



International Journal of Innovative Technologies in Social Science

e-ISSN: 2544-9435

Operating Publisher
SciFormat Publishing Inc.
ISNI: 0000 0005 1449 8214

2734 17 Avenue SW,
Calgary, Alberta, T3E0A7,
Canada
+15878858911
editorial-office@sciformat.ca

ARTICLE TITLE	CURRENT DIRECTIONS IN RESEARCH ON IRRITABLE BOWEL SYNDROME (IBS): PATHOPHYSIOLOGY, DIAGNOSIS, AND THERAPEUTIC PERSPECTIVES
----------------------	--

DOI	https://doi.org/10.31435/ijitss.4(52).2026.6255
------------	---

RECEIVED	14 August 2026
-----------------	----------------

ACCEPTED	13 October 2026
-----------------	-----------------

PUBLISHED	21 October 2026
------------------	-----------------

LICENSE



The article is licensed under a **Creative Commons Attribution 4.0 International License**.

© The author(s) 2026.

This article is published as open access under the Creative Commons Attribution 4.0 International License (CC BY 4.0), allowing the author to retain copyright. The CC BY 4.0 License permits the content to be copied, adapted, displayed, distributed, republished, or reused for any purpose, including adaptation and commercial use, as long as proper attribution is provided.

CURRENT DIRECTIONS IN RESEARCH ON IRRITABLE BOWEL SYNDROME (IBS): PATHOPHYSIOLOGY, DIAGNOSIS, AND THERAPEUTIC PERSPECTIVES

Marlena Radzka (Corresponding Author, Email: lek.m.radzka@gmail.com)

Medical University of Lodz, Al. Kościuszki 4, 90-419 Łódź, Poland

ORCID ID: 0009-0003-6053-9083

Izabela Radzka

Student, Medical University of Wrocław, Wybrzeże Ludwika Pasteura 1, 50-367 Wrocław, Poland

ORCID ID: 0009-0002-0612-6280

Paweł Budzik

Norbert Barlicki Memorial Teaching Hospital No. 1, Medical University of Lodz, Łódź, Poland

ORCID ID: 0009-0003-3177-5634

Szymon Marciszuk

Medical University of Lodz, Łódź, Poland

ORCID ID: 0009-0003-9917-0762

Jonatan Rataj

Medical University of Lodz, Łódź, Poland

ORCID ID: 0009-0006-4670-0100

Michalina Bawor – Mostowa

Medical University of Lodz, Łódź, Poland

ORCID ID: 0009-0007-4660-7851

Amelia Kosowska

Student of Maria Skłodowska-Curie Medical University, Al. Solidarności 12, 03-411 Warsaw, Poland

ORCID ID: 0009-0009-2291-048X

ABSTRACT

This paper provides a comprehensive review of the current state of knowledge on irritable bowel syndrome (IBS), one of the most common gastrointestinal disorders, currently classified as a disorder of gut–brain interaction (DGBI). The review discusses the epidemiology, pathophysiology, clinical presentation, diagnostic approach, therapeutic management, and emerging research directions in IBS. The prevalence of IBS ranges from 3.8% to as high as 14% of the global population, with significant regional and sex-related differences. IBS is a multifactorial disorder involving disturbances of the gut–brain axis, visceral hypersensitivity, alterations in the gut microbiota (dysbiosis), immune dysfunction, as well as genetic, hormonal, and psychological factors. The clinical manifestations include recurrent abdominal pain, altered bowel habits (constipation-predominant, diarrhea-predominant, and mixed subtypes), abdominal bloating, and extraintestinal symptoms such as fatigue, sleep disturbances, anxiety, and depression. The diagnosis is based on the Rome IV criteria and the exclusion of organic diseases, particularly in the presence of alarm features ("red flags"). A multidisciplinary therapeutic approach includes patient education, dietary interventions (including the low-FODMAP and Mediterranean diets), probiotics, pharmacological treatment tailored to the IBS subtype, and psychological therapies such as cognitive behavioral therapy (CBT) and gut-directed hypnotherapy. Emerging therapeutic strategies include modulation of the gut microbiota through fecal microbiota transplantation (FMT) and next-generation probiotics, as well as mechanism-based pharmacological agents, including elobixibat and olorinab.

KEYWORDS

Irritable Bowel Syndrome, Epidemiology, Pathophysiology, Clinical Presentation, Diagnosis, Treatment

CITATION

Radzka, M., Radzka, I., Budzik, P., Marciszuk, S., Rataj, J., Bawor – Mostowa, M., & Kosowska, A. (2026). Current directions in research on irritable bowel syndrome (IBS): Pathophysiology, diagnosis, and therapeutic perspectives. *International Journal of Innovative Technologies in Social Science*, 4(52). [https://doi.org/10.31435/ijitss.4\(52\).2026.6255](https://doi.org/10.31435/ijitss.4(52).2026.6255)

COPYRIGHT

© The author(s) 2026. This article is published as open access under the **Creative Commons Attribution 4.0 International License (CC BY 4.0)**, allowing the author to retain copyright. The CC BY 4.0 License permits the content to be copied, adapted, displayed, distributed, republished, or reused for any purpose, including adaptation and commercial use, as long as proper attribution is provided.

Introduction and Aim of the Study

Irritable bowel syndrome (IBS) is a functional gastrointestinal disorder that is currently classified as a disorder of gut–brain interaction (DGBI). This terminology was introduced with the Rome IV criteria, published by the Rome Foundation in May 2016 (Schmulson et al., 2017).

According to the Rome IV criteria, IBS is defined by recurrent abdominal pain occurring at least one day per week during the previous three months, associated with at least two of the following: related to defecation, associated with a change in stool frequency, and associated with a change in stool form (consistency) (Drossman et al., 2016).

