control and mastery over their condition [30]. This not only reduces avoidance behaviors but also encourages active participation in life roles, leading to improved functional ability and quality of life [27]. The combination of cognitive, behavioral, and skills-based interventions explains the substantial improvement in pain self-efficacy observed in

this study[34].

Despite the meaningful findings, several limitations should be noted. First, the quasi-experimental design limits the ability to draw definitive causal conclusions regarding the effects of CBT. Second, participants were recruited via purposive sampling from a single region, restricting the generalizability of the results. Third, the study included only female patients with IBS, preventing generalization to males or mixed-gender populations. Additionally, reliance on self-report measures may introduce response bias, and the absence of follow-up assessments limits conclusions about the long-term sustainability of treatment effects.

Future research should employ randomized controlled designs to strengthen causal inference, recruit participants from multiple centers and diverse regions to improve external validity, and include both male and female participants to explore potential gender differences in treatment response. Longitudinal studies with follow-up assessments are recommended to evaluate the persistence of CBT effects. Finally, investigating the combination of CBT with other therapeutic approaches may help optimize psychological and functional outcomes in patients with IBS.

Conclusion

The findings of the present study underscore the profound impact of CBT on psychological and functional outcomes in females with IBS. By significantly reducing health anxiety and perceived stress, and by enhancing pain self-efficacy, CBT addresses the cognitive, emotional, and behavioral mechanisms that perpetuate symptom severity and functional impairment in IBS. These results highlight the interconnected nature of mind and body in functional gastrointestinal disorders, demonstrating that psychological processes not only exacerbate symptom perception but also influence coping strategies, daily functioning, and overall quality of life. Furthermore, the study provides evidence that interventions targeting maladaptive cognitions, emotional dysregulation, and self-efficacy beliefs can produce meaningful, durable improvements beyond symptomatic relief. CBT equips individuals with the skills to reinterpret bodily sensations, regulate stress responses, and actively engage in daily activities despite discomfort, fostering both resilience and autonomy.

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Authors' Contribution

A.G: Conceptualization, Methodology, Formal analysis, Investigation, Writing – Original Draft, Writing – Review & Editing

S.M.H: Data Curation, Software, Validation, Formal analysis, Investigation, Writing – Original Draft, Writing – Review & Editing

S.K: Supervision, Methodology, Investigation, Writing – Review & Editing

N.A.T: Conceptualization, Methodology, Investigation, Resources, Writing – Review & Editing

V. S. N: Validation, Formal analysis, Writing – Review & Editing, Project administration, Funding acquisition

Conflict of Interest

The authors declare no conflicts of interest.

Ethical Permission

Ethical principles in manuscript writing have been adhered to by the guidelines of the National Ethics Committee and the COPE regulations.

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References

1. Silva H, Zheng T, Porter J, Barrett J, Garg M, Gibson PR. The Associations of Sucrase-Isomaltase Hypomorphic Variants With Long-Term Outcomes and Dietary Intake in an Australian Irritable Bowel Syndrome Population Educated on the FODMAP Diet: A Cross-Sectional and Retrospective Study. UEGJ. 2026;14(1):e70173. DOI: 10.1002/ueg2.70173
2. Abdelaziz HA, Ellakany WI, Ellakany A, Dean YE, Rouzan SS, Bamousa BA, et al. The relationship between anxiety and irritable bowel syndrome symptoms among females: A cross-sectional study in Egypt. Medicine. 2023;102(32):e34777. https://doi.org/10.1097/md.0000000000034777

3. Mullish BH, Michael DR, Dabcheva M, Webberley TS, Coates N, John DA, et al. A double-blind, randomized, placebo-controlled study assessing the impact of probiotic supplementation on the symptoms of irritable bowel syndrome in females. Neurogastroenterol Motil. 2024;36(4):e14751. DOI: 10.1111/nmo.14751
4. Park JH, Kang SH, Kim JS, Moon HS, Sung JK, Jeong HY. Contribution of sex and gender roles to the incidence of post-infectious irritable bowel syndrome in a prospective study. Sci Rep. 2023;13(1):19467. DOI: 10.1038/s41598-023-45300-2
5. Chen LJ, Plantinga AM, Burr R, Cain K, Barney P, Savidge T, et al. Exploration of cytokines and microbiome among males and females with diarrhea-predominant irritable bowel syndrome. Dig Dis Sci. 2025;70(3):1043-51. https://doi.org/10.1007/s10620-024-08836-5
6. Kilpatrick LA, Gupta A, Tillisch K, Labus JS, Naliboff BD, Mayer EA, et al. Neural correlates of perceived and relative resilience in male and female patients with irritable bowel syndrome. Neurogastroenterol Motil. 2024;36(2):e14710. DOI: 10.1111/nmo.14710
7. Stone JK, Shafer LA, Graff LA, Witges K, Sexton K, Lix LM, et al. The association of efficacy, optimism, uncertainty and health anxiety with inflammatory bowel disease activity. J Psychosom Res. 2022; 154:110719. https://doi.org/10.1016/j.jpsychores.2022.110719
8. Fan W, Chen Y, Fang X, Zhu L, Fei G, Lu J, et al. Gender differences in gastrointestinal, biopsychosocial and healthcare-seeking behaviors in Chinese patients with irritable bowel syndrome predominant with diarrhea. BMC Gastroenterol. 2024;24(1):102. https://doi.org/10.1186/s12876-024-03153-7
9. Nybacka S, Kinnander A, Augustin H, Bärebring L. Perceived healthiness of foods, food avoidance and diet-related anxiety in individuals with self-reported irritable bowel syndrome: a cross-sectional study. BMC Nutr. 2024;10(1):134. https://doi.org/10.1186/s40795-024-00945-8
10. Melchior C, Desprez C, Riachi G, Leroi AM, Déchelotte P, Achamrah N, et al. Anxiety and depression profile is associated with eating disorders in patients with irritable bowel syndrome. Front Psychiatry. 2020;10:928. https://doi.org/10.3389/fpsyt.2019.00928
11. Barberio B, Zamani M, Black CJ, Savarino EV, Ford AC. Prevalence of symptoms of anxiety and depression in patients with inflammatory bowel disease: a systematic review and meta-analysis. Lancet Gastroenterol Hepatol. 2021;6(5):359-70. https://doi.org/10.1016/s2468-1253(21)00014-5
12. Chen HH, Hung CH, Kao AW, Hsieh HF. Exploring quality of life, stress, and risk factors associated with irritable bowel syndrome for female university students in Taiwan. Int J Environ Res Public Health. 2021;18(8):3888. https://doi.org/10.3390/ijerph18083888
13. Çelik ZM, Aktaç Ş, Sabuncular G, Dirican T, Demir AH. Quality of life, perceived stress and nutrition of patients with irritable bowel syndrome: A descriptive study. N Afr J Food Nutr Res. 2022;6(14):107-14 https://doi.org/10.51745/najfnr.6.14.107-114
14. Singh A, Bhardwaj A, Tripathi A, Ranjan MK, Singh D, Sachdeva A, et al. Burden of anxiety, depression and perceived stress in patients with inflammatory bowel disease: a cohort study from North India. Dig Dis Sci. 2024;69(3):775-90. https://doi.org/10.1007/ s10620-023-08242-3
15. Horn A, Stangl S, Parisi S, Bauer N, Roll J, Loeffler C, et al. Systematic review with meta-analysis: Stress-management interventions for patients with irritable bowel syndrome. Stress Health. 2023;39(4):694-707. https://doi.org/10.1002/smi.3226
16. Sonbol HM, El-Sayed MM, Khedr MA, Ibrahim MA, Osama M, Abdel-Sattar AA, et al. Type D personality, insomnia severity, perceived stress, and health-related quality of life in inflammatory bowel disease: A case–control study. J Psychosom Res. 2025:112199. DOI: 10.1016/j.jpsychores.2025.112199
17. Sheehan JL, Greene-Higgs L, Swanson L, Higgins PD, Krein SL, Waljee AK, et al. Self-efficacy and the impact of inflammatory bowel disease on patients' daily lives. Clin Transl Gastroenterol. 2023;14(6):e00577. DOI: 10.14309/ctg.0000000000000577
18. Chen J, Barandouzi ZA, Lee J, Xu W, Feng B, Starkweather A, et al. Psychosocial and sensory factors contribute to self-reported pain and quality of life in young adults with irritable bowel syndrome. Pain Manag Nurs. 2022;23(5):646-54. https://doi.org/10.1016/j.pmn.2021.12.004
19. Bagheri Sheykhangafshe F, Farahani H, Dehghani M, Fathi-Ashtiani A. Examining Alexithymia and Post-Traumatic Stress Disorder across Different Levels of Chronic Pain in Patients. International Journal of Musculoskeletal Pain Prevention. 2025;9(2):1026-33. Doi: 10.22034/IJMPP.9.2.1026
20. Sweeney L, Moss-Morris R, Czuber-Dochan W, Murrells T, Norton C. Developing a better biopsychosocial understanding of pain in inflammatory bowel disease: a cross-sectional study. European Eur J Gastroenterol Hepatol. 2020;32(3):335-44 https://doi.org/10.1097/meg.0000000000001615
21. Bozzetti M, Marcomini I, Lo Cascio A, Magurano MR, Ribaudi E, Petralito M, et al. Exploring the Mediating Role of Self-Efficacy in the Relationship Between Caregiver Contribution and Resilience in Inflammatory Bowel Disease. Behav Sci. 2025; 15(10):1381. https://doi.org/10.3390/bs15101 381
22. Kim H, Oh Y, Chang SJ. Internet-delivered cognitive behavioral therapy in patients with irritable bowel syndrome: systematic review and meta-analysis. J Med Internet Res. 2022;24(6):e35260. DOI:

