Irritable Bowel Syndrome: An Analysis of Evidence-Based Practice for Exacerbation Control and Symptom Management

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Introduction

Irritable bowel syndrome (IBS) is a functional gastrointestinal disorder characterized by various physical symptoms, including abdominal pain or discomfort and can be experienced in adjunction with abdominal distention and altered bowel function (Irritable Bowel Syndrome, 2013). It is the most common diagnosis among gastroenterologists and accounts for over 3.5 million visits to the physician per year (Best Ways to Battle Irritable Bowel Syndrome, 2014). IBS is diagnosed when a person has experienced abdominal pain or discomfort at least 3 times each month in the absence of other illness or injury. The pain may be associated with a change or consistency in stool frequency or be relieved by a bowel movement (Irritable Bowel Syndrome, 2013).

Grundmann and Yoon (2010) estimated that IBS affects up to 20 percent of the adult population worldwide, although only up to 7 percent of adults with IBS are diagnosed; they also found that it demographically affects twice as many women as men, with most being under the age of 45 (as cited in Irritable Bowel Syndrome, 2013).

There are four main subtypes of IBS that implicate various distinguishing symptoms and subsequently, various unique treatments. The first two are the most common and include IBS with constipation (IBS-C), which is diagnosed based on experience of hard or lumpy stools at most of the time and loose or watery stools less often, and IBS-diarrhea (IBS-D), which is oppositely characterized by loose or watery stools more often and hard or lumpy stools less often (Irritable Bowel Syndrome, 2013). The last two subtypes are less common and include mixed IBS (IBS-M), which consists of hard or lumpy stools and loose or watery stools occurring equally often, and
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unsubtyped IBS (IBS-U), which includes hard or lumpy stools and loose or watery stools occurring at irregular intervals (Irritable Bowel Syndrome, 2013).

From the division of subtypes it is apparent that a ‘one size fits all’ treatment will not be effective in managing symptoms of IBS, as the symptom experience varies drastically between subtypes. Therefore, clinicians face challenges in providing treatments that provide adequate control of symptoms. Though a wide variety of treatments exist, questions of effectiveness are constant, and patients are constantly seeking a better method of exacerbation prevention and symptom management. This review seeks to analyze current existing literature on the effectiveness of various interventions being used and/or tested to manage irritable bowel syndrome in adult patients.

**Literature Review**

Methods of treating irritable bowel syndrome are still being developed today and range from western conventional practices to eastern alternative approaches.

**Pharmacologic Therapies**

Conventional pharmaceutical therapies consist of a few different drug classes with various rationales for use, including some separate drugs for each subtype of IBS that are mainly targeted at symptom reduction (Yoon, Grundmann, Koepp, & Farrell, 2011). Drugs used for general treatment of IBS including all subtypes are antispasmodics, which are the most common drugs, and antidepressants. Antispasmodics are antagonists at cholinergic receptors, thereby decreasing contraction of the GI tract. Antidepressants, surprisingly enough, work to normalize GI motility and reduce visceral pain. Though
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originally thought to only work in treating co-existing mental disorders, clinical trials have shown effectiveness for all IBS patients. Classes like tricyclic antidepressants and selective serotonin reuptake inhibitors (SSRIs) are prescribed, and are thought to act on the neurochemical connection between the nervous system and the gastrointestinal tract that is widely hypothesized about in IBS research (Yoon et al., 2011). Specifically for treating the IBS-D subtype, there are numerous recommended drugs, and most have the chief effects of decreasing intestinal motility and pain. 5-HT receptor antagonists are commonly used for this purpose, and some examples of medications are ondansetron and alosetron (Yoon et al., 2011). Selective M-receptor antagonists, such as samifenacin, are also used to decrease intestinal motility but have not been know to help with pain minimization. Other common classes are mu-opioid receptor agonists, like loperamide, and even alpha agonists, like clonidine (Yoon et al., 2011). Pharmacologic options for the IBS-C subtype differ and include drugs that have the primary effects of increasing intestinal motility and water secretion into the gastrointestinal tract. These drug classes include chloride channel modulators, like lubiprostone, and 5-HT agonists, which include drugs like tegaserod, metoclopramide, and domperidone (Yoon et al., 2011). Laxatives and stool softeners have also been recommended, although adverse effects like electrolyte imbalances can occur, and the overall effectiveness of these drugs is limited (Yoon et al., 2011). Drugs recommended for the IBS-M subtype act to increase compliance of the digestive tract, while also decreasing pain, but different classes have various effects on motility. For example, serotonergic and adrenergic receptor drugs like venlafaxine, have minimal effects on motility, but cholinergic receptor antagonists act to decrease motility, and include cimetropium, pinaverium, and hyoscine (Yoon et al., 2011). In general,
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though prescription drug treatments have been useful to reduce symptoms, management of one symptom often has detrimental effects and increases the experience of other symptoms. Due to high placebo responses in randomized drug trials for IBS, efficacy of prescription drugs in general has been difficult to establish (Read, Rampersad-Smith, 2013).

