Beyond Medication: Integrative and Nutrition Therapies for Disorders of Gut-Brain Interaction

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Abstract: Disorders of gut-brain interaction (DGBIs), such as irritable bowel syndrome and functional dyspepsia, affect a substantial portion of the global population. These disorders are best conceptualized through a biopsychosocial framework, reflecting the complex interplay and bidirectional communication among biological, psychological, and social factors. While conventional pharmaceutical treatments remain limited in efficacy and patient satisfaction, interest in integrative approaches to care continues to grow. However, despite the increasing use of integrative interventions for DGBIs, their therapeutic targets and underlying mechanisms remain poorly defined. This article aims to describe current and emerging integrative and nutrition-based interventions for DGBIs and evaluate their potential to complement conventional medicine by addressing a broader spectrum of biopsychosocial risk factors.

Keywords
Disorders of gut-brain interaction, irritable bowel syndrome, functional dyspepsia, integrative medicine, mind-body therapies, biopsychosocial factors

Disorders of gut-brain interaction (DGBIs), also known as functional gastrointestinal (GI) disorders, are chronic GI disorders characterized by the absence of structural or biochemical abnormalities. Approximately 40% of adults worldwide meet the diagnostic criteria for at least 1 DGBI.[1] Irritable bowel syndrome (IBS) is one of the most prevalent lower DGBIs worldwide, affecting approximately 1.5% to 4.1% of the population.[1] Functional dyspepsia (FD) is the most common upper DGBI, impacting an estimated 4.8% to 7.2% of the global population.[1]

A biopsychosocial framework (Figure 1) offers a comprehensive model for understanding DGBIs, emphasizing the complex interplay and bidirectional communication among biological, psychological, and social factors.[2] Stress, psychosocial, and lifestyle factors can contribute to disruptions in gut-brain signaling, resulting in DGBI pathophysiology,

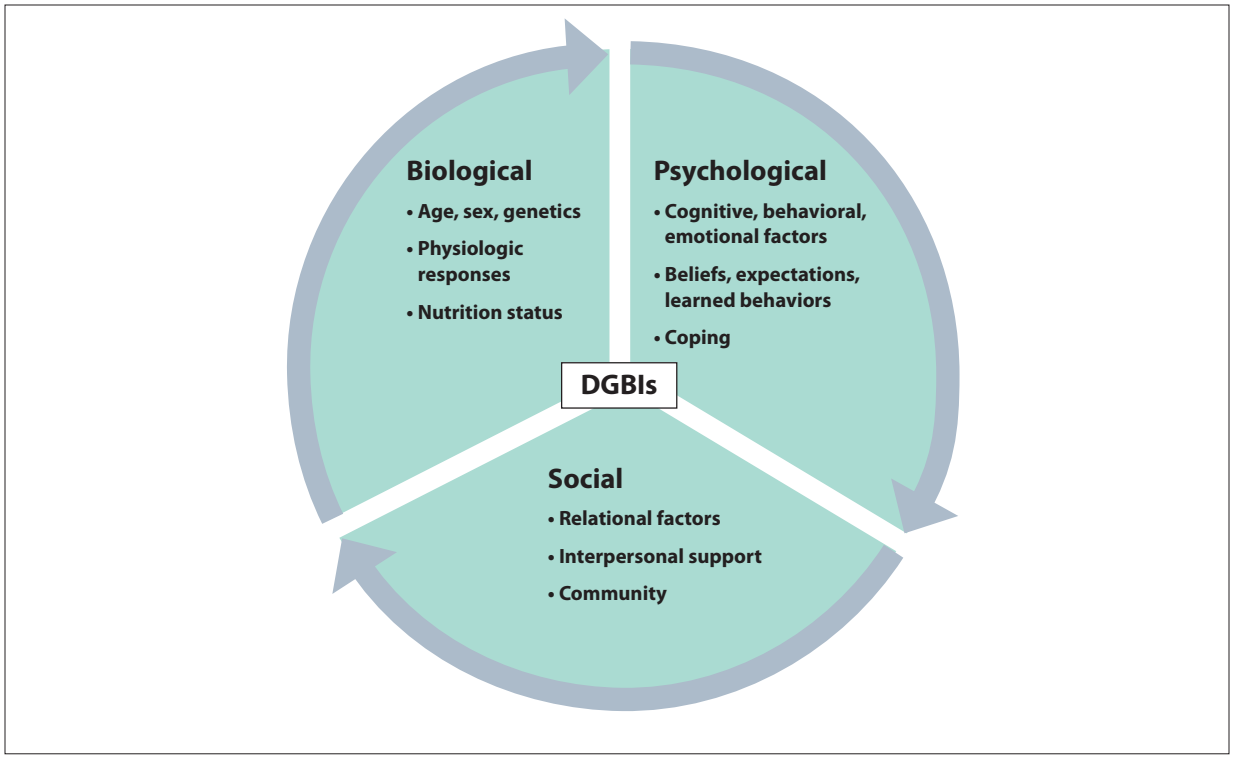


Figure 1. Biopsychosocial framework for DGBIs.

DGBIs, disorders of gut-brain interaction.

including visceral hypersensitivity,[3] altered GI motility,[4] gut microbial dysbiosis,[5] nutritional deficiencies,[6] and immune-mediated changes.[7]

Despite the availability of pharmaceutical treatments, many patients with DGBIs report dissatisfaction owing to limited efficacy and adverse side effects,[8] which contribute to increased patient burden and high health care costs. Moreover, conventional approaches often fail to address the full spectrum of biopsychosocial risk factors that contribute to DGBIs. Consequently, patients increasingly seek nonpharmaceutical and integrative approaches to care. It has been reported that complementary and integrative medicine interventions are used by up to 42% of patients with GI conditions, and the majority of these patients find these interventions to be helpful.[9] However, despite their popularity, integrative treatment targets remain poorly defined. The purpose of this article is to describe current and emerging integrative interventions for DGBIs and explore how they can complement conventional medicine by addressing a broader range of biopsychosocial risk factors.

Summary of Evaluated Literature

For this narrative review, our interdisciplinary team, comprised of experts in integrative and nutritional medicine, identified relevant content areas and then conducted a comprehensive literature search. We summarized relevant studies for patients with common DGBIs such as IBS and FD, including behavioral approaches, nutritional interventions (dietary therapies), dietary supplements, meditative movement, acupuncture, massage therapy, pelvic floor physical therapy (PFPT) and biofeedback, and virtual reality (VR).

Behavioral Approaches

Brain-gut behavior therapies (BGBTs) include short-term clinician-administered behavioral interventions designed to treat GI disorders. BGBTs directly target modifiable cognitive-affective processes and central stress pathways that drive and maintain GI symptoms and related distress (eg, GI-specific anxiety and visceral hypersensitivity) through dysregulation of the gut-brain axis.[10] Cognitive behavioral therapy (CBT) and gut-directed hypnotherapy are the most evidence-based BGBTs.[11] Additional approaches including self-management training, mindfulness programs, emotional processing, and interpersonal therapies are gaining empiric support.[10] A recent updated systematic review and network meta-analysis of 67 randomized controlled trials (RCTs) evaluating behavioral therapies for global IBS symptoms found that BGBTs

Table. Diet Therapies in IBS and FD

	Features of the diet	Rationale	Symptom benefit and evidence
Low-FODMAP diet	• 3-phase elimination diet • Focused on reduction of commonly malabsorbed, short-chain, highly fermentable carbohydrates	• Reduces luminal distention caused from fermentative and osmotic effects of these carbohydrates • Emerging data that FODMAP-rich diet in IBS may induce dysbiosis, contribute to mast cell activation and colonic barrier dysfunction	• Best data in IBS for abdominal pain and bloating,[29] emerging evidence in FD for reduction of IBS symptoms[36,37]
Mediterranean diet	• Emphasizes whole, minimally processed foods: fruits, vegetables, whole grains, legumes, nuts, and seeds • Encourages extra virgin olive oil use • Encourages eating fish and chicken and less red meat	• Reduces inflammation • Benefit to gut microbiome via plant-forward, polyphenol, and fiber-rich diet • Less restrictive than other diets and may provide overall chronic disease risk reduction	• Mixed data for symptom management in IBS,[31,32] may lower risk of condition in FD[40]
Traditional IBS NICE guidelines/regular meal pattern	• Includes eating regular meals (no skipping); limiting caffeine, alcohol, and spicy foods; reducing fiber; limiting fruits to 3 per day; and encouraging adequate hydration	• Balanced diet, reduces potential triggers	• Evidence in IBS[94] only, not validated in FD[44] or FD-IBS overlap
GFD	• Diet free of gluten (found in wheat, barley, and rye)	• Unclear mechanism, some patients may have nonceliac gluten sensitivity, gluten may alter small bowel permeability • In some patients with IBS, other diet components excluded with GFD (eg, fructans, wheat bran) may be a trigger	• Data are mixed but IBS[27,95] and FD[38,96] symptom benefits appear to be due to a reduction in fructans found in gluten-containing grains
Fiber adjustment	• Increasing soluble fiber	• May offer gut microbiome benefit • Some soluble fibers are gel-forming, which may aid stool consistency	• Soluble fiber such as psyllium helpful in IBS, improvement in IBS-SSS with psyllium over placebo at 12 weeks[97,98]; there are insufficient data for FD

FD, functional dyspepsia; FODMAP, fermentable oligosaccharide, disaccharide, monosaccharide, and polyol; GFD, gluten-free diet; IBS, irritable bowel syndrome; IBS-SSS, IBS Symptom Severity Scale; NICE, National Institute for Health and Care Excellence.

demonstrated the strongest evidence of efficacy for this population compared with other behavioral approaches. BGBTs included minimal contact CBT (relative risk [RR], 0.55; 95% CI, 0.39-0.76; *P*-score = .78), telephone disease self-management (RR, 0.57; 95% CI, 0.41-0.80; *P*-score = .75), dynamic psychotherapy (RR, 0.59; 95% CI, 0.43-0.80; *P*-score = .72), CBT (RR, 0.65; 95% CI, 0.53-0.80; *P*-score = .64), disease self-management (RR, 0.68; 95% CI, 0.50-0.92; *P*-score = .58), Internet-based minimal contact CBT (RR, 0.77; 95% CI, 0.61-0.96; *P*-score = .43), and gut-directed hypnotherapy (RR, 0.79; 95% CI, 0.66-0.95; *P*-score = .39).[12] These findings reinforce clinical guidelines that recommend the inclusion of BGBTs as part of a multimodal approach to managing global IBS symptoms.[13] Although most research on BGBTs has been primarily focused on IBS, experts suggest that BGBTs are likely to demonstrate clinical efficacy across the broad spectrum of DGBIs, including FD.[10] A systematic review and meta-analysis of 9 small RCTs demonstrated that psychological interventions were associated with improvement in global FD symptoms (standardized differences in means, -1.33; 95% CI, -1.97 to -0.68), but further research is needed to determine whether BGBTs have specific benefits for this population.[14] Other approaches such as digital applications are not BGBTs because they are not clinician-administered; however, these approaches may be beneficial in some cases, such as when cost and access are prohibitive, and patients are motivated for self-management.[15]

Complementary behavioral interventions for DGBIs include mindfulness, meditation, relaxation, and breathing techniques. These interventions can be incorporated into BGBTs; however, they can also function independently as mind-body interventions. Mindfulness involves attentional awareness of the present moment without judgment[16] and can be incorporated through

approaches including guided meditation, breath work, and awareness in daily activities. A systematic review of 6 mindfulness studies for IBS showed that quality of life and mindful awareness were significantly higher in the mindfulness group compared with controls, whereas pain levels were significantly lower.[17] Meditation approaches have been less well-studied among patients with FD. However, a pilot RCT comparing meditation with standard treatment found that those in the meditation group had greater improvements in GI quality of life, anxiety and depression, and sleep quality compared with controls.[18] Although the underlying mechanisms are still being studied for DGBIs, evidence from the broader medical literature suggests that mindfulness-based interventions enhance adaptive emotion regulation strategies, increase mindfulness and self-compassion, and reduce maladaptive processes such as rumination and experiential avoidance, which in turn reduces stress, depression, and anxiety and enhances positive emotions.[19] Similarly, relaxation training aims to alleviate stress through arousal reduction and can be implemented in various forms (eg, progressive muscle relaxation, guided imagery, diaphragmatic breathing). These forms of relaxation training have been shown to reduce GI symptom severity among patients with IBS,[20] pointing to their value as important stress management tools that can complement many types of clinical interventions. Adverse events are infrequently reported for behavioral approaches; however, these approaches should be used judiciously based on patients' needs and preferences.

Nutrition Interventions

Nutrition plays a therapeutic role in DGBIs by improving GI symptoms, addressing malnutrition and nutrient deficiencies, and supporting psychological and gut microbiome health.[21] Postprandial symptoms, common in IBS and FD,[22] are likely driven by pathophysiologic changes (eg, motility disturbances, visceral hypersensitivity, changes in mucosal and immune function, alterations in the gut microbiota, disruptions in central nervous system processing).[23] Diet-related symptoms can lead patients to adopt restrictive diets, which may compromise their nutritional status and mental well-being. Patients with IBS often show low intake of essential micronutrients, which has been linked to greater GI symptom severity, extraintestinal complaints, and fatigue.[24] The following sections describe dietary therapies for IBS and FD (also detailed in the Table).

Dietary Therapies for Irritable Bowel Syndrome

Postprandial symptoms are common in IBS. In a survey of approximately 200 patients, 84% reported that any food could trigger symptoms, with 70% identifying carbohydrates, especially fermentable types, as key culprits. Frequently cited triggers included dairy (49%), beans/lentils (36%), apples (28%), flour (24%), and plums (23%).[25] Evidence-based dietary strategies for IBS include the low–fermentable oligosaccharide, disaccharide, monosaccharide, and polyol (FODMAP) diet (LFD), gluten-free diet (GFD), Mediterranean diet (MD), UK National Institute for Health and Care Excellence (NICE) IBS diet, and diets rich in soluble fiber.[26] The LFD, a 3-phase elimination diet targeting highly fermentable and/or osmotically active short-chain carbohydrates, currently has the strongest evidence for reducing abdominal pain and bloating.[27] A systematic review and meta-analysis of 41 studies demonstrated a pooled RR of 1.21 for global symptom improvement, although 5 studies found no significant impact on quality of life (mean difference, 4.59; 95% CI, 1.50-7.67).[28]

GFD trials found reduced global symptoms vs control (RR, 0.42; 95% CI, 0.11-1.55; I^2 = 88%), although this was not statistically significant.[29] Observational studies have found that most patients with IBS improve on a GFD; however, RCTs have produced mixed results. Some evidence suggests that the carbohydrate component, particularly fructans, found in gluten-containing grains rather than the gluten protein itself may be the trigger for symptoms.[27]

The MD has shown benefits in IBS, with studies reporting GI symptom and quality-of-life improvements comparable with the LFD and GFD; notably, the MD was most favored by patients.[30] The MD has been shown to be well-tolerated[31]; however, specific MD foods have been associated with worsening symptoms. Personalized diets may benefit those with heightened symptoms.[32] A recent pilot study assessing benefit of the LFD vs the MD revealed that both improved IBS with diarrhea and mixed IBS symptoms, with the LFD offering greater relief.[33] Because the MD can include varying FODMAP levels, its effectiveness may depend on baseline intake. Larger real-world studies are needed before the MD can be routinely recommended.

Another nutritional strategy for IBS includes the NICE guidelines: regular meals; avoidance of large portions; reduced intake of caffeine, alcohol, and carbonated beverages; and adjustment of fiber intake.[34] A diet rich in soluble fiber (eg, oats, legumes, psyllium) helps relieve symptoms more than insoluble fiber.[27] Because many soluble fiber foods are also high in FODMAPs, recommendations should be personalized.

Dietary Therapies for Functional Dyspepsia

FD often presents with food-related symptoms such as early satiety, postprandial fullness, and epigastric

burning.[35] Although diet trials are limited, the LFD and MD are the most studied. The LFD has shown reduction in epigastric symptoms and postprandial bloating in FD. In an RCT of FD patients (81% with IBS), those following the LFD experienced greater symptom improvement and higher response rates compared with those who received standard dietary advice.[36] In an RCT comparing the LFD with traditional dietary advice for FD, both groups improved, but those with postprandial distress or bloating saw greater benefit from the LFD.[37] Gluten has also been studied as a trigger for FD. In a study of refractory FD, 35% of patients (n=77) improved on a GFD, yet only 18% of responders were found to have symptoms provoked by the ingestion of gluten, suggesting that other components in the gluten-containing grains (eg, fructans) or a nocebo effect may be responsible.[38]

Research on other dietary patterns in FD (eg, Dietary Approaches to Stop Hypertension [DASH], vegetarian, vegan) shows mixed results.[39] The DASH diet, which is high in fiber, plant foods, healthy fats, and low-fat dairy, may worsen postprandial distress syndrome, whereas adherence to the MD is linked to reduced FD risk. Research on vegetarian and vegan diets is very low quality, leaving their effect on postprandial distress syndrome uncertain.[40] Evaluations of patient-reported food triggers vary. In an FD patient survey, foods reported to trigger symptoms included processed meat, pickles, vinegar, soft drinks, grains, tea, salt, pizza, watermelon, red pepper, and pasta.[41] In another study of FD patients, fried/fatty foods, hot spices, and carbonated drinks most often triggered symptoms; in postprandial distress syndrome, carbonated drinks and legumes were especially symptom-inducing.[42]

Meal temperature may also affect FD. One study found that cold meals (8 °C) raised intragastric pressure in controls and further increased pressure, reduced compliance, and lowered gastric perfusion in FD patients, with most patients developing discomfort. Cold exposure may heighten visceral sensitivity and limit gastric volume in FD.[43] Eating habits and meal structure can play a role in FD. One study found that skipping lunch has been linked to the highest FD risk (odds ratio, 2.5) followed by skipping breakfast (odds ratio, 1.6); however, skipping dinner showed no significant impact.[44]

Evaluating Food-Related Avoidance

Of particular concern is the link among DGBIs, disordered eating, and fear of food, notably avoidant/restrictive food intake disorder (ARFID), which is characterized by restrictive eating behavior driven by fear of aversive consequences from eating, rather than body image disturbance. Studies show that 13% to 40% of DGBI patients meet criteria for or show significant symptoms of ARFID. Exclusion diets may trigger or worsen ARFID, while ongoing food avoidance can sustain existing symptoms.[45] For this reason, GI professionals should assess patients for disordered eating behaviors prior to recommending restrictive nutritional approaches to reduce harm. When diet therapies are contraindicated or not of interest to the patient, behavioral approaches, lifestyle interventions, and supplements should be considered.

Dietary Supplements

Numerous trials have explored supplements for DGBIs. For IBS, enteric-coated peppermint oil has shown mixed results. A systematic review and meta-analysis of 10 RCTs demonstrated that peppermint oil was more effective than placebo for global IBS symptoms (RR, 0.65; number needed to treat [NNT] = 4) and abdominal pain (RR, 0.76; NNT = 7), although adverse events are more common (RR, 1.57).[46] Another RCT, however, found no significant benefit over placebo.[47] IBgard—a novel oral peppermint oil targeted for release in the small intestine—has shown promising results in an RCT, producing greater reductions in IBS symptom severity than placebo, with good tolerability.[48] In postinfectious IBS, glutamine has been tested in an RCT against placebo and was found to improve IBS symptoms in 79.6% of participants vs 5.8% with placebo. Interestingly, intestinal hyperpermeability normalized only in the glutamine group.[49]

Furthermore, data support the use of supplements in FD. A systematic review and meta-analysis of 52 RCTs found that Rikkunshito outperformed conventional treatments and demonstrated significantly better outcomes, with a higher total clinical efficacy (RR, 1.21). Rikkunshito was associated with greater reductions in total dyspepsia symptom scores, improved gastric emptying rates, and a lower recurrence rate at 6 months posttreatment.[50] Chios mastic gum has also been studied. In an RCT, chios mastic gum significantly improved FD symptoms in 77% of patients vs 40% with placebo (P<.02), with significant benefits for general stomach pain, anxiety-related pain, upper abdominal ache, and heartburn (all P<.05).[51] In an RCT, FDgard—a duodenal-targeted blend of caraway oil and L-menthol—significantly reduced postprandial distress at 24 hours (P=.039), and there was a nonsignificant trend toward benefit of epigastric pain syndrome symptoms (P=.074).[52] Another RCT found greater symptom improvement and disease-specific quality of life with artichoke leaf extract compared with placebo.[53] Ginger extract also shows promise for most dyspepsia symptoms, especially epigastric pain.[54]

Other forms of supplements, such as probiotics, have mixed evidence. The 2020 American Gastroenterological Association clinical practice guidelines do not recommend probiotics for adults with IBS owing to heterogeneity in

study designs, outcomes, and probiotic strains evaluated.[55] More recent studies have echoed similar concerns. For instance, a systematic review and 3-level meta-analysis of 72 studies found that probiotics had a short-term effect on global IBS symptoms; however, the observed effects were impacted by treatment duration and specific probiotics administered.[56] Although alterations in gut microbiota are implicated in FD, the species and strains of probiotics that are most therapeutic remain unclear.[57] Reflecting these uncertainties, a recent American Gastroenterological Association clinical practice update advised against using probiotics for bloating and distention,[58] which are common FD symptoms.

The evidence base for supplements in FD and IBS remains somewhat limited with small sample sizes, inconsistent findings, and limited rigorous trials. Moreover, because supplements are not subject to the same regulatory standards as pharmaceuticals, product quality, purity, and bioactive content can vary substantially between brands. It is important to consider an empiric therapeutic trial of third party–tested supplements, individualized to the patient's symptom profile, with discontinuation if no clinically meaningful benefit is observed.

Pelvic Floor Physical Therapy and Biofeedback

PFPT and biofeedback can be helpful for DGBIs, especially for symptoms involving straining, incomplete emptying, or incontinence. In patients with constipation, evaluation for dyssynergic defecation, a failure to coordinate the abdominal and pelvic floor muscles necessary for effective stool evacuation,[59] should be considered. Dyssynergic defecation is frequently observed in as many as 50% of patients with chronic constipation. Patients presenting with chronic constipation and defecation disorders frequently exhibit additional DGBIs, most notably FD and functional anorectal pain. One study found a notably high co-occurrence of functional constipation and FD, affecting nearly 40% of participants.[60] Another study demonstrated that PFPT was effective in 34% of individuals with constipation, leading to a significant increase in complete spontaneous bowel movements and improvements in straining, abdominal discomfort, bloating, and overall constipation severity after 12 weeks of treatment.[61]

Treatment for dyssynergic defecation often involves a combination of PFPT and biofeedback. PFPT involves practicing contraction and relaxation of the pelvic floor muscles and external anal sphincter to build strength and enhance coordination. Biofeedback uses equipment to record and relay body functions such as muscle contraction and relaxation back to the patient through visual or auditory signals, helping them learn to control the disordered function.[62] Biofeedback improves both defecation function and IBS symptoms in a significant portion of patients.[63] Research indicates that biofeedback is more effective than pelvic floor muscle training alone.[62]

Meditative Movement

Meditative movement practices integrate meditation with physical movement and breath work. Yoga, originating in India, is a widely practiced form of meditative movement. Other forms of meditative movement include qigong and its martial art form (tai chi), which originated in China. A recent systematic review of 12 studies demonstrated that yoga is beneficial for a range of GI disorders, with most studies focusing on IBS. Yoga has been shown to improve IBS symptom severity, mood-related symptoms, and quality of life compared with controls.[64] Yoga for FD has been less well-studied; however, a case series of yoga for patients with FD refractory to medical management demonstrated improvement in GI symptoms following 1 month of yoga therapy.[65]

There is evidence to suggest that yoga is comparable with conventional exercise among patients with IBS, as one study demonstrated no significant difference in improvement in IBS symptoms between yoga and walking groups.[66] These findings suggest that yoga is as effective as other forms of physical activity; however, yoga has benefits beyond physical fitness. Breath work is considered foundational as it is incorporated into every posture. Although yogic breathing has not been formally studied among patients with GI conditions, yogic breathing has demonstrated beneficial health effects across the broader medical literature (eg, cardiovascular, pulmonary, and pain functions),[67] as it enhances vagal function and regulates the autonomic nervous system.[68] Other mechanisms of yoga among patients with DGBIs remain unstudied. Psychological benefits of yoga (eg, reduced distress, improved psychological well-being) may work through interoceptive awareness,[69] which may contribute to self-regulation.[70] A self-regulation framework posits that psychological (eg, mindfulness) and physiologic (eg, relaxation, movement, deep breathing) components facilitate yoga benefits through a reduction in stress and autonomic regulation.[71] Yoga may also reduce pain catastrophizing,[72] which is often elevated among patients with DGBIs, including IBS.[73] Others have suggested that yoga may share common nonspecific mechanisms with other behavioral interventions for GI disease (eg, hypnotherapy), which utilize an attentional focus paired with suggestions for change,[74] but this needs to be empirically studied.

Research on tai chi remains limited. A single-arm, virtual tai chi program for IBS with constipation patients

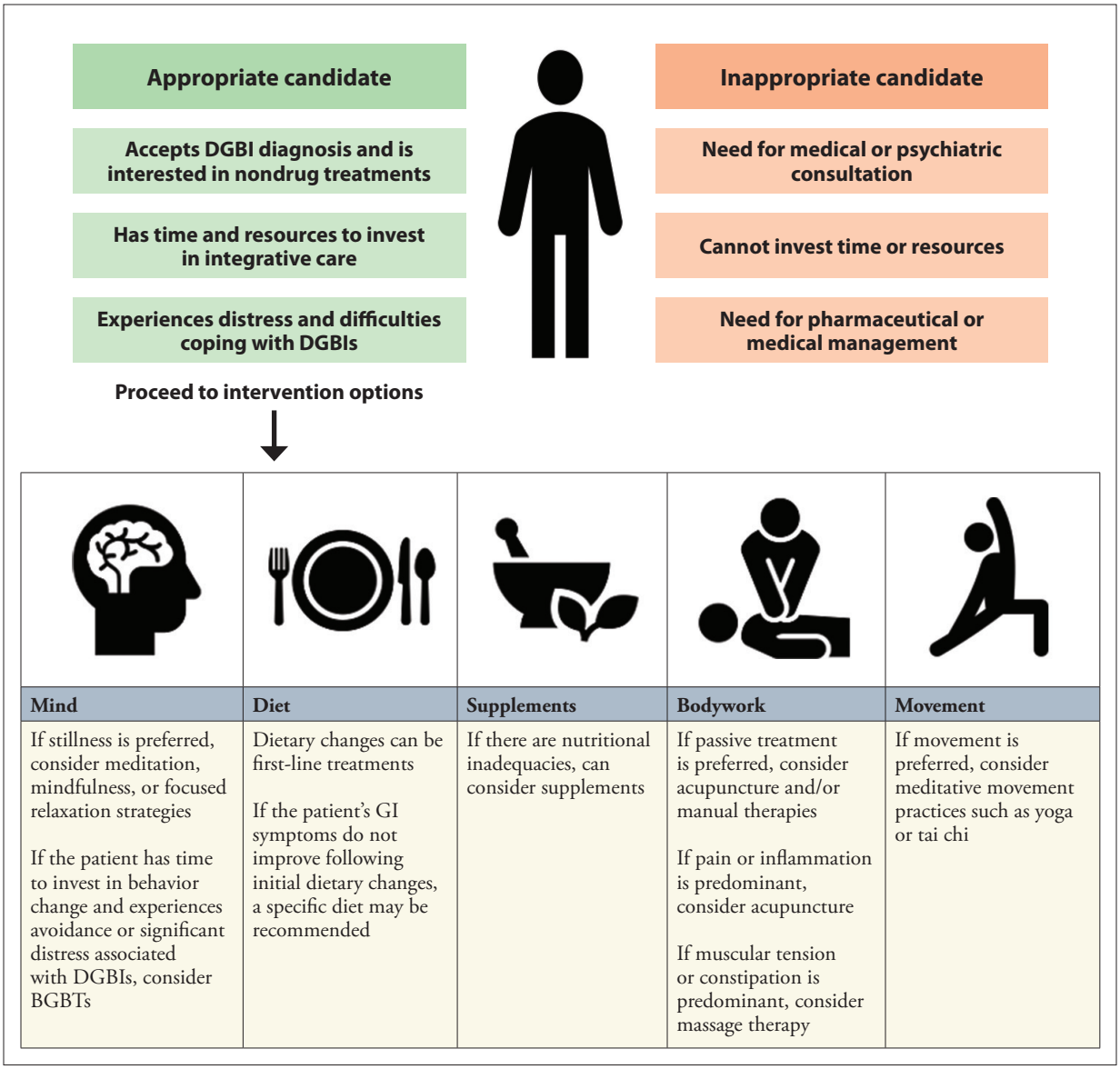
provided preliminary evidence of feasibility and IBS symptom improvement. Patients also improved across secondary outcomes, including additional IBS symptom scoring measures, IBS-related quality of life, abdominal diameter reduction, and increased leg strength.[75] Like yoga, tai chi has shown similar benefits to conventional exercise in patients with functional constipation. In an RCT comparing tai chi to aerobic exercise, both interventions significantly improved clinical symptoms, mood, and heart rate variability. However, tai chi demonstrated marginally greater efficacy in symptom reduction. Neuroimaging revealed that tai chi modulated abnormal anterior insula connectivity within the central autonomic framework, suggesting a potential mechanism by which tai chi promotes autonomic homeostasis and reduces DGBI symptoms.[76] Yoga and tai chi have generally been found to be safe, feasible, and well-tolerated as adverse events are generally minimal.[64,75] However, given the limited evidence in patients with DGBIs, caution is warranted for individuals with functional impairments that may limit certain postures, and more research is needed to fully establish the benefits of meditative movement for this population.

Acupuncture

Acupuncture is a traditional Chinese medicine intervention that includes needling, moxibustion, and cupping. Acupuncture involves the insertion of thin metallic needles to specific acupoints. Electroacupuncture, a more recent form of acupuncture, involves acupuncture needles stimulated by electricity under various frequencies ranging from 1 to 100 Hz.[77] From Chinese medicine philosophies, acupuncture seeks to regulate the flow of energy, known as qi. From a scientific standpoint, acupuncture stimulates neural pathways, influencing the nervous system.[78] Acupuncture has circulatory effects such that inserting needles into acupuncture points enhances circulation in that area, promoting healing and reducing inflammation.[79] Acupuncture influences the somatic and autonomic nervous systems and modulates pain perception.[80] Specifically among GI populations, acupuncture has been shown to stimulate or inhibit gastric motility, modulate the balance between parasympathetic and sympathetic activity, have antiemetic effects, and reduce visceral pain,[77] which is relevant for patients with IBS and FD. A meta-analysis of 61 RCTs on DGBIs demonstrated that acupuncture was significantly associated with a reduction of DGBI symptoms compared with pharmacotherapy (RR, 1.13; 95% CI, 1.09-1.17), placebo acupuncture (RR, 1.69; 95% CI, 1.37-2.08), no specific treatment (RR, 1.86; 95% CI, 1.31-2.62), and acupuncture as an adjuvant intervention to other active treatments (RR, 1.25; 95% CI, 1.21-1.30).[81] Similarly, a meta-analysis of 29 RCTs examining acupuncture for IBS demonstrated that acupuncture significantly improved quality of life (standardized mean difference [SMD], 0.61; 95% CI, 0.26-0.96; P<.001) and alleviated anxiety (SMD, -0.72; 95% CI, -1.76 to 0.32; P=.18) and depression (SMD, -0.74; 95% CI, -1.18 to -0.3; P<.001).[82] Acupuncture has shown promise for patients with FD. A systematic review and meta-analysis of 16 RCTs found that it improved FD symptoms and quality of life, although studies were generally low in quality.[83] A more recent Bayesian meta-analysis for FD supported the effectiveness of acupuncture, especially when combining different techniques or pairing it with conventional medicine; both approaches yielded better symptom relief than conventional treatment alone.[84] Adverse events are generally minimal for patients with DGBIs; however, minor issues such as pain, nausea, and dizziness have been reported.[81]

Massage Therapy

Massage is a manual therapy that involves manipulating soft tissues. Abdominal massage can specifically stimulate parasympathetic activity and improve certain GI responses, such as constipation, abdominal distention, and gastric residual volume.[85] Although clinical studies of abdominal massage for patients with IBS are scarce, available studies suggest clinical value for those with IBS with constipation.[86] For example, an RCT found that abdominal massage significantly reduced total GI symptoms (P=.003), particularly constipation (P=.013) and abdominal pain (P=.019), and increased bowel movements (P=.016) in patients with constipation taking laxatives. However, abdominal massage did not reduce laxative use, suggesting that it may serve as a complementary rather than substitute therapy.[87] Although manual massage offers therapeutic benefits, it can be physically demanding, driving interest in automated alternatives. One RCT demonstrated that an automated abdominal massage device significantly reduced colonic transit time from 54.0 (33.6-75.6) to 28.8 (18.0-52.8) hours (P=.001) in patients with chronic constipation,[88] underscoring the promise of machine-assisted massage therapies. Another form of therapeutic massage, tuina is rooted in traditional Chinese medicine and uses manual manipulation of muscles and acupoints. A systematic review of 14 RCTs of patients with FD showed that tuina significantly improved overall symptoms (RR, 1.12; 95% CI, 1.06-1.19) and early satiety (mean difference, -0.44 scores; 95% CI, -0.72 to -0.16). When combined with conventional therapy, tuina further enhanced outcomes, including overall symptom relief (RR, 1.14; 95% CI, 1.06-1.23), quality of life (mean difference, 10.44 scores;



