Journal Website

Article history:
Received 02 September 2025
Revised 01 January 2026
Accepted 08 January 2026
Initial Publication 21 April 2026
Final Publication 01 September 2026

International Journal of Education and Cognitive Sciences

Volume 7, Issue 3, pp 1-10

E-ISSN: 3041-8828

The Association Between Psychological Distress and Pain Perception in Patients with Irritable Bowel Syndrome: The Mediating Role of Behavioral Activation and Inhibition Systems

Masoumeh. HosseinVerdi[1], Somayeh. Keshavarz[2*], Hasan. Abdollahzadeh[3]

[1] Department of Psychology, Go.C., Islamic Azad University, Gorgan, Iran
[2] Assistant Professor, Department of Psychology, Faculty of Social Science, Imam Khomeini International University, Qazvin, Iran
[3] Associate Professor, Department of Psychology, Payame Noor University, Tehran, Iran

*** Corresponding author email address**: s.keshavarz@soc.ikiu.ac.ir

A r t i c l e I n f o

Article type:
Original Research

How to cite this article:
HosseinVerdi, M., Keshavarz, S., & Abdollahzadeh, H. (2026). The Association Between Psychological Distress and Pain Perception in Patients with Irritable Bowel Syndrome: The Mediating Role of Behavioral Activation and Inhibition Systems. *International Journal of Education and Cognitive Sciences, 7*(3), 1-10.
https://doi.org/10.61838/kman.ijecs.333

© 2026 the authors. Published by Iranian Association for Intelligence and Talent Studies, Tehran, Iran. This is an open access article under the terms of the Creative Commons Attribution-NonCommercial 4.0 International (CC BY-NC 4.0) License.

A B S T R A C T

Purpose: This study aimed to examine the association between psychological distress and pain perception in individuals with Irritable Bowel Syndrome (IBS), with particular emphasis on the mediating roles of the Behavioral Activation System (BAS) and the Behavioral Inhibition System (BIS).

Methods and Materials: A descriptive–correlational design based on structural equation modeling (path analysis) was employed. The statistical population consisted of patients diagnosed with IBS who attended the Masoud Gastrointestinal and Liver Clinic in Tehran in 2024. Using convenience sampling, 320 patients were recruited. Data were collected using the Kessler Psychological Distress Scale (Kessler et al., 2002), the McGill Pain Questionnaire (Melzack, 1975), and the BIS/BAS Scales (Carver & White, 1994). Path analysis was conducted using IBM SPSS AMOS version 24.

Findings: Psychological distress showed a significant direct association with pain perception. In addition, BAS and BIS were significantly associated with pain perception. Bootstrapping analyses confirmed that both BAS and BIS significantly mediated the relationship between psychological distress and pain perception in patients with IBS.

Conclusion: The findings indicate that pain perception in IBS is influenced both directly and indirectly by psychological distress through its effects on behavioral activation and inhibition systems. These results highlight the importance of simultaneously addressing emotional distress and behavioral regulation processes in psychological and multidisciplinary interventions aimed at reducing pain perception in individuals with IBS.

Keywords: *Pain perception; Psychological distress; Behavioral activation system; Behavioral inhibition system; Irritable bowel syndrome*

1. Introduction

Irritable Bowel Syndrome (IBS) is among the most prevalent functional gastrointestinal disorders worldwide and constitutes a major challenge for modern healthcare systems due to its chronic, relapsing, and multidimensional symptom pattern. Clinically, IBS is defined by recurrent abdominal pain associated with changes in bowel habits and heightened visceral sensitivity, in the absence of identifiable organic pathology (Hung et al., 2023; Tian et al., 2023). The disorder exerts a profound negative impact on patients' quality of life, occupational functioning, interpersonal relationships, and psychological well-being, and is associated with substantial economic costs and increased healthcare utilization (AlDosari et al., 2024; Fan et al., 2024). Among the various manifestations of IBS, persistent abdominal pain remains the most disabling and treatment-resistant symptom, serving as the principal determinant of disease burden and functional impairment (AlDosari et al., 2024; Fan et al., 2024; Marano et al., 2025). Contemporary conceptualizations of IBS emphasize that the disorder emerges from complex interactions between the gastrointestinal tract and the central nervous system within the framework of the gut–brain axis, wherein biological, psychological, and behavioral processes continuously influence symptom expression (Hung et al., 2023; Tian et al., 2023). In this model, pain perception is no longer viewed as a direct consequence of peripheral nociceptive input alone but rather as a multidimensional construct shaped by cognitive appraisal, emotional states, motivational processes, and behavioral regulation mechanisms (Farahani et al., 2025; Horsburgh et al., 2024; Özdemir & Kuru, 2023).