10.2196/35260
23. Wang C, Sheng Y, Yu L, Tian F, Xue Y, Zhai Q. Effects of cognitive behavioral therapy on mental health and quality of life in inflammatory bowel disease patients: a meta-analysis of randomized controlled trials. Behav Brain Res. 2023;454:114653. DOI: 10.1016/j.bbr.2023.114653
24. Goodoory VC, Khasawneh M, Thakur ER, Everitt HA, Gudleski GD, Lackner JM, et al. Effect of brain-gut behavioral treatments on abdominal pain in irritable bowel syndrome: systematic review and network meta-analysis. Gastroenterology. 2024; 167(5):934-43. DOI: 10.1053/j.gastro. 2024. 05.010
25. Islam Z, D'Silva A, Raman M, Nasser Y. The role of mind body interventions in the treatment of irritable bowel syndrome and fibromyalgia. Front Psychiatry. 2022;13:1076763. https://doi.org/ 10.3389/ fpsyt. 2022.1076763
26. Sugaya N, Shirotsuki K, Nakao M. Cognitive behavioral treatment for irritable bowel syndrome: a recent literature review. Biopsychosoc Med. 2021;15(1):23. https://doi.org/10.1186/s13030-021-00226-x
27. Yang PL, Matthews SW, Burr RL, Cain KC, Barney PG, Zia JK, et al. Cognitive behavioral therapy-based comprehensive self-management program improves presenteeism in persons with irritable bowel syndrome: a secondary data analysis. Int J Environ Res Public Health. 2022;19(5):3003. https://doi.org/10.3390/ijerph19053003
28. Kovač N, Ratković K, Watson P, Farahani H, Bagheri Sheykhangafshe F. Machine learning classification models for predicting chronic pain. Curr Psychol. 2025;44:15409–15422. https://doi.org/10.1007/s12144-025-08294-w
29. Kennedy T, Jones R, Darnley S, Seed P, Wessely S, Chalder T. Cognitive behaviour therapy in addition to antispasmodic treatment for irritable bowel syndrome in primary care: randomised controlled trial. Bmj. 2005;331(7514):435. DOI: 10.1136/bmj. 38545.505764.06
30. Roger AH, Gudleski GD, Quigley BM, Zvolensky MJ, Lackner JM. Pain catastrophizing and clinical outcomes among patients receiving a novel cognitive-behavioral therapy for irritable bowel syndrome: an experimental therapeutics approach. Behav Ther. 2023;54(4):623-36. DOI: 10.1016/ j.beth.2023.01.004
31. Lackner JM. Innovative cognitive behavioral therapies for irritable bowel syndrome: processes, predictors, platforms, and outcomes. Pain. 2024;165(7):1464-71. https://doi.org/10.1097/ j.pain.0000000000003186
32. Owusu JT, Sibelli A, Moss-Morris R, van Tilburg MA, Levy RL, Oser M. A pilot feasibility study of an unguided, internet-delivered cognitive behavioral therapy program for irritable bowel syndrome. Neurogastroenterol Motil. 2021;33(11):e14108. DOI: 10.1111/nmo.14108
33. Dunlap LJ, Jaccard J, Lackner JM. Minimal-contact versus standard cognitive behavioral therapy for irritable bowel syndrome: cost-effectiveness results of a multisite trial. Ann Behav Med. 2021;55(10):981-93. https://doi.org/10.1093/abm/kaaa119
34. Tao QF, Hua C, Zhuo X, Mou JJ, Xie CR, Zhang YX, et al. Face-to-Face Versus Digital, Telephone-Delivered, and Self-Help Cognitive Behavioral Therapy for Irritable Bowel Syndrome: Systematic Review and Bayesian Indirect Treatment Comparison Meta-Analysis. J Med Internet Res. 2026;28:e75833. doi: 10.2196/75833
35. Ashour L. A review of user-friendly freely-available statistical analysis software for medical researchers and biostatisticians. Res Stat. 2024; 2(1):2322630. https://doi.org/10.1080/27684520.2024.2322630
36. Salkovskis PM, Rimes KA, Warwick HM, Clark D. The Health Anxiety Inventory: development and validation of scales for the measurement of health anxiety and hypochondriasis. Psychol Med. 2002;32(5):843-53. https://doi.org/10.1017/S0033291702005822
37. Cohen S, Kamarck T, Mermelstein R. A global measure of perceived stress. J Health Soc Behav. 1983: 24(4): 385-396.
38. Nicholas MK. Self-efficacy and chronic pain. In: Proceedings of the Annual Conference of the British Psychological Society; 1989; St Andrews, Scotland.
39. Wright JH, Brown GK, Thase ME, Basco MR. Learning cognitive-behavior therapy: An illustrated guide. 2nd ed. Arlington (VA): American Psychiatric Publishing; 2017.