Mind	Diet	Supplements	Bodywork	Movement
If stillness is preferred, consider meditation, mindfulness, or focused relaxation strategies If the patient has time to invest in behavior change and experiences avoidance or significant distress associated with DGBIs, consider BGBTs	Dietary changes can be first-line treatments If the patient's GI symptoms do not improve following initial dietary changes, a specific diet may be recommended	If there are nutritional inadequacies, can consider supplements	If passive treatment is preferred, consider acupuncture and/or manual therapies If pain or inflammation is predominant, consider acupuncture If muscular tension or constipation is predominant, consider massage therapy	If movement is preferred, consider meditative movement practices such as yoga or tai chi

Figure 2. How to choose a candidate for integrative and nutrition interventions for DGBIs.

BGBTs, brain-gut behavior therapies; DGBIs, disorders of gut-brain interaction; GI, gastrointestinal.

95% CI, 7.65-13.23), and reduced epigastric pain (mean difference, -0.76 scores; 95% CI, -1.11 to -0.41). However, there was a low certainty of evidence; thus, more research is needed to confirm benefit.[89]

Virtual Reality

VR is emerging as a promising intervention for DGBIs, including IBS. VR immerses patients in dynamic, multisensory environments that modulate central nervous system activity through mechanisms such as immersive distraction, attentional redirection, and facilitation of cognitive and emotional regulation, rendering visceral pain signals less salient and down-regulating autonomic arousal.[90]

Building on this foundation, IBS/VR is a human-centered, disease-specific VR program codesigned with patients, gastroenterologists, and psychologists. It includes modules on the gut-brain axis, gut-directed meditation, CBT, and social connection exercises to address the loneliness many DGBI sufferers experience.[91] Early qualitative evaluations have demonstrated high acceptability, improved understanding of symptom mechanisms, and enhanced confidence in self-management.[92] Prospective

clinical trials are now underway to assess effects on symptom severity, health-related quality of life, and health care utilization.

If validated, VR could become a scalable, side effect–free adjunct to dietary, pharmacologic, and psychological interventions in DGBIs, accessible via commercial headsets in the home. This has the potential to reframe treatment as an active, immersive process that directly engages the gut-brain axis and empowers patients to participate fully in their care. However, more research is needed to determine how to most effectively use VR for patients with DGBIs.

Clinical Implementation

As integrative and nutrition interventions continue to gain popularity, it is important to consider how to best incorporate these practices into GI settings. Through interdisciplinary collaboration and shared decision-making, GI professionals can offer personalized treatment plans that support GI symptom management and whole-person health.[93] However, referrals and recommendations should be made judiciously, ensuring alignment with clinical needs and patient preferences. Criteria for identifying appropriate candidates have been outlined in Figure 2, highlighting the benefit for patients with an interest in nonpharmacologic approaches who have difficulties managing stress in the context of a DGBI diagnosis. Patients who have unmet clinical or psychiatric needs (eg, severe psychopathology, active substance abuse, disordered eating) or who have limited capacity to engage because they cannot invest time may not be appropriate candidates. Access and affordability pose additional barriers, as integrative interventions may not be covered by insurance or readily available in all communities.

Conclusion

Emerging research suggests that integrative and nutrition interventions may address a broader range of biopsychosocial risk factors than conventional care alone. A shared mechanism across behavioral, bodywork, and meditative movement practices is their capacity to attenuate the physiologic and psychological effects of chronic stress, which is a key contributor to gut-brain dysregulation. Innovative approaches such as digital applications and VR offer flexible and engaging formats; however, these technologies warrant further exploration to determine their role in integrated GI care. Nutritional interventions, through targeted dietary modification and supplementation, address underlying nutritional deficiencies and highlight the therapeutic benefit of natural products. These interventions may be particularly effective when used in combination, offering synergistic benefits rather than functioning in isolation.

However, despite the potential of these interventions, current evidence remains limited. There is a critical need for high-quality RCTs across a broader spectrum of DGBIs to identify who is most likely to benefit. Future studies should focus on biopsychosocial predictors of treatment response, evaluate underlying mechanisms, and incorporate objective biomarkers alongside patient-reported outcomes. This will set the groundwork to optimize multimodal care pathways and improve uptake of integrative approaches in GI practice.

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