A substantial body of empirical evidence demonstrates that psychological distress plays a central role in modulating pain perception in IBS. Psychological distress, encompassing anxiety, depressive symptoms, chronic stress, and emotional dysregulation, is consistently elevated in IBS populations and is strongly associated with greater pain severity, increased symptom frequency, and poorer quality of life (Coleman et al., 2024; Marano et al., 2025; Tarar et al., 2023). Large epidemiological studies further indicate that the co-occurrence of chronic pain and psychological distress produces compounded functional disability and amplifies health-care utilization, emphasizing the clinical significance of emotional factors in pain disorders (Jennifer et al., 2024; Ounajim et al., 2021). Cognitive-affective models of pain propose that distress heightens attentional focus on bodily sensations, increases threat interpretation of visceral cues, and promotes maladaptive cognitive patterns such as catastrophizing and rumination, which collectively intensify subjective pain experience (Horsburgh et al., 2024; Özdemir & Kuru, 2023). Neurobiological research provides further support for this association, demonstrating that chronic psychosocial distress induces sustained neuroinflammatory responses and maladaptive neuroplastic changes in central pain networks, thereby lowering pain thresholds and strengthening central sensitization mechanisms (Fülöp et al., 2025). Longitudinal investigations reveal that distress and pain reinforce one another over time, creating a self-perpetuating cycle in which psychological distress exacerbates abdominal pain while persistent pain simultaneously deepens emotional distress (Engel et al., 2022; Pletikosić Tončić et al., 2025). This bidirectional dynamic offers a compelling explanation for the chronicity and therapeutic resistance frequently observed in IBS.

Nevertheless, marked heterogeneity exists in patients' symptom profiles. Not all individuals with elevated distress experience severe pain, and conversely, some patients report intense pain despite only moderate levels of emotional distress. This variability highlights the importance of identifying mediating mechanisms that translate psychological distress into altered pain perception. One prominent framework for understanding such mechanisms is Gray's theory of the Behavioral Inhibition System (BIS) and Behavioral Activation System (BAS), operationalized by Carver and White (Carver & White, 1994). These neurobehavioral systems regulate sensitivity to threat and reward and play a critical role in emotional processing, motivational orientation, and behavioral control. The BIS is responsive to signals of punishment, uncertainty, and potential danger and promotes avoidance, vigilance, and anxiety, whereas the BAS governs approach behavior, reward responsiveness, and goal-directed engagement. Extensive empirical research indicates that individual differences in BIS/BAS functioning are closely linked to emotional regulation capacity, vulnerability to psychopathology, and adaptive versus maladaptive coping styles (Firoozjah et al., 2022; Sam et al., 2025). Developmental models further suggest that chronic stress exposure may sensitize BIS circuitry while suppressing BAS responsiveness, thereby increasing vulnerability to affective and stress-related disorders (Fülöp et al., 2025; Ostlund & Pérez-Edgar, 2023).

Within the context of pain, BIS and BAS exert substantial influence on how individuals interpret, respond to, and regulate nociceptive input. Chronic pain populations

E-ISSN: 3041-8828

consistently exhibit elevated BIS activity and diminished BAS functioning, reflecting heightened threat sensitivity, avoidance tendencies, and reduced engagement in rewarding activities (Sánchez-Rodríguez et al., 2021; Turner et al., 2021). Such behavioral tendencies directly contribute to pain maintenance by reinforcing hypervigilance toward bodily sensations, restricting adaptive coping strategies, and amplifying emotional distress (Bartley et al., 2024; Kircher et al., 2023). Neurophysiological findings indicate that BIS-related neural circuits substantially overlap with brain regions implicated in pain modulation, including the amygdala, anterior cingulate cortex, insula, and prefrontal cortex, thereby facilitating threat-based amplification of nociceptive signals (Farahani et al., 2025; Fülöp et al., 2025). Conversely, robust BAS functioning supports endogenous pain inhibition by promoting motivational engagement, positive affect, and persistence in valued activities (Bartley et al., 2024; Kircher et al., 2023). Clinical interventions aimed at strengthening BAS functioning—such as behavioral activation, positive psychology, and solution-focused therapies—have demonstrated efficacy in reducing pain intensity and improving functional outcomes in chronic pain populations (Bartley et al., 2024; Naderipour et al., 2023).

In IBS specifically, emerging evidence suggests that BIS and BAS constitute critical pathways through which psychological distress shapes pain perception. IBS patients frequently display elevated anxiety sensitivity, threat monitoring, and avoidance behavior—core features of heightened BIS activation—alongside diminished motivation for pleasurable and goal-directed activities, reflecting reduced BAS functioning (Marano et al., 2025; Pletikosić Tončić et al., 2025). These neurobehavioral patterns interact with distress-related cognitive distortions and emotional dysregulation, intensifying visceral hypersensitivity and reinforcing maladaptive pain processing. Global bibliometric analyses of IBS research confirm that psychological and behavioral mechanisms are increasingly recognized as central determinants of symptom severity and disease course (Tian et al., 2023). Gender-based studies further indicate that these mechanisms may operate with particular strength in female IBS populations, where emotional distress and behavioral dysregulation demonstrate stronger associations with pain severity and functional impairment (Fan et al., 2024; Marano et al., 2025).