**Alternative Therapies**

As the experience of irritable bowel syndrome is extremely inconsistent from one patient experience to another and multiple aspects of life are affected as well as multiple types of symptom experiences, alternative therapies have become increasingly popular in recent years, as western healthcare in general is experiencing a change in focus from treatment to wellness. Multitudes of alternative therapies are surfacing, including activities as simple as exercise and as complex as acupuncture and psychotherapy. Other methods include ingestion of peppermint oil, adherence to diets targeted at decreasing IBS symptoms, mindfulness exercises and the use of probiotics. Results and effectiveness have been variable, but practitioners are seeing trends of increasing compliance and attention to general wellness in those who use alternative therapies in comparison to pharmacologic options (Staudacher, Whelan, Irving, & Lomer, 2011).

**Diet alteration.** Diet therapy has been the cornerstone of alternative therapy for IBS, and practitioners are shifting focus of first-line treatments from prescription drug therapy to diet modification.

**Low FODMAPS diet.** Arguably the diet modification with the most support at present is a diet low in rapidly-fermentable carbohydrates. This diet is called the low
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‘fermentable oligosaccharides, disaccharides, monosaccharides and polyols’ diet, also known as the low FODMAPS diet, and has seen success rates as high at 86% (Medlin, 2012). Not only does the gut poorly absorb FODMAPS, but FODMAPS increase the amount of water drawn into the intestines and the bacteria in the colon rapidly ferment them, producing excess gas (Medlin, 2012).

![Table 1. Examples of FODMAP containing foods](image)

<table>
<thead>
<tr>
<th>Examples of foods high in FODMAP</th>
<th>Examples of suitable alternatives</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oligosaccharides (fructans and galactans)</td>
<td>Some vegetables including onion and garlic, wheat and rye, e.g. pasta, bread, some cereals, legumes and watermelon</td>
</tr>
<tr>
<td>Disaccharides (lactose)</td>
<td>Cow, goat and sheeps milk, yogurt, cheese</td>
</tr>
<tr>
<td>Monosaccharides (fructose)</td>
<td>Apples, pears, peaches, mango, concentrated fruit juice</td>
</tr>
<tr>
<td>Polys</td>
<td>Stoned fruits, mushrooms, artificial sweeteners ending in ‘ol’</td>
</tr>
</tbody>
</table>

FODMAP = fermentable, oligosaccharides, disaccharides, monosaccharides and polyols
Adapted from Gibson and Shepherd (2009)

(Medlin, 2012).

These processes clinically manifest as typical IBS symptoms, like bloating, abdominal pain, changes in bowel habits, abdominal distention, and production of wind. Though a majority of people can consume a high FODMAP diet and have no problems, the existing visceral hypersensitivity and abnormal motility in those with IBS that FODMAPs trigger is what causes problems in patients. Rather, it is not the FODMAPs that cause IBS, but exacerbate symptoms in those with IBS (Medlin, 2012). Adherence to a low FODMAP diet involves first cutting out all FODMAP foods for 6-8 weeks and then slowly reintroducing some FODMAPs foods by consuming a small portion of the reintroduced food followed by a symptoms analysis and retrial. The goal is to reintroduce as many foods as possible without triggering symptoms. Foods like garlic, broccoli, and wheat or
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rye bread are usually reintroduced fairly easily (Medlin, 2012). In a study done by the Nutritional Science Division at King’s College in London, 82 patients with established IBS by a primary care physician were seen by dieticians and either advised to consume a low FODMAPs diet or were given standard dietary advice for IBS based on diagnostic criteria- like regularly scheduled meals, slow consumption of meals, and incorporating fiber (Staudacher et al., 2011).

Over a period of 9 months, those on low FODMAPs diets reported significant improvement in symptoms compared to the standard group, with 82% experiencing improvement in bloating, 85% experiencing improvement in abdominal pain, and 87% experiencing improved rates of flatulence (compared to 49%, 61%, and 50% in the standard groups, respectively). Additionally, 28% of patients in the low FODMAPs group reported ‘moderate improvement’, and 47% reported ‘substantial improvement’ in terms of diarrheal symptoms, compared to 7% and 31% in the standard groups, respectively (Staudacher et al., 2011). Only 14% of patients following the low FODMAPs diet experienced no change in symptoms, as compared to 51% of the standard group. Overall, 75% of patients in the low FODMAPs group reported satisfaction with their symptom response (Staudacher et al., 2011). Despite the strong evidence implicated in the study, some drawbacks to the diet exist, as elimination of fruits and vegetables as well as lactose can lead to an imbalanced diet (Medlin, 2012). Thus it is vital that patients adhering to low FODMAPs diets continue to eat at least 5 or more portions of fruits and vegetables per day and seek dairy-free sources of calcium to promote bone health, as IBS patients are at increased risk of osteoporosis and fractures (Medlin, 2012). Another drawback of the diet is that it hasn’t been found to improve outcome in patients with the IBS-C
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subtype, thus other diet modifications may be better at decreasing constipation. Additionally, geographical locations influence the diet, as different countries consume different foods, and thus the list of FODMAP foods would need to be altered in each country to remain accurate (Medlin, 2012; Staudacher et al., 2011). The study performed by researchers at King’s College recommends for subsequent follow-up with a randomized controlled trial to further confirm the results (Staudacher et al., 2011).

Probiotics. Another dietary approach to IBS symptom management that has become increasingly popular in the past few years is the consumption of probiotics. The World Health Organization defines probiotics as “…live microorganisms, that when administered in adequate amounts, have beneficial effects for the host” (as cited in Stevenson & Blaauw, 2011, p. 63). Though it is widely known that our digestive systems contain microflora, it is less known that over 500 different species of microbiota play a crucial role in metabolic processes required for digestion and wellness. The digestive system is colonized with these microbiota at birth, and many factors continue to play a role in the composition of organisms, like route of birth (cesarean vs. vaginal), use of antibiotics during the prenatal period, and breastfed versus bottle-fed practices after birth (Stevenson & Blaauw, 2011). These factors contribute to the permeability of the digestive tract as well as the types of microorganisms inhabiting the intestines. Dysbiosis, or a disturbance in the balance between host and microbiota can cause problems like inflammation, and thus, the microbiota in healthy patients versus patient with IBS differs greatly.

Balsari conducted a stool study of 20 IBS patients in which it was found that IBS stools contained less coliforms, lactobacilli, and bifidobacteria (as cited in Stevenson and
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Blaauw, 2011). Thus, the consumption of probiotic supplements with specific bacteria, such as *lactobacillua plantarum* and *bifidobacterium infantis*, has been recommended by researchers (Stevenson & Blaauw, 2011). Probiotics have been known to help with the secretion of antibacterial substances that decrease the luminal pH and decrease growth ability of pathogens, produce mucin that affects mucosal adherence of pathogens in the gastrointestinal tract, and increase the secretion if IgA that protects the microflora of the digestive system from bacterial attachment (Stevenson & Blaauw, 2011). Probiotics also ferment nutrients and subsequently acidify the colon, along with expressing receptors that sense bacteria and trigger appropriate immune responses to them (Stevenson & Blaauw, 2011). In over 7 studies on probiotic use compiled by Stevenson and Blaauw, consumption of both *L. plantarum* and *B. infantis* was related to improvements in bloating, reduction in flatulence and pain, and bowel movement satisfaction (Stevenson & Blaauw, 2011).

Whorwell stated that evidence of the effectiveness of *B. infantis* prompted large, multi-centered research trials comprising over 360 patients with IBS that confirmed the symptomatic relief potential of the microorganism (as cited in Stevenson and Blaauw, 2011). Stevenson and Blaauw (2011) emphasize that the various groupings of IBS provide barriers to effective treatment, as the different subtypes require different treatment considerations, and much of the current published data does not differentiate between subgroups, which complicates interpretation of research results. Additionally, although *L. plantarum* and *B. infantis* have been used in various research studies and trials, a study that combines the use of both of them as a “cocktail” hasn’t been conducted, which would be a valuable addition to existing evidence for the effectiveness of the two
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strains. Gastrointestinal specialists in Canada completed an additional systematic review evaluating effectiveness of probiotics in IBS, and the results of over 918 participants with IBS in 10 different studies were evaluated and compared (Moayyedi, Ford, Talley, Cremonini, