

Review article

Mind–body therapies for functional bowel disorders—A review of recent clinical trials[☆]

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Abstract

Introduction: Functional bowel disorders (FBDs) significantly affect a person's daily life; however, because their diagnosis is mostly based on symptom presentation, time to diagnosis is long. This delay in diagnosis remains true even when other methods, such as biochemical parameters, immunogenic and inflammatory markers, are used to differentiate the type of disorder. As treatment approaches are mainly symptom-based and often result in suboptimal outcomes, mind–body therapies may offer benefits either used alone or in combination with pharmacological treatments. **Methodology:** Thus, the purposes of this article are to: (1) describe the scientific knowledge based on currently available clinical trials of mind–body therapies for FBDs, (2) examine potential benefits of using such therapies and, (3) provide recommendations regarding their clinical application in the treatment of FBDs. The literature search covered the last decade from June 2002 to June 2012 and resulted in a total of 19 original research articles that met the inclusion criteria. The four common mind–body therapies, which include yoga, hypnotherapy, cognitive behavioral therapy, and biofeedback, were examined in this article.

Conclusion: The heterogeneity of clinical study designs as well as the wide disparity in defining primary outcome variables often limits the comparison of studies on the same mind–body therapy. Overall findings of these studies were promising, but not conclusive, and further recommendations for the research direction of mind–body therapies are proposed.

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Keywords: CAM; Functional bowel disorders; Hypnotherapy; Mind–body therapies; Yoga

Introduction

Functional bowel disorders (FBDs) represent a significant portion of gastrointestinal disorders with a high prevalence estimated in the range of 15–35% of adults [1,2]. The classification and diagnosis of FBDs is based on symptom representation and has been classified by the Rome foundation into irritable bowel syndrome (IBS), functional bloating, functional constipation, functional diarrhea, and unclassified FBDs [1]. The most

recent Rome III criteria define FBDs as a subgroup of functional gastrointestinal disorders with onset of symptoms at least 6 months prior to diagnosis and other diagnostic criteria active for 3 months [3]. In spite of differential diagnosis and classification, treatment for FBDs is primarily based on patient-specific symptoms because of their unclear pathophysiology as well as significant overlap in symptoms among the different types.

While previous classifications were based on the presence of symptoms, the new classification indicates that pathophysiological parameters such as morphological, biochemical, and immunogenic changes can be evaluated for the diagnosis of FBDs [4]. For instance, there is significant indication that serotonin transmission and receptors, which are located in the intestinal tract and central nervous system, as well as immunogenic responses, inflammatory markers, and preexisting conditions, contribute to the development of IBS [5–7]. In addition, the development of functional constipation and diarrhea—hallmarks of IBS—may result from an imbalance of

Abbreviations: FBD, functional bowel disorder; IBS, irritable bowel syndrome; 5-HT, serotonin; CAM, complementary and alternative medicine; CBT, cognitive behavioral therapy; GI, gastrointestinal.

[☆] Editor's Choice.

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cholinergic and serotonergic nerve transmission and receptor dysfunction in the enteric system [8]. Although more research is needed, new ways of identifying and classifying symptoms have led to more frequent and accurate diagnoses of IBS in the US [9].

More frequent diagnoses, however, do not correlate to better pharmacological treatment approaches, which have demonstrated limited success due to the pain sensitivity that often accompanies other symptoms. For example, laxatives and the off-label use of a serotonin 5-HT₄ receptor agonist, tegaserod, are predominantly used for constipation [10] while opioid agonists such as loperamide and diphenoxylate and a serotonin 5-HT₃ antagonist (i.e., alosetron), may be used for managing diarrhea [5]. The reduction of bloating and gas formation—other frequent symptoms of FBDs—can be achieved with surfactants and changes in lifestyle and diet restrictions [9]. Smooth muscle relaxants, tricyclic antidepressants, and selective serotonin reuptake inhibitors can also be used for general symptom relief [5]. In sum, despite the many pharmacological approaches that are available and because of the variety of often conflicting symptoms, there is no silver bullet to alleviate conditions associated with FBDs.

Because pathophysiological as well as psychosocial components affect symptom severity of FBDs [1], one of the solutions may be the use of mind–body therapies, which are defined as “focusing on the interactions among the brain, mind, body, and behavior, with the intent to use the mind to affect physical functioning and promote health” [11]. Under this definition, yoga, Tai chi, meditation, hypnotherapy, deep-breathing exercises, progressive relaxation, and acupuncture, are mind–body therapies as they serve to raise awareness of body sensations and engage in self-regulation of body processes in order to alleviate symptoms [12,13]. One study pointed out that women with FBDs have significantly lower expectations of success and benefits from psychological interventions such as cognitive behavioral therapy or yoga than from taking oral medications although psychosocial factors predominantly determined improvement [14].

Although historically these therapies have not been popular, recent years have shown an increase in interest and use: indeed, the 2007 National Health Interview Survey results showed that nearly 4 out of 10 US adults use some form of complementary and alternative medicine (CAM) with a rise in mind–body therapies, specifically deep-breathing exercises (12.7%), meditation (9.4%), and yoga (6.1%) [15]. Despite the rise in general popularity, CAM was only used by 1.2% of US adults for stomach and gastrointestinal disorders [15], indicating that there is an opportunity for CAM to play an increased role in the treatment of FBDs, particularly if patients are as receptive to using it as recent surveys have shown. When Harris and Roberts asked 256 patients with IBS about the acceptability of certain treatments, they found that tablets were most acceptable (84%) followed by life-style changes (82%), yoga (77%), stomach cream (68%), homeopathy (65%), heat pad (64%) and hypnotherapy (64%) [16]. Another study revealed that 50% of IBS patients are turning to CAM because of low satisfaction levels with conventional treatment, and that hypnotherapy and cognitive behavior therapy (CBT) were the most clinically effective, CAM treatment

approaches [17]. However, because these approaches have limitations that mind body therapies lack (e.g. hypnotherapy depends upon the “hypnotizability” of a patient, while CBT depends upon availability and patient preference) the latter represents a powerful treatment for patients with FBDs. Thus, the purposes of this article are to: (1) describe the scientific knowledge based on currently available clinical trials of mind–body therapies for FBDs, (2) examine potential benefits of using such therapies, and (3) provide recommendations regarding their clinical application in the treatment of FBDs.

Methodology

Complementary and alternative medicine (CAM) can be categorized into five areas according to the National Center for Complementary and Alternative Medicine (NCCAM), National Institute of Health (NIH). These are (1) Alternative Medical Systems, (2) Biological Based Therapies, (3) Mind/Body Therapies, (4) Manipulative and Body Based Therapies, and (5) Energy Therapies. This article will review current research regarding the most commonly used mind–body therapies for FBDs in the US, which are yoga, hypnotherapy, cognitive behavioral therapy, and biofeedback [18]. Acupuncture and massage therapy were excluded because the former is categorized as an “alternative medical system” and the latter within “manipulative and body based therapies”.

Inclusion criteria of the literature search were (1) English language only, (2) articles published between June 2002 and June 2012, (3) Medline, PsycINFO, EBSCO, Alt-Health Watch, CINAHL, and PubMed databases, and (4) the search terms “mind–body therapies”, “yoga”, “hypnotherapy”, “cognitive behavioral therapy”, or “biofeedback”, in combination with “functional bowel disorders”, “irritable bowel syndrome”, “constipation”, “functional abdominal pain”, or “diarrhea”. This resulted in retrieval of a total of 518 references. Of those, review articles, protocols, case reports, duplicated publications, and studies with less than 20 patients were excluded for review. Finally, 19 original research articles met the review criteria (Fig. 1). The 19 original research articles for review included randomized and non-randomized as well as non-blinded and single-blinded studies because the nature of mind–body interventions often do not allow for blinding (Table 1).

Results

Yoga

Yoga is a mind–body therapy with roots in ancient Indian philosophy that combines physical postures (asanas), breathing techniques (pranayama), and relaxation or meditation in order to balance the mind and body [19]. It has shown benefits for a variety of acute and chronic disorders [20–23] and because of this, is presently being used by 10% of IBS patients for symptom management [18].

Although clinical studies involving yoga and patients with IBS are few, there is some evidence to suggest a positive influence of yoga on both pain and anxiety. For example, one study

Table 1
Clinical studies involving mind–body therapies for the treatment of functional bowel disorders.

Reference	Publication year	Country	Sample characteristics and size (<i>N</i>)	Study design	# of sessions (duration)	Outcome
<i>Yoga</i>						
Taneja et al. [24]	2004	Canada	IBS-D, IBS determined by Rome II criteria (<i>N</i> = 22)	Randomized, non-double blinded, non-placebo controlled	8 sessions (2 months)	Significant reductions in bowel symptom, state anxiety, and autonomic symptom scores comparable or greater than standard therapy
Kuttner et al. [25]	2006	Netherlands	All IBS forms, IBS determined by Rome I criteria (<i>N</i> = 28)	Randomized, non-double blinded, non-placebo controlled	1 yoga session followed by 4 weeks of home sessions, wait-list control received same protocol after 1 month wait (2 months)	Significant reduction in GI symptoms and emotion-focused pain coping in both groups after yoga intervention, non-significant reductions in pain intensity and anxiety scores
Brands et al. [26]	2011	United States	All IBS forms and functional abdominal pain determined by Rome III criteria (<i>N</i> = 20)	Non-randomized, non-double blinded, non-placebo controlled	10 yoga sessions over 12 weeks in two groups of children (ages 8–11 and 12–18) with 3 month follow-up period	Results of the pilot study indicate significant decreases in pain intensity scores for children in both age groups compared to baseline
<i>Hypnotherapy</i>						
Gonsalkorale et al. [33]	2004	United States	All IBS forms, IBS determined by Rome I criteria (<i>N</i> = 78)	Non-randomized, non-double blinded, non-placebo controlled	12 sessions (12 weeks)	Significant improvements in HAD scores and IBS symptoms compared to baseline
Palsson et al. [34]	2002	United Kingdom	All IBS forms, IBS determined by Rome I criteria (<i>N</i> = 42)	Randomized, non-double-blinded, non-placebo-controlled	7 sessions with post-evaluation (7–28 weeks)	Significant reduction in IBS symptoms in both pain-specific and non-pain-specific hypnotherapy groups, reductions in anxiety and depression scores for pain-specific hypnotherapy
Vlieger et al. [36,44]	2007	United Kingdom	Pediatric patients with functional abdominal pain or IBS, IBS determined by Rome II criteria (<i>N</i> = 53)	Randomized, non-double-blinded, non-placebo controlled	6 sessions over 3 months with follow-up (12 weeks with 1 year follow-up)	Significant improvement in IBS symptom scores, abdominal pain and distension, and anxiety compared to standard medical therapy, at 5 year follow-up pain intensity and frequency scores remained significantly lower in both the supportive therapy and hypnotherapy groups
Lea et al. [37]	2003	United Kingdom	All IBS forms, IBS determined by Rome I criteria (<i>N</i> = 40)	Non-randomized, non-double-blinded, non-placebo controlled	12 sessions over 3 months with follow-up (12 weeks with 2 week follow-up)	Moderate improvement in rectal sensitivity, significant improvement in anxiety and depression symptoms compared to baseline
Gonsalkorale et al. [42]	2003	United Kingdom	All IBS forms, no documentation of IBS diagnosis (<i>N</i> = 204)	Non-randomized, non-double-blinded, non-placebo controlled	12 sessions over 3 months (12 weeks with 6 year follow-up)	Significant improvement in IBS symptom scores, abdominal pain and distension, and HAD compared to pre-treatment in responders
Roberts et al. [43]	2006	United Kingdom	All IBS forms, no documentation of IBS diagnosis (<i>N</i> = 81)	Randomized, non-double-blinded, placebo-controlled	5 sessions over 5 weeks with 12 month follow-up	Significant improvement in overall symptom scores, pain, and diarrhea scores compared to placebo after 3 months, but results were not maintained after 12 months with no difference between groups

Table 1 (Continued)

Reference	Publication year	Country	Sample characteristics and size (N)	Study design	# of sessions (duration)	Outcome
Lindfors et al. [47]	2012	Sweden	All IBS forms, IBS determined by Rome II criteria in two separate studies (N=90 for study 1, N=48 for study 2)	Randomized, non-double-blinded, placebo-controlled	12 session over 3 months of hypnotherapy in private practices or individual therapy for the control group (study 1) or in a hospital (study 2) with a wait-list as control group	Significant and maintained improvements in overall symptom scores in study 1 patients compared with placebo group, smaller and non-maintained improvements in symptom scores for patients in study 2 compared to baseline and control group Study results expected by end of 2013.
Flik et al. [49]	2011	Netherlands	All IBS forms, IBS determined by Rome III criteria (N=354)	Randomized, non-double-blinded, placebo-controlled	6 sessions over 12 weeks of individual hypnotherapy, group hypnotherapy, or educational supportive therapy (placebo)	
<i>Cognitive behavioral therapy (CBT)</i> Tkachuk et al. [61]	2003	Canada	All IBS forms, IBS determined by Rome I criteria (N=28)	Randomized, non-double-blinded, non-placebo-controlled	10 CBT sessions or symptom monitoring with telephone contact over 9 weeks with 3 month follow-up	Significant improvements in cognitive scale for functional bowel disorders, assertiveness questionnaire, and short form 36 health survey – physical health component scale
Drossman et al. [55], Weinland et al. [56]	2003, 2010	United States	FBDs (IBS, functional abdominal pain, painful constipation, and unspecified FBD), no documentation of FBD diagnosis (N=431)	Randomized, non-double-blinded, placebo-controlled	12 CBT, anti-depressant, or educational sessions over 3 months (12 weeks with 1 year follow-up)	Significant improvements in satisfaction, global well-being, and responder rate of CBT group vs. education group at 1 year follow-up, CBT as effective as antidepressant in reducing IBS symptoms
Kennedy et al. [58]	2006	United Kingdom	All IBS forms, no documentation of IBS diagnosis (N=149)	Randomized, non-double-blinded, non-placebo-controlled	6 CBT sessions over 6 weeks in addition to mebeverine hydrochloride for treatment of IBS symptoms in intervention group, only mebeverine treatment in control group with 12 month follow-up	Significant reduction in symptom scores and increase in quality of life measures in patients receiving CBT compared to mebeverine alone although effects of CBT were not lasting beyond 6 months during follow-up
Mahvi-Shirazi et al. [60]	2008	Iran	All IBS forms, IBS determined by Rome II criteria (N=50)	Randomized, non-double-blinded, non-placebo-controlled	8 CBT sessions over 2 months	Significant improvements in IBS symptoms (Rome-II questionnaire) and psychological symptoms (SCL-90-R)
Jones et al. [57]	2011	Australia	All IBS forms, IBS determined by Rome I criteria (N=105)	Randomized, non-double-blinded, non-placebo-controlled	8 CBT or relaxation sessions over 2 months (8 weeks with 1 year follow-up)	Significant improvements in mood (HAD scale) and IBS symptoms (BSSS) after CBT comparable to relaxation therapy and standard medical care
<i>Biofeedback</i> Ding et al.	2011	China	Functional constipation determined by Rome III criteria (N=21)	Non-randomized, non-double-blinded, non-placebo-controlled	10 1-h biofeedback sessions, initially every other day followed by 2–3 times per week for 8 weeks, manometry and anal electrode were used to measure sphincter contractions, patients were asked to keep sphincter constrictions within certain range through relaxation and constriction of the pelvic floor muscles	Significant improvements in several psychological questionnaires (self-rating anxiety scale, self-rating depression scale), several variables on the 36-item short-form health survey for quality of life, and the Bristol stool scale. No changes in autonomic function as evaluated by high and low frequency heart rate bands.

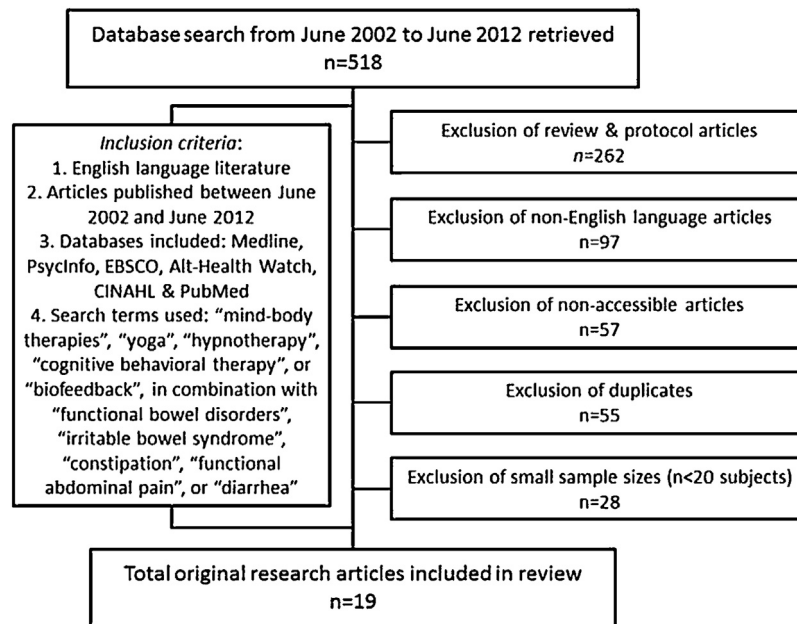


Fig. 1. Flow chart illustrating the selection criteria for clinical trials.

evaluated the effect of mixed Surya Nadi pranayama yoga postures and select breathing techniques in 22 patients with diarrhea-predominant IBS and found that yoga was at least as effective as loperamide in reducing both anxiety and motility scores in IBS patients [24]. The subjects were split into two groups: one group received the standard pharmacological anti-diarrhea treatment with loperamide while another group practiced yoga twice a day for two months. Evaluation of anxiety and motility scores before, 1 month, and 2 months into the intervention showed that yoga was at least as effective as loperamide in reducing both anxiety and motility scores in IBS patients ($p < 0.01$ for bowel symptom scores in conventional and $p < 0.001$ in yoga group after 2 months compared to baseline; $p < 0.02$ for state anxiety scores in conventional and $p < 0.004$ in yoga group after 2 months compared to baseline). Furthermore, yogic intervention resulted in significantly better improvement in autonomic symptom score ($p < 0.05$ for yoga group compared to conventional group after 2 months of intervention), which is an indicator of reduced parasympathetic tone while normalizing the sympathetic activity to provide balance in motility. Another study evaluated the effect of yoga on 25 IBS patients who were diagnosed by Rome I criteria and aged 11–18 [25]. After an initial screening, they were given an instructional and introduced to yoga self-practice at home. Once they had engaged in practice for one month, they were interviewed again using a 10-point scale pain score, pain coping questionnaire, and the Children's depression inventory form. The authors found that there was a significant difference in functional disability, child manifest anxiety, and emotion-focused avoidance between the yoga and waitlist group at a significance level of $p < 0.1$. In addition, gastrointestinal symptoms and anxiety-related avoidance behavior were significantly reduced after 1 month, further supporting the idea that yoga can benefit patients with IBS [25]. However, due to the small sample size and the use of only descriptive

statistics, the study results remain questionable, especially in light of the higher p -value of 0.1 instead of the widely accepted $p < 0.05$ with a potential for a type II error.

A similar pilot study evaluated yoga in two adolescent groups, aged 8–11 and 12–18 years, who were diagnosed with either IBS or functional abdominal pain according to Rome III criteria in the Netherlands [26]. After 10 Hatha yoga sessions lasting 1.5 h with suggestive and general relaxation elements, the pain intensity and frequency scores for both patient groups significantly decreased compared to baseline ($p = 0.031$ and $p = 0.004$ for pain frequency in 8–11 and 12–18 year old group respectively, $p = 0.015$ for pain intensity in 8–11 year old group). In particular, the pain frequency score in the younger patient group remained significantly lowered at a 3 month follow-up ($p = 0.04$). Because of the significant results, the authors plan to conduct a similarly designed study with a larger patient population to provide further evidence for the benefits of yoga in treating FBDs.

Although there are only a few studies that indicate a benefit of yoga in the treatment of FBDs, the evidence to date suggests that yoga may alleviate pain and anxiety in a diverse patient population. However, the current trials are limited by their small sample size, which indicates that further studies with larger sample sizes are necessary to support the findings.

Hypnotherapy

Hypnosis or hypnotherapy, is one of the oldest practices for induction and maintenance of a sedative or anesthetic state, and is associated with relaxation, elevated mood, reduced pain sensitivity as well as a lower heart and respiration rate [27]. Similar to other mind–body therapies, hypnosis induces a state of heightened internal awareness of and control over bodily processes without losing control or consciousness [28]. The effects of hypnosis are evident in certain brain regions, particularly the

frontolimbic attention system, which is associated with being able to shift focus from unpleasant stimuli to pleasurable or neutral emotions [29].

Because hypnosis has primarily been used to initiate a sedative and anesthetic state, it has demonstrated effectiveness in reducing both acute pain during surgery as well as chronic pain [30–32]. Furthermore, hypnosis has been shown to help improve FBD symptoms as effectively as pharmacological treatments [27,33–38].

The application of hypnosis specifically for the treatment of IBS has been introduced and utilized as gut-directed hypnotherapy by Peter Whorwell and colleagues at the University Hospital of South Manchester in the 1980s [39]. This approach focuses specifically on a framework that provides patients with the necessary hypnotic skills to control gut function and reduce symptoms.

In fact, in one study, gut-focused hypnotherapy relieved pain and increased quality of life after 12 hypnotherapy sessions in 78 IBS patients who did not respond to conventional pharmacological treatments [33]. The overall extracolonic symptom score decreased by 70.7 points ($p < 0.01$), the overall IBS symptom score decreased by 159.7 points ($p < 0.001$), and the overall quality of life score increased by 75.4 points ($p < 0.001$) between pre- and post-hypnotherapy intervention. Nearly all parameters of the cognitive scale improved with the exception of the self-nurturance and perfectionism scores. Another study found similar results for 42 IBS patients who were treated with 12 weeks of hypnotherapy, in which significant improvements in rectal pain, sensitivity, anxiety, depression, and somatic symptoms were observed [34,37]. This study consisted of two sub-studies that used different evaluation techniques to test the different hypotheses. In the first sub-study, which consisted of 18 patients, seven 45-min individual hypnosis sessions were administered to two groups of 9 participants: one group received pain-specific verbal suggestions while the other group did not. Rectal muscle tone and pain threshold were evaluated in conjunction with a daily diary of GI symptoms, pain frequency and severity, and administration of the Beck Depression inventory. The second sub-study consisted of 24 patients that were randomized into an immediate and delayed hypnosis treatment groups. The immediate group received seven hypnosis sessions with pain-specific verbal suggestions over the course of 12 weeks after a 2 week baseline observation period while the delayed waiting-list group received the same hypnotherapy treatment after 4 months. Both groups were interviewed 4 months and 8 months after enrollment. All patients in the first sub-study were evaluated with the physical symptoms inventory and an autonomic functioning test, which involved measurement of skin conductance, skin temperature, and muscle tension via electromyography (EMG). The results showed an immediate effect on abdominal pain ($p < 0.001$ between baseline and posttreatment), bloating ($p = 0.002$), and stool consistency ($p = 0.003$) with pain-specific and non-pain-specific hypnotherapy; however, there was no change in bowel movements per day ($p = 0.733$). Significant improvements in somatization ($p = 0.0001$ pre-treatment vs. post-treatment), anxiety ($p = 0.008$), and depression ($p = 0.03$) were observed in the

second study. The effect of hypnotherapy lasted for at least 10 months after study admission with significant ($p < 0.05$) improvements in abdominal pain, bloating, and stool consistency. These findings indicate that hypnosis is a promising mind–body therapy for patients of FBDs.

Similarly, a review by Gholamrezaei and colleagues of 13 hypnotherapy, clinical studies showed that hypnotherapy was a promising way to alleviate symptoms of IBS, but methodologic inadequacies hampered its efficacy [40]. The authors provided a list of recommendations that might improve the quality of clinical trials which included—among other suggestions—a well-defined study population, a large sample size to allow for small effect sizes, and the use of validated instruments to measure changes in a reliable manner.

Another review of hypnosis by Whorwell, which related the specific type of hypnotherapy to the outcome [41], found that gut-directed or symptom-directed hypnotherapy can alleviate colonic and non-colonic ailments related to IBS and improve patient quality of life. Whorwell concluded that hypnotherapy can influence psychological and gastrointestinal responses by altering the central processing of noxious stimuli and can thus be used in the treatment of many disorders.

However, because these studies were limited by small sample sizes, it is important to examine studies with larger sample sizes to establish validity. In a clinical study that included 204 IBS patients, the long-term effects of hypnotherapy after a 12 week hypnotherapy intervention were evaluated over the course of 6 years [42] and revealed significantly improved pain severity and frequency, bloating, and overall quality of life, especially in patients who continued to practice self-administered hypnotherapy. In addition, a 2007 Cochrane database review regarding the use of hypnotherapy for IBS, which included a total of 147 patients in four studies between 1998 and 2006, demonstrated that, in comparison to conventional pharmacological therapy alone, 5–12 hypnotherapy sessions significantly reduced the overall symptom and abdominal pain scores after 3 months [38]. Although the authors of the review [38] found significant changes in frequency of bowel movements, abdominal pain, and stool consistency, they were not able to determine an overall confidence interval for the improvements due to heterogeneity of the study outcome measures and evaluation tools. These findings are supported by a study of 81 IBS patients that were randomized to receive 5 gut-directed hypnotherapy sessions over the course of 5 weeks in addition to standard care or standard care alone; results indicated significantly lower symptom scores for pain ($p = 0.02$), diarrhea ($p = 0.046$), and overall quality of life ($p = 0.008$) after 3 months [43]. The study notes though, that these differences could not be maintained in comparison to the control group after 12 months, thus indicating a limit to the chronic effects of hypnotherapy after intervention. These findings suggest that the results seen in smaller studies can be replicated on a larger scale, further establishing that hypnosis can be an effective complementary treatment for chronic sufferers of FBDs.

Because children with IBS may suffer from higher social stigma, they could require special consideration in regards to symptom alleviation. One study investigated the use of

gut-directed hypnotherapy in 53 children ages 8–18 who were diagnosed with either functional abdominal pain ($N=31$) or IBS ($N=22$) according to Rome II criteria [36]. Patients were randomized to receive either 6 hypnotherapy sessions over 3 months or conventional treatment with supportive therapy. (The results were not separated into an IBS and functional abdominal pain group, which is a limitation of the study.) However, at 3, 6, and 12 months following the intervention, more children in the hypnotherapy group showed either an improvement (26%, 22%, and 11%, respectively) or were in clinical remission (59%, 71%, and 85%, respectively) compared to the supportive therapy group. Both groups also showed a significant improvement of pain intensity and frequency scores after 1 year following the intervention ($p<0.001$ for hypnotherapy and $p=0.002$ for supportive therapy group). The authors conducted a 5-year follow-up study with the original group of patients [36] to determine pain intensity and frequency [44]. Both parameters remained significantly lower after 5 years in the hypnotherapy and the supportive therapy arm of the initial study, but the hypnotherapy group presented significantly lower scores than the supportive therapy group for both pain intensity ($p=0.003$) and frequency ($p=0.002$). Thus, although the primary study had mostly positive outcomes, it provided few insights into specific improvements and was also limited by the inclusion of multiple conditions in a small sample size.

The role of gut-directed hypnotherapy for IBS has also been evaluated in a patient population of 75 IBS patients diagnosed using Rome II criteria with evaluation of quality of life and IBS symptom questionnaires pre- and post-intervention [45]. Gut-directed hypnotherapy was administered over the course of a 3 month period in 5–7 sessions. The predominant symptoms of abdominal pain and distension decreased significantly ($p<0.05$) after hypnotherapy as did almost all health-related quality of life measures (emotional ($p<0.05$), mental health ($p<0.05$), sleep ($p<0.05$), energy ($p<0.05$), physical health ($p<0.05$), diet ($p<0.001$), social ($p<0.05$) and physical role ($p<0.001$) as well as anxiety scores ($p<0.05$)). However, the limitation of the study was the absence of a control group and the fact that at least some of the improvements may have been linked to the individual attention patients received from the nurse therapist. As a result, the author advocates for an appropriately trained and educated GI nurse specialist to be involved in gut-directed hypnotherapy for IBS patients.

Although gut-directed hypnotherapy is beneficial for many IBS patients, it appears to be of particular benefit to refractory IBS patients if they respond to the treatment. In a retrospective study, Lindfors et al. evaluated 208 patients who received hypnotherapy between 2000 and 2006 using a subjective assessment questionnaire for IBS symptoms [46]. Of the 208 patients, 103 were classified as responders that improved significantly with hypnotherapy with 73% still using hypnotherapy for their IBS symptoms during the 5-year follow-up. Overall, 100% of hypnotherapy responders compared to 74% of non-responders ($p<0.001$) considered gut-directed hypnotherapy a worthwhile treatment. The use of hypnotherapy may serve both the purpose of complementing the traditional pharmacological approaches as well as providing patients who do not get adequate relief or

are refractory to current conventional treatment an alternative treatment for long-term relief of IBS symptoms and severity. The relief experienced with the continued use of hypnotherapy appears to be sustained over years following the initial hypnotherapy intervention.

Because IBS symptoms can alter with the environment, researchers evaluated the influence of setting on hypnotherapeutic effectiveness. In this study, hypnotherapy sessions occurred either in the private practice of a clinical psychologist (study 1) or a hospital setting (study 2) [47]. For both studies, 138 patients with refractory IBS were either randomly assigned to receive hypnotherapy sessions over 12 weeks or assigned to a waiting list in study 2 and receive supportive therapy in study 1 as control treatments. At a follow-up of 3 months, both hypnotherapy groups showed significant improvements ($p<0.05$) in symptom scores for IBS (total GI symptoms, sensory symptoms, and bowel habits) compared to the baseline and respective control groups, but after 1 year, only the hypnotherapy group assigned to private practice sessions was able to maintain reduced pain ($p<0.01$), bloating ($p<0.01$), and diarrhea ($p<0.05$), improved quality of life (emotional functioning ($p<0.01$), mental health ($p<0.05$), sleep ($p<0.05$), energy ($p<0.01$), and social role ($p<0.05$)). The other 3 groups showed no significant improvement compared to baseline, which may indicate that the hypnotherapy environment can significantly influence clinical outcomes.

Similarly, because symptoms of IBS appear to be linked to food ingestion, researchers investigated the effect of hypnotherapy in post-prandial IBS patients refractory to conventional therapy [48]. A total of 28 patients were assigned to receive either 1-h hypnotherapy sessions over 12 weeks or supportive therapy for the same time period. Colonic distension was evaluated at baseline and after 3 months using a barostat measurement before and after a 1-h duodenal lipid infusion. The results indicated that hypnotherapy reduced symptoms, with higher balloon pressure compared to supportive therapy, which significantly lowered gas ($p<0.01$), discomfort ($p<0.01$), and pain ($p<0.01$) levels 1 h after lipid infusion. Due to these findings, the authors concluded that hypnotherapy affects both motor and sensory components in the GI tract. This study, however, was limited by a small sample size as well as a failure to include cholecystokinin measurements that impact significantly gastrocolonic response. In addition, although this study was well-designed, it lacks questionnaires that are commonly used when evaluating overall improvement and personal perception of the patients, which would further support the physiological findings. Therefore, the study cannot be directly compared to other studies that incorporate these tools.

Based on the small sample size of previous studies involving IBS patients and hypnotherapy, a research group in the Netherlands is currently conducting a study including 354 patients with IBS diagnosis [49]. Patients are randomly assigned to either individual or group hypnotherapy sessions and compared to educational sessions that served as the placebo group. The aim of the study is to provide further support for the therapeutic application of hypnotherapy in reducing IBS symptoms as well as become one of the few studies that compares

individual to group settings in a hypnotherapy intervention; results of the study are expected to be published at the end of 2013.

Overall, hypnotherapy in the treatment of FBDs has shown to be effective in a number of small clinical studies compared to either wait-list or conventional pharmacological treatment groups. It appears to be important to maintain regular hypnotherapy as an intervention to retain the effectiveness in reducing the symptoms of FBDs. However, inadequate study designs and heterogeneity in regards to the outcome measures warrant further research in order to solidify the current findings. In addition, frequency and durations of hypnotherapy interventions should be investigated further for generalizability and maximum benefits with minimum frequency.

Cognitive behavioral therapy

Patients with chronic conditions often have a negative attitude that limits their ability to heal. However, this attitude can be altered with cognitive behavioral therapy (CBT), which challenges negative thoughts and causes patients to focus on a more positive outlook. A review of meta-analyses has shown CBT to be effective in a number of chronic conditions [50] such as depressive disorders [51], obesity [52], insomnia [53], and chronic pain [54], but improvement with these conditions is not immediate; indeed, CBT requires at least 8–10 weekly sessions before improvement of symptoms is observed because it takes time for patients to adjust their perspective.

In addition to these chronic conditions, present research currently demonstrates the effectiveness of CBT in easing symptoms of FBDs. For example, in one large study that examined 431 female patients suffering from FBDs, CBT was at least as effective as the antidepressant, desipramine in reducing symptoms [55]. Participants who were diagnosed with IBS, painful functional constipation, chronic functional abdominal pain, or unspecified FBD according to Rome I criteria were allocated to one of four treatment arms: 135 patients received 12 CBT sessions over the course of 3 months, 66 patients received 12 modified-attentional control sessions during the same time period, 135 patients were randomized to receive desipramine (final dose 150 mg/day), and 66 patients received placebo for 3 months. The composite score when comparing CBT with modified-attentional control and desipramine with placebo resulted in a significant improvement for CBT over control ($p < 0.0001$) while desipramine was not significantly better than placebo ($p = 0.16$). However, patient satisfaction was significantly higher for the desipramine ($p = 0.011$) and CBT ($p = 0.0004$) groups. In addition, the CBT group presented with significantly ($p = 0.04$) improved global well-being after 3 months compared to the control. The responder rate was also significantly higher in the CBT group vs. control ($p < 0.0001$) while desipramine responder rate was not significantly different from placebo. Interestingly, neither CBT nor desipramine had a significant effect on IBS quality of life and the McGill average daily pain scores. A further analysis of the outcome suggests that satisfaction with treatment depends on cognitive factors such as confidence in treatment, perceived control over

the illness, and reduction in negative cognition of the symptoms, which may be better obtained with CBT than medication therapy alone [56]. In another, clinical study, 105 IBS patients were diagnosed using Rome I criteria, and used either CBT ($N = 34$), relaxation therapy ($N = 36$), or standard medical care ($N = 35$) [57]. Results showed that CBT was able to affect mood (mainly anxiety and depression) and change bowel symptoms as much as relaxation and standard clinical care. However, this study was limited because the CBT group received both standard clinical care and relaxation therapy; thus, researchers were unable to distinguish which variable determined the outcome. Although these findings are supportive of the use of CBT to ease FBD symptoms, more research is needed that investigates the potential mediator role that CBT plays between mood changes and IBS symptoms.

Another study investigated the complementary use of CBT in patients with IBS receiving mebeverine hydrochloride as an antispasmodic treatment [58]. Only patients that were not well controlled after 4 weeks of mebeverine treatment were randomized to receive either complementary CBT ($N = 72$) or continue with only mebeverine ($N = 77$). Patients receiving CBT in addition to mebeverine showed significant improvements in overall symptom severity scores (95% CI -109 to -32) and increased quality of life (95% CI -35.4 to -7.9) at 3 months after the intervention. However, the benefits of CBT appeared to wane over time and did not reduce the overall social costs, following a one-year follow-up period. This may point to the necessity of a long-term supportive treatment with CBT in addition to commonly used medication for IBS. The secondary analysis [58] of the original study [57] indicated that behavioral and cognitive components were important in the treatment of IBS and that IBS-related cognition and behaviors were actually mediators of change for IBS patients who received CBT [59].

When CBT as a complementary therapy is compared to medication treatment alone, it is evident that CBT not only improves IBS-related symptoms, but also mental health and well-being. For example, in one study, 50 IBS patients who were diagnosed according to Rome II criteria were assigned to receive medication treatment alone or 8 CBT sessions over the course of 2 months as a complementary therapy [60]. Results indicated significant reduction of all parameters in the CBT group following the intervention. These parameters included Rome-II score ($p = 0.001$), somatization ($p = 0.0001$), obsessive-compulsiveness ($p = 0.0001$), interpersonal sensitivity ($p = 0.0001$), depression ($p = 0.002$), anxiety ($p = 0.0001$), hostility ($p = 0.0001$), phobic anxiety ($p = 0.0001$), paranoid ideation ($p = 0.003$), psychoticism ($p = 0.001$), and general symptom index ($p = 0.0001$) that were evaluated using standardized questionnaires. Although the results were positive, this study was limited because it lacked a placebo for the medication group alone.

Researchers primarily investigate CBT using individual sessions, but recent studies have examined CBT in a group therapy setting. A study conducted in Canada investigated the use of cognitive behavioral group therapy in 28 patients diagnosed with IBS according to Rome I criteria over the course of 9 weeks with a 3 month follow-up [61]. Patients were randomized to receive

either a CBT intervention as a group or symptom monitoring with weekly telephone contact. Significant improvements were observed for the CBT group therapy arm over the course of the study for the cognitive scale for functional bowel disorders ($p=0.002$ vs. control group), on the assertiveness questionnaire ($p=0.035$), and the short form 36 health survey physical health component scale ($p=0.036$). This study had a small sample size and the control group was offered CBT after completion of the initial 9 week treatment, which may have influenced the perception of initial treatment effects at the 3 month follow-up. Nonetheless, the results indicate that group-directed CBT may provide similar relief and benefits in treating IBS.

Taylor et al. incorporated a range of complementary mind–body therapies while investigating the benefits of group CBT, educational, and hypnotherapy sessions in 158 participants over the course of 4 months [62]. Participants had been diagnosed with IBS according to Rome II criteria and were divided into small groups of 4–7 patients who received a combination of CBT, IBS education, and gut-directed hypnotherapy. The pooled data for all 23 groups showed marked and significant improvements for psychological and general well-being, gastrointestinal symptom rating, and prevention of enjoyment of life scales (all $p<0.001$ post- vs. pre-intervention). Although this study successfully addressed a holistic approach to IBS treatment, the conclusions that can be drawn are limited because the effects of each therapy are difficult to distinguish.

The current research on the effectiveness of CBT in FBDs is promising, but due to small sample sizes and heterogeneity in study protocols, including dosages and duration of intervention, further research with larger sample sizes and standardized study protocols are warranted to establish CBT as an effective treatment for patients with FBDs.

Biofeedback

Biofeedback training, which allows patients to gain control over certain physiological functions, also assists them in recognizing the often subconscious dysfunction through a simple physiological measurement (e.g. temperature, blood pressure, intestinal distension) and visualization. Biofeedback can then employ both motor skill and sensory discrimination training to improve the patient's awareness and allow for adaptations [63]. The use of biofeedback has long been employed in a number of conditions including substance abuse, hypertension, headaches, chronic pain, constipation, and anxiety disorders [64]. With respect to general, functional gastrointestinal disorders, training specific muscle groups and recognition of symptoms can substantially aid patients, but the voluntary control of smooth muscles and secretory responses remains very limited [63].

Biofeedback has been evaluated in a number of functional gastrointestinal disorders such as fecal incontinence, functional anorectal pain, irritable bowel syndrome, and functional dyspepsia. One study, which included 19 patients with functional disorders, provided participants with an 8-week treatment protocol of biofeedback training and compared them to a control group of 40 patients who received conventional therapy [65]. Of the 59 patients, 24 had been diagnosed with IBS while the

others had been diagnosed with fibromyalgia, functional cardiac pain, myofascial pain, or panic and anxiety disorders with somatization. The study mainly focused on the feasibility and cost of the biofeedback treatment rather than evaluation of symptom reductions, which were noted as significant ($p<0.05$) for all conditions in the 11 symptom questionnaire. Results of this study, however, did not indicate any specific variables and factors that would benefit IBS patients. Also, the overall evaluation was brief and not well explained, thus limiting replication of the study as well as applicability to other FBDs.

Another study evaluated the effect of biofeedback training in 21 patients with functional constipation [66]. Patients were evaluated before treatment and again after 10 biofeedback sessions as well as home training. Patients reported significant improvements in several clinical parameters, such as spontaneous frequency of bowel movement ($p<0.01$ post- vs. pre-intervention), straining effort ($p<0.01$), sensation of incomplete evacuation ($p<0.01$), stool consistency ($p<0.01$), and bloating ($p<0.01$). In addition, both anxiety and depression scores also improved significantly ($p<0.01$) following biofeedback intervention. Changes in quality of life showed significance for some factors but not others, especially physical and social role functioning, and mental health. The authors did not find an indication for an influence of biofeedback on autonomous nervous system function, which may be attributed to the small sample size in the study.

Biofeedback has also been evaluated for symptom relief in patients with IBS with limited results. Small studies using a variety of physiological measures including bowel sounds, balloon probes, or general electromyogram and temperature measures as indicators for stress responses had varied, unpromising results. There are some indications that certain general cognitive approaches supported by biofeedback may improve symptoms of bloating and GI distress in IBS patients, but more research is needed to substantiate this report. Table 1 includes a summary of the clinical studies involving mind–body therapies for the treatment of functional bowel disorders.

The currently available research for biofeedback is limited by small sample sizes, mostly uncontrolled study protocols, and heterogeneity in the use of various biofeedback approaches. Further research with rigorous trial designs are needed to provide a higher level of evidence for the benefits of biofeedback in the treatment of FBDs.

Conclusions

Functional bowel disorders remain a challenge for both the healthcare providers and patients in diagnosis and treatment. Many pharmacological approaches are unspecific to the disease and often result in suboptimal outcomes that leave patients unsatisfied with treatment. The use of mind–body therapies for the alleviation of symptoms has been evolving with a growing number of trials establishing a body of evidence of their effectiveness. However, many studies remain challenged by small sample sizes, incomplete explanation of the study protocol, or lack of rigor of the study designs that do not utilize control groups or include baseline characteristics. At present, the strongest

scientific support exists for the use of hypnotherapy in the treatment of IBS and potentially other FBDs associated with pain and gastrointestinal discomfort. Although research findings for other mind–body therapies are limited and not conclusive, these alternative treatment approaches are not associated with any significant side effects, unlike many available pharmacological treatments. Thus, whenever a patient has an FBD and standard pharmacological care alone proves to be unsatisfactory then mind–body therapies should be considered as a viable complement to standard pharmacological therapies. When comparing studies using hypnotherapy, CBT, and brief psychodynamic psychotherapy, Blanchard reached the conclusion that these treatments are effective in reducing IBS symptoms without indicating superiority for one treatment over another [67]. He also points out that a lack of uniform success in reasonable sized trials indicates that further research on a larger scale and comparing various mind–body treatment options is necessary to establish validity.

In line with the rise in popularity of CAM, the United Kingdom National Institute for Health and Clinical Excellence (NHS) has released guidelines on the diagnosis and treatment of IBS in which cognitive behavioral therapy, hypnotherapy, and biofeedback are addressed [68]. While the NHS guidelines suggest an overall improvement of symptoms and symptom management, the guidelines highlight the need for larger and well-designed clinical studies. One of the findings was that cognitive behavioral and hypnotherapy were generally more effective in refractory IBS patients. However, the NHS guidelines are not clear about biofeedback and relaxation techniques, largely due to insufficient research data regarding their effectiveness.

Of importance to the use of mind–body therapies to the medical community is their cost-to-benefit or cost-to-effectiveness ratio which may help to establish such complementary treatment approaches further. In this area, even less data is available to date. Van Tilburg and colleagues evaluated the cost effectiveness of mind–body therapies in the treatment of FBDs and found that there is a significant cost-benefit to using mind–body therapies and other CAM as complements to conventional therapy [18]. The authors also concluded that most patients are generally satisfied with conventional care, and are only seeking out additional treatment options. Thus, future studies should compare the cost-benefit ratio and effectiveness of CAM therapies in the treatment of FBDs, thus allowing patients to make a more informed decision.

Another factor that may limit the use of mind–body therapies in the treatment of FBDs is access to well-qualified therapists. Both funding limitations (e.g. CAM therapy not covered by health insurance, unaffordable for low-income households) and a lack of regulation and adequate training of therapists may limit access and use of mind–body therapies in many populations. Overall though, there has been a steady increase in the use of CAM therapies especially among rural populations that often have restricted access to standard treatment providers or do not have healthcare coverage to provide for expensive medicine and physician costs [69].

Overall, although it is inconclusive to determine the effectiveness and usefulness of using mind–body therapies for FBDs,

the majority of published studies indicate positive outcomes of these therapies [14]. Patients who have not responded well to conventional therapies are best suited to benefit from the use of mind–body therapies, but CAM treatment can provide additional relief to patients treated with conventional medicines.

Thus, recommendations for future research related to this area include, but are not limited to: (1) study with larger sample sizes and rigorous trial design, (2) examining the mechanisms of these interventions to alleviate symptoms, (3) investigating the dosages and durations of the intervention for short-term effects and retaining long-term effects, and (4) standardizing the study protocols based on a type of mind–body therapy, which would be beneficial for replication of a study and generalizing the findings. Finally, a combination of certain mind–body therapies with other types of complementary therapies may be beneficial as part of an integrative and holistic approach to manage the diverse symptoms of FBDs.

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Conflict of interest disclosure

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