Although previous research has independently documented associations among psychological distress, pain perception, and BIS/BAS functioning, the precise mechanisms through which these variables interact remain insufficiently understood. Most existing studies have examined these constructs in isolation or through simple correlational frameworks, leaving the mediating processes that connect emotional distress to pain perception largely unexplored. Given the multidimensional nature of IBS and the substantial individual variability in symptom expression, elucidating these mediating mechanisms is essential for advancing theoretical understanding and improving clinical interventions.

The aim of the present study was to examine the association between psychological distress and pain perception in patients with Irritable Bowel Syndrome, with particular emphasis on the mediating roles of the Behavioral Activation System and the Behavioral Inhibition System.

2. Methods and Materials

2.1. Study Design and Participants

The present study was fundamental in terms of objective and employed a descriptive-correlational design using structural equation modeling (path analysis). The statistical population comprised all patients diagnosed with Irritable Bowel Syndrome (IBS) attending the Masoud Gastrointestinal and Liver Clinic in Tehran during 2024.

A sample of 320 participants was selected via convenience sampling. Based on Kline's (2016) guidelines for determining sample size in path analysis, the number of free parameters in the model serves as the criterion, with a recommendation of 10 to 20 participants per parameter. Accordingly, a sample size of 320 was deemed appropriate, and questionnaires were distributed among the selected participants.

Inclusion criteria were: (1) a diagnosis of Irritable Bowel Syndrome based on Rome IV criteria, confirmed by a gastroenterologist; (2) absence of specific psychiatric disorders and non-use of psychiatric medications; (3) willingness to participate in the study; and (4) age range between 20 and 45 years. Exclusion criteria included withdrawal from the study or submission of incomplete questionnaires.

Following the approval of the research topic by the Islamic Azad University and obtaining the necessary permits from the medical center, researchers visited the Masoud Gastrointestinal and Liver Clinic to collect data. Participants were provided with necessary explanations regarding the confidentiality of their information, and their trust was

E-ISSN: 3041-8828

secured to ensure voluntary participation. It is noteworthy that incomplete questionnaires or those failing to meet the inclusion criteria were excluded from the final analysis The study adhered to ethical principles, including informed and voluntary consent, the right to withdraw, privacy and confidentiality, non-maleficence, avoidance of discrimination, non-exploitation, and protection against harm resulting from participation. The collected data were analyzed using path analysis via IBM SPSS AMOS version 24.

2.2. Measures

McGill Pain Questionnaire (MPQ): The *McGill Pain Questionnaire* (MPQ), developed by Melzack (1975), consists of 20 sets of descriptive words designed to assess the multidimensional nature of pain perception. Scoring is performed on a dichotomous scale (0–1); if the respondent selects a descriptor within a set, a score of 1 is assigned, whereas no selection yields a score of 0. Exploratory and confirmatory factor analyses have supported a four-component structure comprising Sensory, Affective, Evaluative, and Miscellaneous dimensions. Kuder-Richardson coefficients for these dimensions have been reported as .77, .91, .75, and .89, respectively. Dworkin et al. (2009) reported a Cronbach's alpha of .95 and a content validity index of .61 for this instrument. In the Iranian context, Naderi Pour et al. (2023) reported reliability coefficients ranging from .79 to .85 across dimensions, and a content validity index of .87. In the present study, the internal consistency of the scale was calculated using Cronbach's alpha, yielding a coefficient of .73.

Kessler Psychological Distress Scale (K10): The *Kessler Psychological Distress Scale* (K10) was developed by Kessler et al. (2002) to assess non-specific psychological distress. This instrument consists of 10 items, rated on a 5-point Likert scale ranging from 0 (*None of the time*) to 4 (*All of the time*). The total score ranges from 0 to 40, with higher scores indicating greater levels of psychological distress. Research indicates a strong association between high K10 scores and diagnoses of anxiety and mood disorders based on the Composite International Diagnostic Interview (CIDI). The scale demonstrates good convergent validity, showing a correlation of .70 with the Hospital Anxiety and Depression Scale (HADS). Cronbach's alpha reliability has been reported as .94. In the Iranian context, Vaziri and Lotfi Kashani reported a correlation of .83 with the General Health Questionnaire (GHQ) and reliability coefficients of .90 using Cronbach's alpha and .86 using the split-half method (Arsanjan, 2021). In the present study, the internal consistency of the scale was calculated using Cronbach's alpha, yielding a coefficient of .85.