IBS is one of the most frequently diagnosed gastrointestinal disorders worldwide, affecting a substantial proportion of the adult population. Despite its high prevalence, the etiology of IBS remains largely unclear, and its symptoms—including abdominal pain, altered bowel habits, and bloating—significantly impair patients' quality of life. IBS also represents a considerable socioeconomic burden due to healthcare costs and work absenteeism. A comprehensive review of the literature provides a concise overview of the current state of knowledge, facilitates the identification of research gaps, and may contribute to the development of more effective diagnostic and therapeutic strategies, which are essential for improving patient care.

The aim of this study is to provide a comprehensive review of the current knowledge on irritable bowel syndrome (IBS), with particular emphasis on its pathophysiology, diagnostic approaches, and available therapeutic strategies. In addition, the study aims to present the latest research trends and identify areas that require further investigation.

Regional Epidemiological Variation of Irritable Bowel Syndrome

The epidemiology of irritable bowel syndrome (IBS) exhibits considerable geographic variation. The global prevalence has been estimated at approximately 11.2% (Lovell et al., 2012). However, meta-analyses based on the Rome III and Rome IV diagnostic criteria have reported substantially different prevalence estimates of 9.2% and 3.8%, respectively (Oka et al., 2020). In the most recent meta-analysis, published in 2025 and including data from 96 studies conducted across 51 countries, the overall prevalence of IBS was estimated at 14% (Arif et al., 2025).

According to studies applying the Rome IV criteria, the prevalence of IBS in the United States ranges from 4.7% to 5.3%. Considerable regional differences have also been reported worldwide, with prevalence estimates reaching approximately 21% in South America, 15% in Southern Europe, 7% in Southeast Asia, and 7.5% in the Middle East (Cheng et al., 2024).

By contrast, exceptionally low prevalence has been observed in some countries. For example, a cross-sectional study conducted in Iran reported an IBS prevalence of only 1.1% (Takeoka et al., 2023).

Sex-related differences have also been consistently demonstrated. In Western countries, IBS is diagnosed approximately twice as frequently in women as in men, whereas studies conducted in Asian populations have generally reported comparable prevalence rates between the sexes (Huang et al., 2023).

These findings highlight the substantial influence of geographic, demographic, and methodological factors—including the diagnostic criteria employed—on reported IBS prevalence. They also emphasize the need for standardized epidemiological studies to enable reliable comparisons across populations.

Table 1. Estimated Prevalence of Irritable Bowel Syndrome by Geographic Region

Region/Country	Estimated IBS Prevalence	Reference
Worldwide	11.2%	Lovell et al., 2012
Rome III studies	9.2%	Oka et al., 2020
Rome IV studies	3.8%	Oka et al., 2020
Global meta-analysis (2025)	14.0%	Arif et al., 2025
United States (Rome IV)	4.7–5.3%	Almario et al., 2023
South America	~21.0%	Cheng et al., 2024
Southern Europe	~15.0%	Cheng et al., 2024
North America	~11.8%	Cheng et al., 2024
Southeast Asia	~7.0%	Cheng et al., 2024
Middle East	~7.5%	Cheng et al., 2024
Iran	1.1%	Takeoka et al., 2023

Pathophysiology of Irritable Bowel Syndrome: A Multifactorial Disease Mechanism

The pathophysiology of irritable bowel syndrome (IBS) is complex and multifactorial, involving interactions among neurological, immunological, microbiological, genetic, and psychosocial factors. Dysregulation of communication between the central nervous system (CNS) and the enteric nervous system (ENS) through the gut–brain axis is considered one of the key mechanisms underlying IBS. Dysfunction of this bidirectional signaling network affects gastrointestinal motility, secretory function, visceral sensitivity, and intestinal barrier permeability through autonomic, immune, and neuroendocrine regulatory pathways (Dudzińska et al., 2016).

One of the hallmark features of IBS is visceral hypersensitivity. As first demonstrated by Ritchie (1973), patients with IBS exhibit an exaggerated perception of pain in response to colorectal balloon distension. This enhanced pain perception involves both peripheral mechanisms, including sensitization of sensory neurons and immune cell activation, and central mechanisms, characterized by altered processing of visceral sensory signals within the central nervous system.

Abnormal gastrointestinal motility also contributes substantially to symptom generation. Patients with IBS may exhibit delayed gastric emptying, altered intestinal transit times, and impaired evacuation of intestinal gas and stool. These disturbances are closely associated with characteristic symptoms such as abdominal pain, bloating, constipation, and diarrhea (Aliyu et al., 2025).

Alterations in the composition and function of the intestinal microbiota (dysbiosis) represent another major component of IBS pathogenesis. Dysbiosis affects mucosal barrier integrity, gastrointestinal motility, neurotransmitter production—particularly serotonin—and immune regulation. Reduced microbial diversity has been consistently associated with low-grade intestinal inflammation and increased visceral sensitivity (You et al., 2021).

Growing evidence also supports the role of immune activation in IBS. Low-grade mucosal inflammation, increased intestinal permeability, elevated numbers of mast cells and lymphocytes, and enhanced production of pro-inflammatory cytokines may alter sensory nerve function and contribute to the development of visceral hypersensitivity (Beatty et al., 2022).

Psychological factors play an equally important role in disease development and symptom exacerbation. Chronic stress, anxiety, and depression not only aggravate gastrointestinal symptoms but may also precede their onset. Persistent stress activates the hypothalamic–pituitary–adrenal (HPA) axis, alters serotonergic neurotransmission, and affects both gastrointestinal motility and visceral perception (Mudyanadzo et al., 2018).

Genetic susceptibility has also been implicated in IBS. Polymorphisms in genes involved in serotonin metabolism, immune regulation, and neuronal signaling have been associated with an increased risk of developing the disorder. Furthermore, sex hormones, particularly estrogen and progesterone, appear to modulate gastrointestinal motility, visceral sensitivity, and intestinal barrier function, potentially contributing to the higher prevalence of IBS among women (Accarie et al., 2022).

Another well-recognized pathogenic mechanism is post-infectious IBS (PI-IBS). Previous episodes of acute infectious gastroenteritis may trigger long-lasting immune activation, microbial dysbiosis, increased intestinal permeability, and neuroendocrine alterations involving serotonin signaling. Even after clinical resolution of the infection, affected individuals often demonstrate persistently increased numbers of CD3+, CD4+, and CD8+ T lymphocytes, enterochromaffin (EC) cells, and markers of low-grade inflammation. This persistent immune activation is considered a defining feature of PI-IBS. Enteric infections—particularly those caused by *Campylobacter* species—can disrupt intestinal barrier integrity, leading to chronic immune responses and sustained gastrointestinal symptoms (Spiller et al., 2012; Beatty et al., 2014; Barbara et al., 2019; Lupu et al., 2023).

Overall, current evidence indicates that IBS should not be regarded as a disorder attributable to a single pathogenic mechanism. Rather, it represents the result of complex interactions among disturbances of the gut–brain axis, altered gastrointestinal motility, visceral hypersensitivity, immune dysregulation, microbial imbalance, genetic predisposition, hormonal influences, and psychosocial factors. The relative contribution of each mechanism likely varies between individuals, explaining the marked heterogeneity of clinical manifestations and therapeutic responses observed in patients with IBS.

Clinical Presentation of Irritable Bowel Syndrome

According to the Rome IV criteria, IBS is classified into four subtypes based on the predominant bowel habit:

- IBS-C (constipation-predominant IBS) – characterized by predominant constipation;
- IBS-D (diarrhea-predominant IBS) – characterized by predominant diarrhea;
- IBS-M (mixed IBS) – characterized by alternating episodes of diarrhea and constipation;
- IBS-U (unclassified IBS) – an unclassified subtype in which symptoms do not clearly meet the criteria for the other categories (Lacy et al., 2016).

The prevalence of individual IBS subtypes varies across populations. In studies conducted in the United States, IBS-D was reported in approximately 40% of patients, IBS-C in 35%, and IBS-M in 23% (Black et al., 2020).

The hallmark symptom of IBS is recurrent abdominal pain associated with defecation and changes in bowel habits. The pain is typically localized in the lower abdomen and has a recurrent nature (Chey et al., 2015). Other common symptoms include abdominal bloating and distension, diarrhea or constipation—sometimes occurring alternately—and a sensation of incomplete bowel evacuation (Ford et al., 2020). Symptoms are often exacerbated by psychological stress, the consumption of certain foods (particularly those rich in FODMAPs), and, in women, during menstruation (Adeyemo et al., 2010; Halmos et al., 2014).

Treatment of Irritable Bowel Syndrome (IBS)

The management of IBS is primarily symptomatic and multidisciplinary, as the disorder has no single, well-defined pathophysiological mechanism. Treatment includes lifestyle modification, dietary interventions, pharmacotherapy, and psychological and behavioral therapies. Establishing a trusting physician–patient relationship and providing appropriate education regarding the functional nature of the disorder are among the most important components of successful management. A better understanding of the disease mechanisms reduces patients' anxiety and improves treatment outcomes (Chey et al., 2015).

Non-pharmacological management primarily focuses on dietary modification. The low-FODMAP diet has been shown to reduce abdominal bloating, diarrhea, and abdominal pain in many patients with IBS (Halmos et al., 2014). According to a recent meta-analysis published in 2025, the combination of a low-FODMAP diet and probiotics was the most effective intervention for alleviating IBS symptoms. The analysis, which included 44 clinical studies, demonstrated that this combination produced significantly greater symptom improvement than placebo (RR: 17.79; 95% CI: 3.27–112.54) and the low-FODMAP diet alone (RR: 3.22;

95% CI: 1.70–6.26). The low-FODMAP diet alone was also effective, achieving a 70.8% response rate in symptom relief, whereas its combination with probiotics reached an effectiveness of 80.4% (Lei et al., 2025).

Furthermore, the low-FODMAP diet was the most effective intervention in reducing the total IBS Symptom Severity Score (IBS-SSS), with an effectiveness of 90.5%, outperforming the low-FODMAP diet alone (76.6%), probiotics alone (62.3%), and the gluten-free diet (28.3%) (Lei et al., 2025).

Regarding probiotic therapy, evidence suggests that therapeutic efficacy depends on the bacterial strain used. Combinations of *Lactobacillus* and *Bifidobacterium* species appear to provide greater clinical benefits than single-strain preparations in patients with IBS (Xie et al., 2022). The Mediterranean diet has also been proposed as a beneficial dietary approach owing to its anti-inflammatory properties and greater long-term adherence, with studies indicating a reduction in abdominal pain among IBS patients (Guasch-Ferré et al., 2015; Gotsis et al., 2015).

A meta-analysis published in 2025, including 1,264 patients with IBS, demonstrated that fermented foods, particularly probiotic fermented milk products, may improve overall IBS symptoms. Subgroup analysis showed that fermented milk significantly increased symptom relief compared with placebo (RR: 1.19; 95% CI: 1.01–1.39; $p = 0.04$; $P = 0\%$). However, no significant improvement was observed in abdominal pain or bloating. These findings suggest that fermented milk products may alleviate the overall symptom burden of IBS, although their effects on specific symptoms remain inconclusive (Ding et al., 2025).

In addition, soluble fiber, particularly psyllium, improves stool consistency and relieves constipation (Ford et al., 2014). Reducing the intake of caffeine, alcohol, and artificial sweeteners may also lessen symptom severity (Ford et al., 2020). Regular physical activity has been shown to decrease gastrointestinal symptoms and improve overall well-being (Johannesson et al., 2011), while relaxation techniques and mindfulness-based interventions may positively influence gut–brain axis regulation (Zhou et al., 2019).

Pharmacological therapy should be tailored to the predominant IBS subtype (Lacy et al., 2016; Ford et al., 2020):

- IBS-C (constipation-predominant IBS):
 - Osmotic laxatives (e.g., polyethylene glycol/macrogol);
 - Lubiprostone, linaclotide (a guanylate cyclase-C agonist), and plecanatide, which improve stool consistency and reduce abdominal pain (Chey et al., 2012).
- IBS-D (diarrhea-predominant IBS):
 - Loperamide, which reduces stool frequency;
 - Rifaximin, a poorly absorbed intestinal antibiotic that decreases bloating and diarrhea (Pimentel et al., 2011);
 - Eluxadoline, a mixed opioid receptor modulator that alleviates diarrhea-related symptoms (Lembo et al., 2016).
- Management of abdominal pain and bloating:
 - Antispasmodic agents (e.g., hyoscine and mebeverine);
 - Low-dose tricyclic antidepressants (TCAs), which exert analgesic effects and modulate visceral hypersensitivity (Ford et al., 2019).
- Management of anxiety and mood disorders:
 - Selective serotonin reuptake inhibitors (SSRIs) may be particularly beneficial in patients with IBS-C and coexisting psychological disorders (Laird et al., 2016).
- Microbiota-targeted therapies:
 - Probiotics, with certain strains such as *Bifidobacterium infantis* 35624 demonstrating efficacy in reducing gastrointestinal symptoms and improving quality of life (Didari et al., 2015);
 - Fecal microbiota transplantation (FMT) represents a promising therapeutic approach; however, current evidence remains inconsistent, and further well-designed clinical trials are required before its routine clinical implementation (Ianiro et al., 2019).

Psychological therapies also play an important role in IBS management. Cognitive behavioral therapy (CBT) has been shown to reduce gastrointestinal symptoms and improve patients' ability to cope with stress (Ford et al., 2019). Gut-directed hypnotherapy has demonstrated sustained long-term efficacy in reducing abdominal pain and bloating (Miller et al., 2015).

Emerging Research Directions and Future Therapeutic Approaches in Irritable Bowel Syndrome

Current IBS research is increasingly focused on innovative therapeutic strategies that extend beyond conventional treatment, including microbiota modulation, novel pharmacological agents, nutritional interventions, and psychoneurological technologies.

One of the most promising areas involves microbiome-based therapies. Full-spectrum live biotherapeutic products have recently emerged as a novel treatment strategy. Results from the phase IIa TrlUMPH trial, presented at Digestive Disease Week (DDW) 2025, demonstrated that EBX-102-02, an orally administered full-spectrum live biotherapeutic product, significantly improved IBS with constipation (IBS-C) symptoms, including abdominal pain and stool consistency, while exhibiting a favorable safety profile (Gomersall, 2025).

Recent meta-analyses indicate that fecal microbiota transplantation (FMT) does not consistently outperform placebo in relieving IBS symptoms. However, selected subgroups of patients receiving FMT via invasive routes, such as colonoscopic administration, may experience clinically meaningful symptom improvement, with some analyses reporting a number needed to treat (NNT) of approximately three. Nevertheless, the overall quality of evidence remains low, and further high-quality randomized controlled trials are warranted (Zhao et al., 2022; Lo et al., 2024).

Another rapidly developing field involves next-generation probiotics (NGPs). Unlike conventional probiotics, NGPs consist of advanced bacterial strains specifically developed for pharmaceutical applications. These microorganisms are designed to enable personalized modulation of the intestinal microbiome according to individual patient characteristics. Recent advances include the development of oxygen-tolerant bacterial strains that remain viable during oral administration, thereby improving their therapeutic potential (Khan et al., 2023).

Similarly, defined bacterial consortia represent a promising microbiome-based strategy. These consist of carefully selected combinations of bacterial strains that collectively restore microbial homeostasis, modulate intestinal inflammation, improve epithelial barrier function, and regulate gastrointestinal motility. One example is the GUT-108 consortium, which has demonstrated the ability to reduce pathogenic pathobionts, increase the production of metabolites promoting mucosal healing, and induce immunoregulatory responses (Van der Lelie et al., 2021).

Increasing attention has also been directed toward microbial metabolites as potential therapeutic targets. Metabolites produced by intestinal bacteria, including butyrate, indoles, and polyamines, play essential roles in regulating intestinal inflammation, gastrointestinal motility, epithelial barrier integrity, and gut–brain communication. For example, indole-3-lactate (ILA), a tryptophan-derived metabolite produced by *Lactobacillus* species, exhibits anti-inflammatory properties and may contribute to restoring microbial homeostasis in the intestine (Wang et al., 2024).

Novel pharmacological approaches to IBS treatment are increasingly focused on the precise modulation of intestinal motility, visceral pain signaling, and gut microbiota.

- Elobixibat (A3309), an inhibitor of the ileal bile acid transporter (IBAT), has demonstrated significant improvements in spontaneous bowel movement frequency and quality of life in phase III clinical trials conducted in Japanese patients with chronic constipation (Nakajima et al., 2019).

- Olorinab (APD371) is a selective cannabinoid receptor type 2 (CB₂) agonist currently evaluated in phase IIb clinical trials for the treatment of abdominal pain associated with both IBS-C and IBS-D. Preclinical studies have demonstrated substantial analgesic effects through modulation of visceral nociception (Chang et al., 2023).

- Renzapride, a 5-HT₄ receptor agonist and partial 5-HT₃ receptor antagonist, continues to be investigated as a potential therapeutic option for disorders characterized by impaired gastrointestinal motility (Meyers et al., 2008).

Neuromodulation and digital psychological interventions are becoming increasingly important components of IBS management, particularly in the field of gut-directed hypnotherapy (GDH). One of the most promising digital therapeutic platforms is the Nerva mobile application, developed by Dr. Simone Peters and colleagues at Monash University. Gut-directed hypnotherapy utilizes hypnotic techniques to modulate intestinal responses to sensory stimuli, reduce visceral hypersensitivity, and improve gut–brain communication. Traditionally delivered by trained therapists, GDH has become more accessible through digital platforms that allow patients to undergo treatment remotely. The Nerva program consists of a six-week intervention including

daily 15-minute hypnotherapy sessions together with educational modules covering gut–brain axis physiology and IBS pathophysiology. The program is intended for patients with all IBS subtypes, including IBS-C, IBS-D, and IBS-M (Peters et al., 2015; Peters et al., 2016).

Another innovative research direction involves the therapeutic use of psilocybin. Dr. Erin Mauney, a pediatric gastroenterologist at Tufts University, is leading pioneering studies investigating psilocybin-assisted therapy for IBS. These studies represent one of the first attempts to integrate psychedelic-assisted therapy into gastroenterology, offering a potential treatment option for patients who do not respond adequately to conventional therapies. Current evidence suggests that psilocybin modulates brain regions involved in emotional regulation and pain processing, mechanisms that may be particularly relevant in disorders of gut–brain interaction. The incorporation of advanced neuroimaging techniques is expected to provide further insight into the neural mechanisms underlying psychedelic therapy in functional gastrointestinal disorders (Mauney et al., 2025).

Conclusions

Irritable bowel syndrome (IBS) is a complex disorder with a multifactorial pathogenesis involving the interplay of biological, psychological, and environmental factors. It is currently recognized as a disorder of gut–brain interaction (DGBI) and is diagnosed according to the symptom-based Rome IV criteria, following the exclusion of organic gastrointestinal diseases.

The prevalence of IBS varies considerably depending on geographical region, diagnostic criteria, and study methodology. Its pathophysiology is driven by interactions among gut–brain axis dysfunction, altered gastrointestinal motility, visceral hypersensitivity, gut microbiota dysbiosis, immune activation, and genetic, hormonal, and psychological factors. Together, these mechanisms contribute to the hallmark clinical manifestations of IBS, including recurrent abdominal pain, bloating, and altered bowel habits. The clinical presentation encompasses a broad spectrum of both gastrointestinal and extraintestinal symptoms, which vary substantially in severity and clinical course among affected individuals.

The management of IBS should be personalized and multidisciplinary, integrating dietary interventions, pharmacological therapy, psychological treatment, and microbiota-targeted strategies. The greatest therapeutic benefits are achieved through a comprehensive approach combining patient education, individualized dietary management, pharmacotherapy tailored to the IBS subtype, psychological support, and interventions aimed at restoring gut microbial homeostasis.

Recent advances suggest that the future of IBS management lies in precision medicine, with therapeutic strategies increasingly guided by biomarkers, individual patient characteristics, and microbiome profiling. Emerging pharmacological agents, next-generation microbiome-based therapies, digital therapeutics, and personalized nutritional interventions represent promising developments that may further improve symptom control and quality of life in patients with IBS.

REFERENCES

1. Accarie, A., Toth, J., Wauters, L., Farré, R., Tack, J., & Vanuytsel, T. (2022). Estrogens play a critical role in stress-related gastrointestinal dysfunction in a spontaneous model of disorders of gut–Brain interaction. *Cells*, 11(7), 1214.
2. Adeyemo MA, Spiegel BM, Chang L. Association among somatization, psychological distress, and IBS. *Am J Gastroenterol*. 2010;105(4):904-912. <https://doi.org/10.1038/ajg.2010.73>
3. Aliyu, A. I., Katsumata, R., Törnblom, H., & Simrén, M. (2025). Gastrointestinal transit abnormalities in irritable bowel syndrome and their relation to symptoms. *Expert Review of Gastroenterology & Hepatology*, 19(5), 447-454. <https://doi.org/10.1080/17474124.2025.2493867>
4. Almario, C. V., Sharabi, E., Chey, W. D., Lauzon, M., Higgins, C. S., & Spiegel, B. M. (2023). Prevalence and burden of illness of Rome IV irritable bowel syndrome in the united states: Results from a nationwide cross-sectional study. *Gastroenterology*, 165(6), 1475-1487. <https://doi.org/10.1053/j.gastro.2023.08.010>
5. Almario, C. V., Sharabi, E., Chey, W. D., Lauzon, M., Higgins, C. S., & Spiegel, B. M. (2023). Prevalence and burden of illness of Rome IV irritable bowel syndrome in the united states: Results from a nationwide cross-sectional study. *Gastroenterology*, 165(6), 1475-1487. <https://doi.org/10.1053/j.gastro.2023.08.010>
6. Arif TB, Ali SH, Bhojwani KD, Sadiq M, Siddiqui AA, Ur-Rahman A, Khan MZ, Hasan F, Shahzil M. Global prevalence and risk factors of irritable bowel syndrome from 2006 to 2024 using the Rome III and IV criteria: a meta-analysis. *Eur J Gastroenterol Hepatol*. 2025 Dec 1;37(12):1314-1325. <https://doi.org/10.1097/MEG.0000000000002994>. Epub 2025 Apr 30. PMID: 40359286

7. Barbara, G., Grover, M., Bercik, P., Corsetti, M., Ghoshal, U. C., Ohman, L., & Rajilić-Stojanović, M. (2019). *Rome foundation working team report on post-infection irritable bowel syndrome*. *Gastroenterology*, 156(1), 46-58.
8. Beatty, J. K., Akierman, S. V., Motta, J. P., Muise, S., Workentine, M. L., Harrison, J. J., ... & Buret, A. G. (2017). *Giardia duodenalis* induces dysbiosis of human intestinal microbiota.; hasler, w. L., Grabauskas, G., Singh, P., & Owyang, C. (2022). *Mast cell mediation of visceral sensation and permeability in irritable bowel syndrome*. *Neurogastroenterology & Motility*, 34(7), e14339.;
9. Beatty, J. K., Bhargava, A., & Buret, A. G. (2014). Post-infectious irritable bowel syndrome: Mechanistic insights into chronic disturbances following enteric infection. *World journal of gastroenterology: WJG*, 20(14), 3976966
10. Black CJ, Drossman DA, Talley NJ, Ruddy J, Ford AC. Functional gastrointestinal disorders: advances in understanding and management. *Lancet*. 2020;396(10263):1664-1674. [https://doi.org/10.1016/S0140-6736\(20\)32115-2](https://doi.org/10.1016/S0140-6736(20)32115-2)
11. Chang, L., Cash, B. D., Lembo, A., Kunkel, D. C., English, B. A., Lindstrom, B., ... & Tack, J. (2023). Efficacy and safety of olorinab, a full agonist of the cannabinoid receptor 2, for the treatment of abdominal pain in patients with irritable bowel syndrome: Results from a phase 2b randomized placebo-controlled trial (captivate). *Neurogastroenterology & Motility*, 35(5), e14539.
12. Cheng, K., Lee, C., Garniene, R., Cabral, H., & Weber, H. C. (2024). *Epidemiology of irritable bowel syndrome in a large academic safety-net hospital*. *Journal of Clinical Medicine*, 13(5), 1314. <https://doi.org/10.1053/j.gastro.2023.08.010>
13. Cheng, K., Lee, C., Garniene, R., Cabral, H., & Weber, H. C. (2024). *Epidemiology of irritable bowel syndrome in a large academic safety-net hospital*. *Journal of Clinical Medicine*, 13(5), 1314. <https://doi.org/10.1053/j.gastro.2023.08.010>
14. Cheng, K., Lee, C., Garniene, R., Cabral, H., & Weber, H. C. (2024). *Epidemiology of irritable bowel syndrome in a large academic safety-net hospital*. *Journal of Clinical Medicine*, 13(5), 1314. <https://doi.org/10.1053/j.gastro.2023.08.010>
15. Cheng, K., Lee, C., Garniene, R., Cabral, H., & Weber, H. C. (2024). *Epidemiology of irritable bowel syndrome in a large academic safety-net hospital*. *Journal of Clinical Medicine*, 13(5), 1314. <https://doi.org/10.1053/j.gastro.2023.08.010>
16. Cheng, K., Lee, C., Garniene, R., Cabral, H., & Weber, H. C. (2024). *Epidemiology of irritable bowel syndrome in a large academic safety-net hospital*. *Journal of Clinical Medicine*, 13(5), 1314. <https://doi.org/10.1053/j.gastro.2023.08.010>
17. Cheng, K., Lee, C., Garniene, R., Cabral, H., & Weber, H. C. (2024). *Epidemiology of irritable bowel syndrome in a large academic safety-net hospital*. *Journal of Clinical Medicine*, 13(5), 1314. <https://doi.org/10.1053/j.gastro.2023.08.010>
18. Chey WD, Kurlander J, Eswaran S. Irritable bowel syndrome: a clinical review. *JAMA*. 2015;313(9):949-958. <https://doi.org/10.1001/jama.2015.0954>
19. Chey WD, Lembo AJ, Lavins BJ, et al. Linaclotide for IBS with constipation. *N Engl J Med*. 2012;367:542-552. <https://doi.org/10.1056/NEJMoal205055>
20. Didari T, Mozaffari S, Nikfar S, Abdollahi M. Effectiveness of probiotics in IBS: meta-analysis. *World J Gastroenterol*. 2015;21(10):3072-3084. <https://doi.org/10.3748/wjg.v21.i10.3072>
21. Ding, L., Duan, J., Yang, T., Yuan, M., Ma, A. H., & Qin, Y. (2025). Efficacy of fermented foods in irritable bowel syndrome: A systematic review and meta-analysis of randomized controlled trials. *Frontiers in Nutrition*, 11, 1494118.
22. Drossman, D. A., & Hasler, W. L. (2016). *Rome IV—functional gi disorders: Disorders of gut-brain interaction*. *Gastroenterology*, 150(6), 1257-1261.. <https://doi.org/10.1053/j.gastro.2016.02.032>
23. Dudzińska, E. (2016). *Wpływ mikroflory jelitowej na rozwój zespołu jelita drażliwego*. *Medycyna Środowiskowa-Environmental Medicine*, 19(3), 70-76.
24. Fond G, Loundou A, Hamdani N, Boukouaci W, et al. Anxiety and depression comorbidities in irritable bowel syndrome (IBS): a systematic review and meta-analysis. *Eur Arch Psychiatry Clin Neurosci*. 2014;264(8):651-660. <https://doi.org/10.1007/s00406-014-0502-z>
25. Ford AC, Lacy BE, Harris LA, Quigley EMM, Moayyedi P. Effect of antidepressants and psychological therapies in IBS: an updated systematic review and meta-analysis. *Am J Gastroenterol*. 2019;114(1):21-39. <https://doi.org/10.1038/s41395-018-0222-5>
26. Ford AC, Lacy BE, Talley NJ. Irritable bowel syndrome. *N Engl J Med*. 2020;382:1240-1250. <https://doi.org/10.1056/NEJMr1907796>
27. Ford AC, Moayyedi P, Lacy BE, et al. American College of Gastroenterology monograph on the management of irritable bowel syndrome. *Am J Gastroenterol*. 2014;109(S1):S2-S26. <https://doi.org/10.1038/ajg.2014.187>
28. Gomersall, B. (2025). *Digestive disease week 2025*. *The Lancet Gastroenterology & Hepatology*, 10(7), 618.
29. Gotsis, E., Anagnostis, P., Mariolis, A., Vlachou, A., Katsiki, N., & Karagiannis, A. (2015). *Health benefits of the mediterranean diet: An update of research over the last 5 years*. *Angiology*, 66(4), 304-318.

30. Guasch-Ferré, M., & Willett, W. C. (2021). *The mediterranean diet and health: A comprehensive overview. Journal of internal medicine*, 290(3), 549-566.
31. Halmos EP, Power VA, Shepherd SJ, Gibson PR, Muir JG. A diet low in FODMAPs reduces symptoms of irritable bowel syndrome. *Gastroenterology*. 2014;146(1):67-75. <https://doi.org/10.1053/j.gastro.2013.09.046>
32. Huang, K. Y., Wang, F. Y., Lv, M., Ma, X. X., Tang, X. D., & Lv, L. (2023). Irritable bowel syndrome: Epidemiology, overlap disorders, pathophysiology and treatment. *World Journal of Gastroenterology*, 29(26), 4120. <https://doi.org/10.3748/wjg.v29.i26.4120>
33. Ianiro G, Eusebi LH, Black CJ, Gasbarrini A, Cammarota G, Ford AC. Fecal microbiota transplantation for IBS: systematic review and meta-analysis. *Am J Gastroenterol*. 2019;114(7):1043-1050. <https://doi.org/10.14309/ajg.0000000000000198>
34. Johannesson E, Simrén M, Strid H, Bajor A, Sadik R. Physical activity improves symptoms in irritable bowel syndrome: a randomized controlled trial. *Am J Gastroenterol*. 2011;106(5):915-922. <https://doi.org/10.1038/ajg.2010.480>
35. Khan, M. T., Dwibedi, C., Sundh, D., Pradhan, M., Kraft, J. D., Caesar, R., ... & Bäckhed, F. (2023). *Synergy and oxygen adaptation for development of next-generation probiotics. Nature*, 620(7973), 381-385.
36. Lacy BE, Mearin F, Chang L, et al. Bowel Disorders. *Gastroenterology*. 2016;150(6):1393-1407. <https://doi.org/10.1053/j.gastro.2016.02.031>
37. Lacy BE, Mearin F, Chang L, et al. Bowel Disorders. *Gastroenterology*. 2016;150(6):1393-1407. <https://doi.org/10.1053/j.gastro.2016.02.031>
38. Laird KT, Tanner-Smith EE, Russell AC, Hollon SD, Walker LS. Short-term and long-term efficacy of psychological therapies for IBS. *Clin Gastroenterol Hepatol*. 2016;14(7):937-947. <https://doi.org/10.1016/j.cgh.2015.11.020>
39. Lei, Y., Sun, X., Ruan, T., Lu, W., Deng, B., Zhou, R., & Mu, D. (2025). Effects of probiotics and diet management in patients with irritable bowel syndrome: A systematic review and network meta-analysis. *Nutrition Reviews*, nuae217.
40. Lembo AJ, Lacy BE, Zuckerman MJ, et al. Eluxadoline for IBS with diarrhea. *N Engl J Med*. 2016;374:242-253. <https://doi.org/10.1056/NEJMoa1505180>
41. Lo, S. W., Hung, T. H., Lin, Y. T., Lee, C. S., Chen, C. Y., Fang, C. J., & Lai, P. C. (2024). Clinical efficacy and safety of faecal microbiota transplantation in the treatment of irritable bowel syndrome: A systematic review, meta-analysis and trial sequential analysis. *European Journal of Medical Research*, 29(1), 464.
42. Lovell, R. M., & Ford, A. C. (2012). *Global prevalence of and risk factors for irritable bowel syndrome: A meta-analysis. Clinical gastroenterology and hepatology*, 10(7), 712-721. <https://doi.org/10.1016/j.cgh.2012.02.029>
43. Lupu, V. V., Ghiciuc, C. M., Stefanescu, G., Mihai, C. M., Popp, A., Sasaran, M. O., ... & Lupu, A. (2023). Emerging role of the gut microbiome in post-infectious irritable bowel syndrome: A literature review. *World Journal of Gastroenterology*, 29(21), 3241.
44. Mauney, E. E. (2025). *Erin mauney: Psychedelics as modulators of the gut-brain interaction. Psychedelics*, 1(aop), 1-3.
45. Mayer EA. Gut feelings: the emerging biology of gut-brain communication. *Nat Rev Neurosci*. 2011;12(8):453-466. <https://doi.org/10.1038/nrn3071>
46. Meyers, N. L., & Hickling, R. I. (2008). Pharmacology and metabolism of renzapride: A novel therapeutic agent for the potential treatment of irritable bowel syndrome. *Drugs in R&D*, 9(1), 37-63.
47. Miller V, Carruthers HR, Morris J, Hasan SS, Archbold S, Whorwell PJ. Hypnotherapy for IBS: long-term follow-up. *Aliment Pharmacol Ther*. 2015;41(3):301-312. <https://doi.org/10.1111/apt.13030>
48. Mudyanadzo, T. A., Hauzaree, C., Yerokhina, O., Architha, N. N., & Ashqar, H. M. (2018). *Irritable bowel syndrome and depression: A shared pathogenesis. Cureus*, 10(8)
49. Nakajima, A., Taniguchi, S., Kurosu, S., Gillberg, P. G., Mattsson, J. P., & Camilleri, M. (2019). Efficacy, long-term safety, and impact on quality of life of elobixibat in more severe constipation: Post hoc analyses of two phase 3 trials in japan. *Neurogastroenterology & Motility*, 31(5), e13571.
50. Oka, P., Parr, H., Barberio, B., Black, C. J., Savarino, E. V., & Ford, A. C. (2020). Global prevalence of irritable bowel syndrome according to Rome III or IV criteria: A systematic review and meta-analysis. *The lancet Gastroenterology & hepatology*, 5(10), 908-917.
51. Peters, S. L., Muir, J. G., & Gibson, P. R. (2015). Gut-directed hypnotherapy in the management of irritable bowel syndrome and inflammatory bowel disease. *Alimentary pharmacology & therapeutics*, 41(11), 1104-1115.
52. Peters, S. L., Yao, C. K., Philpott, H., Yelland, G. W., Muir, J. G., & Gibson, P. R. (2016). Randomised clinical trial: The efficacy of gut-directed hypnotherapy is similar to that of the low FODMAP diet for the treatment of irritable bowel syndrome. *Alimentary pharmacology & therapeutics*, 44(5), 447-459.
53. Pimentel M, Lembo A, Chey WD, et al. Rifaximin therapy for patients with IBS without constipation. *N Engl J Med*. 2011;364:22-32. <https://doi.org/10.1056/NEJMoa1004409>
54. Ritchie, J. (1973). *Pain from distension of the pelvic colon by inflating a balloon in the irritable colon syndrome. Gut*, 14(2), 125-132.

55. Schmulson i inni, 2017 Schmulson, M. J., & Drossman, D. A. (2017). *What is new in Rome IV*. *Journal of neurogastroenterology and motility*, 23(2), 151. <https://doi.org/10.5056/jnm16214>
56. Spiller, R., & Lam, C. (2012). An update on post-infectious irritable bowel syndrome: Role of genetics, immune activation, serotonin and altered microbiome. *Journal of neurogastroenterology and motility*, 18(3), 258.
57. Takeoka, A., Kimura, T., Hara, S., Hamaguchi, T., Fukudo, S., & Tayama, J. (2023). Prevalence of irritable bowel syndrome in japan, china, and south korea: An international cross-sectional study. *Journal of neurogastroenterology and motility*, 29(2), 229. <https://doi.org/10.5056/jnm22037>
58. Takeoka, A., Kimura, T., Hara, S., Hamaguchi, T., Fukudo, S., & Tayama, J. (2023). Prevalence of irritable bowel syndrome in japan, china, and south korea: An international cross-sectional study. *Journal of neurogastroenterology and motility*, 29(2), 229. <https://doi.org/10.5056/jnm22037>
59. Takeoka, A., Kimura, T., Hara, S., Hamaguchi, T., Fukudo, S., & Tayama, J. (2023). Prevalence of irritable bowel syndrome in japan, china, and south korea: An international cross-sectional study. *Journal of neurogastroenterology and motility*, 29(2), 229. <https://doi.org/10.5056/jnm22037>
60. Van der Lelie, D., Oka, A., Taghavi, S., Umeno, J., Fan, T. J., Merrell, K. E., ... & Sartor, R. B. (2021). Rationally designed bacterial consortia to treat chronic immune-mediated colitis and restore intestinal homeostasis. *Nature communications*, 12(1), 3105.
61. Wang, G., Fan, Y., Zhang, G., Cai, S., Ma, Y., Yang, L., ... & Zeng, X. (2024). *Microbiota-derived indoles alleviate intestinal inflammation and modulate microbiome by microbial cross-feeding*. *Microbiome*, 12(1), 59.
62. Xie, C. R., Tang, B., Shi, Y. Z., Peng, W. Y., Ye, K., Tao, Q. F., ... & Chen, M. (2022). Low FODMAP diet and probiotics in irritable bowel syndrome: A systematic review with network meta-analysis. *Frontiers in pharmacology*, 13, 853011
63. You, X. Y., Zhang, H. Y., Han, X., Wang, F., Zhuang, P. W., & Zhang, Y. J. (2021). *Intestinal mucosal barrier is regulated by intestinal tract neuro-immune interplay*. *Frontiers in pharmacology*, 12, 659716
64. Zhao, H. J., Zhang, X. J., Zhang, N. N., Yan, B., Xu, K. K., Peng, L. H., & Pan, F. (2022). Fecal microbiota transplantation for patients with irritable bowel syndrome: A meta-analysis of randomized controlled trials. *Frontiers in Nutrition*, 9, 890357.
65. Zhou C, Zhao E, Li Y, Jia Y. Mindfulness interventions for IBS: a systematic review and meta-analysis. *J Psychosom Res*. 2019;120:29-38. <https://doi.org/10.1016/j.jpsychores.2019.03.013>