Behavioral Inhibition/Activation Systems (BIS/BAS) Scales: The *BIS/BAS Scales*, developed by Carver and White (1994), are a self-report inventory designed to assess the dispositional sensitivities of the Behavioral Inhibition System (BIS) and the Behavioral Activation System (BAS). This instrument comprises 24 items. The BIS scale (7 items) measures sensitivity to punishment cues. The BAS scale consists of three subscales: Reward Responsiveness (5 items), Drive (4 items), and Fun Seeking (4 items). Carver and White reported internal consistency (Cronbach's alpha) of .74 for the BIS scale. For the BAS subscales—Reward Responsiveness, Drive, and Fun Seeking—alphas were reported as .73, .76, and .66, respectively. The psychometric properties of the Persian version have been confirmed in Iranian university students by Mohammadi (2008). Abdollahi Majarshin (2006) reported test-retest reliability coefficients of .78 for the BAS and .81 for the BIS (Mansouri et al., 2018). In the present study, internal consistency using Cronbach's alpha was calculated as .78 for Behavioral Activation and .81 for Behavioral Inhibition.

2.3. Data Analysis

To assess univariate normality, a widely accepted criterion suggests that data deviate from a normal distribution if skewness and kurtosis values fall outside the range of ±2. As indicated by the data in Table 1, the skewness and kurtosis indices for none of the indicators exceed the (-2, +2) range; therefore, the data can be considered normally or approximately normally distributed. A primary assumption of structural equation modeling, including path analysis, is multivariate normality. To verify this assumption, Mardia's multivariate kurtosis coefficient was examined using IBM SPSS AMOS 24. The obtained value for Mardia's coefficient in the present study was 3.29, indicating that the assumption of multivariate normality was met. To screen for multivariate outliers, Mahalanobis distance (d2) was evaluated, using a significance level of $p < .05$ to identify potential outliers. Based on this criterion, no significant multivariate outliers were identified. To examine multicollinearity among predictor variables, Tolerance and Variance Inflation Factor (VIF) indices were utilized.

E-ISSN: 3041-8828

3. Findings and Results

The study sample consisted of 320 patients with Irritable Bowel Syndrome (IBS), of whom 101 (31.6%) were male, and 219 (68.4%) were female. Regarding age distribution, 198 participants (61.9%) were aged 20–30 years, and 103 participants (38.1%) were aged 31–45 years. In terms of educational attainment, 114 participants (35.6%) held a high school diploma or associate degree, 129 (40.3%) held a bachelor's degree, and 77 (24.1%) possessed a master's degree or higher.

Table 1

Descriptive Statistics of Study Variables

Variable	M	SD	Skewness	Kurtosis
Psychological Distress	24.78	8.31	-0.19	-0.46
Behavioral Inhibition (BIS)	14.93	3.40	0-.24	0.45
Behavioral Activation (BAS)	37.41	9.60	-0.94	0-.47
Pain Perception	49.33	8.04	-0.43	0.16

Table 1 presents normality assumptions were satisfied (skewness and kurtosis within ±2). Mardia's multivariate kurtosis coefficient was 3.29, supporting multivariate normality. No multivariate outliers or multicollinearity issues were detected.

Table 2

Correlation matrix of research variables

Variable	1	2	3	4
1. Psychological Distress	1			
2. Behavioral Inhibition (BIS)	0-.45**	1		
3. Behavioral Activation (BAS)	0.28**	-0.41**	1	
4. Pain Perception	0.54**	0.36**	-0.29**	1

**p<0.01

The results presented in Table 2 indicate that the relationships between the study variables are statistically significant at the 95% confidence level ($p < 0.05$).

Table 3

Goodness-of-Fit Indices for the Proposed Model

Model	$\chi 2$/df	GFI	PCFI	PNFI	CFI	IFI	RMSEA
Proposed Model	2.69	0.923	0.758	0.798	0.924	0.919	0.067

Note. Acceptable thresholds: CMIN/DF < 3; RMSEA < .08; CFI, GFI, IFI > .9; PCFI, PNFI > .5.

Table 3 reports the key goodness-of-fit indices for the proposed conceptual model. To evaluate the model fit, the following indices were examined: the Chi-square to degrees of freedom ratio (x2/df), Root Mean Square Error of Approximation (RMSEA), Goodness of Fit Index (GFI), Comparative Fit Index (CFI), Normed Fit Index (NFI), Incremental Fit Index (IFI), and Parsimony Normed Fit Index (PNFI).

Additionally, the R2 index represents the amount of explained variance in the endogenous latent variables. Psychological distress showed a significant direct effect on pain perception ($\beta = .50$, $p < .001$). BAS negatively predicted pain perception ($\beta = -.31$, $p < .001$), while BIS positively predicted pain perception ($\beta = .35$, $p < .001$). Psychological distress was negatively associated with BAS ($\beta = -.46$, $p < .001$) and positively associated with BIS ($\beta = .27$, $p < .001$). Bootstrapping analysis (2,000 samples, 95% CI) indicated significant indirect effects through both BAS (CI [.12, .23]) and BIS (CI [.08, .19]), confirming partial mediation.

E-ISSN: 3041-8828

Table 4

Coefficients and Significance of Direct Effects of Research Variables

Outcome Variable	Predictor Variable	Effect Type	Unstandardized Coefficient	Standardized Coefficient (β)	t	Sig.
Pain Perception	Psychological Distress	Direct	0.78	0.50	7.19	0.001
Pain Perception	Behavioral Activation	Direct	-0.36	-.31	-5.18	0.001
Pain Perception	Behavioral Inhibition	Direct	0.48	0.35	5.47	0.001
Behavioral Activation	Psychological Distress	Direct	-0.39	-.46	-6.93	0.001
Behavioral Inhibition	Psychological Distress	Direct	0.44	0.27	4.50	0.001

According to the Table above, the direct relationship between Psychological Distress and Pain Perception was significant (β = .50, t = 7.19). Similarly, the direct relationship between Behavioral Activation and Pain Perception was significant (β = -.31, t = -5.18), as was the direct relationship between Behavioral Inhibition and Pain Perception (β = .35, t = 5.47). Furthermore, the direct relationship between Psychological Distress and Behavioral Activation was significant (β = -.46, t = -6.93), and its direct relationship with Behavioral Inhibition was also significant (β = .27, t = 4.50).

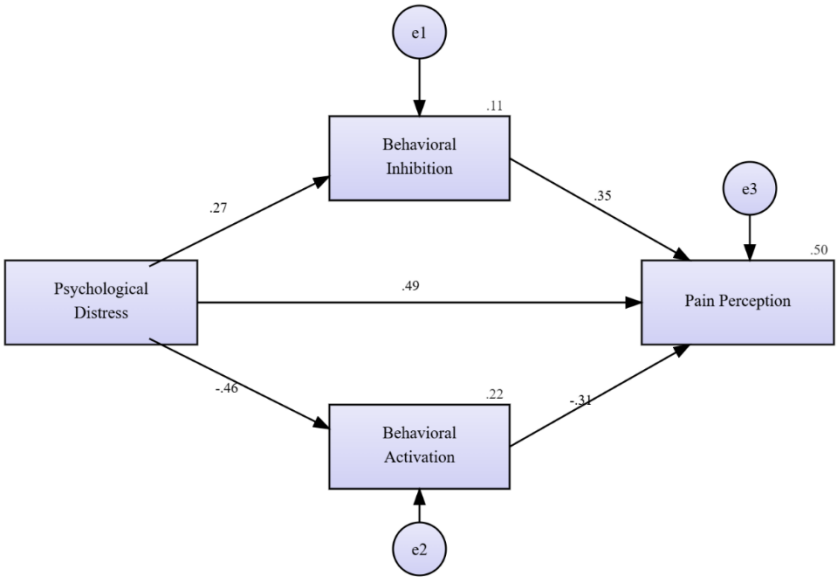
Table 5

Coefficients and Significance of Indirect Effect of Psychological Distress on Pain Perception

Outcome Variable	Predictor Variable	Effect Type	Data (B)	Error (SE)	Lower Limit	Upper Limit	Sig.
Pain Perception	Psychological Distress	Mediated by Behavioral Activation	0.15	0.03	0.12	0.23	.001
Pain Perception	Psychological Distress	Mediated by Behavioral Inhibition	0.11	0.02	0.08	0.19	.001

Figure 1

Path Analysis Model of the Research in Standardized Coefficients Mode



The results in Table 5 indicate that for the mediating role of Behavioral Activation between psychological distress and pain perception, the 95% confidence interval (CI) ranged from .12 to .23. Similarly, for Behavioral Inhibition mediating the relationship between psychological distress and pain perception, the 95% CI ranged from .08 to .19. The

E-ISSN: 3041-8828

analysis was conducted using 2,000 bootstrap samples at a 95% confidence level. Given that zero is excluded from these confidence intervals, the indirect effects are statistically significant. Therefore, both behavioral activation and behavioral inhibition significantly mediate the relationship between psychological distress and pain perception in patients with Irritable Bowel Syndrome (IBS).

4. Discussion and Conclusion

The present study investigated the association between psychological distress and pain perception in patients with Irritable Bowel Syndrome (IBS), with specific emphasis on the mediating roles of the Behavioral Activation System (BAS) and Behavioral Inhibition System (BIS). The findings provide compelling evidence that psychological distress exerts a substantial direct influence on pain perception, while simultaneously shaping pain experience indirectly through its effects on both behavioral activation and behavioral inhibition. The structural equation model demonstrated excellent fit indices and revealed that psychological distress significantly predicted pain perception, with higher distress levels associated with greater perceived pain. These findings reinforce contemporary biopsychosocial models of IBS, which conceptualize pain as an emergent product of interacting biological, psychological, and behavioral processes rather than a purely peripheral nociceptive phenomenon (Hung et al., 2023; Tian et al., 2023).

The strong direct association between psychological distress and pain perception observed in this study is consistent with a robust body of prior research. Large-scale epidemiological investigations and clinical studies have consistently demonstrated that anxiety, depression, and chronic stress are among the most powerful predictors of pain severity and symptom persistence in IBS populations (Coleman et al., 2024; Marano et al., 2025; Tarar et al., 2023). Patients experiencing higher levels of psychological distress report more frequent abdominal pain episodes, heightened visceral sensitivity, and greater functional impairment (Jennifer et al., 2024; Ounajim et al., 2021). The present findings extend this literature by confirming that this association remains strong even when accounting for the contribution of motivational and regulatory behavioral systems.

From a mechanistic perspective, psychological distress intensifies pain perception through several interrelated processes. Distress heightens vigilance toward bodily sensations, biases cognitive appraisal toward threat interpretation, and promotes maladaptive cognitive styles such as catastrophizing and rumination, all of which amplify subjective pain experience (Horsburgh et al., 2024; Özdemir & Kuru, 2023). Moreover, sustained emotional distress induces neuroinflammatory responses and maladaptive neuroplastic changes in central pain processing networks, thereby lowering pain thresholds and enhancing central sensitization (Fülöp et al., 2025). Longitudinal research further demonstrates that distress and pain reinforce one another in a self-perpetuating cycle, wherein psychological distress exacerbates abdominal pain while persistent pain deepens emotional distress (Engel et al., 2022; Pletikosić Tončić et al., 2025). The present findings empirically support this bidirectional model and underscore the necessity of addressing emotional distress as a core component of IBS pain management.

Beyond the direct effect of distress on pain perception, the present study revealed that both BAS and BIS serve as significant mediators in this relationship. Specifically, psychological distress was negatively associated with BAS and positively associated with BIS. In turn, reduced BAS and elevated BIS independently predicted higher levels of pain perception. These findings align with and extend previous research demonstrating that chronic pain populations exhibit characteristic profiles of diminished behavioral activation and heightened behavioral inhibition (Sánchez-Rodríguez et al., 2021; Turner et al., 2021). Such profiles reflect increased threat sensitivity, avoidance behavior, and reduced engagement in rewarding or goal-directed activities, which collectively maintain and exacerbate pain-related disability.

The mediating role of BAS provides critical insight into how psychological distress translates into heightened pain perception. BAS governs approach behavior, reward sensitivity, motivation, and persistence in goal-directed activity. When psychological distress suppresses BAS functioning, patients become less engaged in adaptive behaviors that might otherwise buffer pain, such as physical activity, social interaction, and pursuit of meaningful goals. Reduced BAS functioning is associated with diminished positive affect, impaired coping capacity, and increased emotional dysregulation (Firoozjah et al., 2022; Sam et al., 2025). These factors weaken endogenous pain inhibition and increase vulnerability to distress-induced pain amplification. The present findings are consistent with clinical intervention studies demonstrating that enhancing behavioral activation through structured activity scheduling, positive psychology

E-ISSN: 3041-8828

interventions, and solution-focused therapy significantly reduces pain intensity and improves quality of life in chronic pain populations (Bartley et al., 2024; Naderipour et al., 2023). Thus, BAS emerges not merely as a correlate but as a mechanistic pathway through which emotional distress is converted into altered pain perception.

The mediating role of BIS further clarifies the distress–pain relationship. BIS reflects sensitivity to threat, punishment, and uncertainty and promotes avoidance, hypervigilance, and anxiety. Psychological distress strongly increases BIS activation, which in turn amplifies pain perception by heightening attention to visceral sensations and reinforcing maladaptive appraisal patterns. Individuals with elevated BIS are predisposed to catastrophizing, selective attention to somatic cues, and anticipation of negative outcomes, which sustain emotional arousal and intensify visceral hypersensitivity (Ostlund & Pérez-Edgar, 2023; Özdemir & Kuru, 2023). Neurobiologically, BIS-related circuits overlap extensively with central pain modulation networks, including the amygdala, anterior cingulate cortex, insula, and prefrontal cortex, thereby facilitating threat-based amplification of nociceptive signals (Farahani et al., 2025; Fülöp et al., 2025). The present findings therefore provide empirical support for theoretical models proposing that behavioral inhibition constitutes a core vulnerability factor in chronic pain disorders.

Importantly, the combined mediating effects of BAS and BIS illuminate why patients with comparable levels of psychological distress may exhibit markedly different pain experiences. Individuals whose distress primarily suppresses BAS may suffer from reduced engagement and diminished resilience, whereas those whose distress strongly activates BIS may experience heightened threat perception and hypervigilance. In both pathways, distress is translated into amplified pain through distinct but interacting neurobehavioral mechanisms. These findings help explain the substantial heterogeneity in IBS symptom trajectories and reinforce the inadequacy of purely biomedical approaches to pain management.

The present results are also consistent with emerging IBS research emphasizing the centrality of psychological and behavioral mechanisms in symptom expression. Bibliometric analyses of global IBS literature reveal an increasing focus on psychological distress, emotional regulation, and behavioral processes as primary determinants of disease severity (Tian et al., 2023). Clinical studies further demonstrate that female IBS patients, who constitute a majority of IBS populations, exhibit particularly strong associations between distress, behavioral dysregulation, and pain perception (Fan et al., 2024; Marano et al., 2025). These findings converge with the present study's results and underscore the importance of integrative models that simultaneously address emotional, cognitive, and behavioral dimensions of IBS.

Collectively, the findings of this study provide strong support for a comprehensive biopsychosocial framework in which psychological distress influences pain perception both directly and indirectly through behavioral activation and inhibition systems. This integrated model offers a more precise understanding of IBS pathophysiology and provides a coherent theoretical foundation for designing more effective multidisciplinary interventions.

Despite the strengths of the present study, several limitations should be acknowledged. The cross-sectional design precludes causal inference, and the reliance on self-report measures may introduce response biases. The use of convenience sampling limits generalizability, and potential biological or pharmacological confounders were not controlled. Additionally, cultural and contextual factors unique to the sampled population may restrict the applicability of the findings to other settings.

Future investigations should employ longitudinal and experimental designs to clarify causal pathways among psychological distress, behavioral systems, and pain perception. Neurobiological measures should be integrated to further elucidate the underlying neural mechanisms. Researchers should also examine whether targeted interventions that modify BAS and BIS functioning produce sustained reductions in pain and distress among diverse IBS populations.

Clinical practice should incorporate comprehensive psychological assessment into routine IBS care. Interventions should simultaneously target emotional distress, enhance behavioral activation, and reduce maladaptive behavioral inhibition. Multidisciplinary treatment models integrating gastroenterology, psychology, and behavioral therapy are likely to yield the most durable improvements in pain management and quality of life for IBS patients.

Authors' Contributions

All authors significantly contributed to this study.

Declaration

E-ISSN: 3041-8828

In order to correct and improve the academic writing of our paper, we have used the language model ChatGPT.

Transparency Statement

Data are available for research purposes upon reasonable request to the corresponding author.

Acknowledgments

We hereby thank all individuals for participating and cooperating us in this study.

Declaration of Interest

The authors report no conflict of interest.

Funding

According to the authors, this article has no financial support.

Ethical Considerations

In this study, to observe ethical considerations, participants were informed about the goals and importance of the research before the start of the interview and participated in the research with informed consent.

References

AlDosari, M. N., Alotaibi, R. M., Algahtani, M. N., Alshammari, T. S., Almziri, B. F., Alotaibi, R., & Alshammari, T. (2024). Assessing the Impact of Irritable Bowel Syndrome on Quality of Life in Patients at Family Medicine and Primary Health Care Clinics of the National Guard Health Affairs, Riyadh. *Cureus*, *16*(12). https://doi.org/10.7759/cureus.76158

Bartley, E. J., Ofri, B. L., Vasilopoulos, T., Palit, S., Torres, C. A., & Sibille, K. T. (2024). Promoting a foundation of resilience in older adults: pilot trial of a strengths-based positive psychology intervention for chronic low back pain. *Health Psychology and Behavioral Medicine*, *12*(1), 2434711. https://doi.org/10.1080/21642850.2024.2434711

Carver, C. S., & White, T. L. (1994). Behavioral inhibition, behavioral activation, and affective responses to impending reward and punishment: The BIS/BAS Scales. *Journal of personality and social psychology*, *67*(2), 319-333. https://doi.org/10.1037/0022-3514.67.2.319

Coleman, J. N., Arthur, S. S., & Shelby, R. A. (2024). Psychological distress and pain related to gynecologic exams among female survivors of sexual and physical violence: A systematic review. *Journal of Traumatic Stress*, *37*(2), 217-230. https://doi.org/10.1002/jts.23006

Engel, F., Stadnitski, T., Stroe-Kunold, E., Berens, S., Schäfert, R., & Wild, B. (2022). Temporal relationships between abdominal pain, psychological distress and coping in patients with IBS: A time series approach. *Frontiers in Psychiatry*, *13*, 768134. https://doi.org/10.3389/fpsyt.2022.768134

Fan, W., Chen, Y., Fang, X., Zhu, L., Fei, G., Lu, J., & Li, X. (2024). Gender differences in gastrointestinal, biopsychosocial and healthcare-seeking behaviors in Chinese patients with irritable bowel syndrome predominant with diarrhea. *BMC Gastroenterology*, *24*(1), 102. https://doi.org/10.1186/s12876-024-03153-7

Farahani, H., Kovač, N., Fardi, H., & Watson, P. C. (2025). Modelling Pain Perception Using Fuzzy Cognitive Maps. *Journal of Pain Research*, 5153-5174. https://doi.org/10.2147/JPR.S525200

Firoozjah, M. H., Homayouni, A., Shahrbanian, S., Shahriari, S., & Janinejad, D. (2022). Behavioral activation/inhibition systems and lifestyle as predictors of mental disorders in adolescent athletes during Covid19 pandemic. *BMC public health*, *22*(1), 1444. https://doi.org/10.1186/s12889-022-13816-3

Fülöp, B., Borbély, É., & Helyes, Z. (2025). How does chronic psychosocial distress induce pain? Focus on neuroinflammation and neuroplasticity changes. *Brain, Behavior, & Immunity-Health*, 100964. https://doi.org/10.1016/j.bbih.2025.100964

Horsburgh, A., Summers, S. J., Lewis, A., Keegan, R. J., & Flood, A. (2024). The relationship between pain and Interoception: A systematic review and meta-analysis. *The Journal of Pain*, *25*(7), 104476. https://doi.org/10.1016/j.jpain.2024.01.341

Hung, T. H., Wang, C. Y., & Lee, H. F. (2023). Update in diagnosis and management of irritable bowel syndrome. *Tzu Chi Medical Journal*, *35*(4), 306-311. https://doi.org/10.4103/tcmj.tcmj_104_23

Jennifer, S., Brady, B. R., Ibrahim, M. M., Herder, K. E., Wallace, J. S., Padilla, A. R., & Vanderah, T. W. (2024). Co-occurrence of chronic pain and anxiety/depression symptoms in US adults: prevalence, functional impacts, and opportunities. *Pain*, *165*(3), 666-673. https://doi.org/10.1097/j.pain.0000000000003056

Kircher, J. A., Charles, S. T., Sin, N. L., & Almeida, D. M. (2023). Chronic pain and affective experiences associated with daily stressors and uplifts. *International Journal of Applied Positive Psychology*, *8*(3), 485-500. https://doi.org/10.1007/s41042-023-00101-w

Marano, G., Traversi, G., Pola, R., Gasbarrini, A., Gaetani, E., & Mazza, M. (2025). Irritable Bowel Syndrome: A Hallmark of Psychological Distress in Women? *Life*, *15*(2), 277. https://doi.org/10.3390/life15020277

Naderipour, A., Toozandehjani, H., Bagherzadeh Golmakani, Z., & Zendehdel, A. (2023). The effectiveness of short-term solution-oriented psychotherapy on pain perception and distress tolerance in female patients with multiple sclerosis. *Rooyesh*, *12*(5), 75-84. http://frooyesh.ir/files/site1/user_files_3380b3/0041884582-A-10-8543-2-cbd9642.pdf

Ostlund, B., & Pérez-Edgar, K. (2023). Two-hit model of behavioral inhibition and anxiety. *Annual Review of Developmental Psychology*, *5*(1), 239-261. https://doi.org/10.1146/annurev-devpsych-120621-043722

Ounajim, A., Billot, M., Louis, P. Y., Slaoui, Y., Frasca, D., Goudman, L., & Rigoard, P. (2021). Finite mixture models based on pain intensity, functional disability and psychological distress composite assessment allow identification of two distinct classes of persistent spinal pain syndrome after surgery patients related to their quality of life. *Journal of clinical medicine*, *10*(20), 4676. https://doi.org/10.3390/jcm10204676

Özdemir, İ., & Kuru, E. (2023). Investigation of cognitive distortions in panic disorder, generalized anxiety disorder and social anxiety disorder. *Journal of clinical medicine*, *12*(19), 6351. https://doi.org/10.3390/jcm12196351

E-ISSN: 3041-8828

Pletikosić Tončić, S., Tončić, M., & Bradić, S. (2025). Anxiety Moderates the Relationship Between Stress and Pain in IBS Patients: A Prospective Diary Study. *Gastrointestinal Disorders*, *7*(3), 50. https://doi.org/10.3390/gidisord7030050

Sam, M., Pirkhaefi, A., & Asgharanjad Farid, A. A. (2025). The role of brain inhibition/activation systems (BIS/BAS) in impulsivity with a mediating role of emotion dysregulation in female vocational school teenagers with borderline personality disorder. *Journal of Psychological Science*, *24*(145), 221-237. http://psychologicalscience.ir/article-1-2414-en.pdf

Sánchez-Rodríguez, E., Racine, M., Castarlenas, E., Tomé-Pires, C., Galán, S., Jensen, M. P., & Miró, J. (2021). Behavioral activation and inhibition systems: further evaluation of a BIS-BAS model of chronic pain. *Pain Medicine*, *22*(4), 848-860. https://doi.org/10.1093/pm/pnaa330

Tarar, Z. I., Farooq, U., Zafar, Y., Gandhi, M., Raza, S., Kamal, F., & Ghouri, Y. A. (2023). Burden of anxiety and depression among hospitalized patients with irritable bowel syndrome: a nationwide analysis. *Irish Journal of Medical Science (1971-)*, *192*(5), 2159-2166. https://doi.org/10.1007/s11845-022-03258-6

Tian, S., Zhang, H., Chen, S., Wu, P., & Chen, M. (2023). Global research progress of visceral hypersensitivity and irritable bowel syndrome: bibliometrics and visualized analysis. *Frontiers in Pharmacology*, *14*, 1175057. https://doi.org/10.3389/fphar.2023.1175057

Turner, A. P., Jensen, M. P., Day, M. A., & Williams, R. M. (2021). Behavioral activation and behavioral inhibition: An examination of function in chronic pain. *Rehabilitation Psychology*, *66*(1), 57. https://doi.org/10.1037/rep0000316

E-ISSN: 3041-8828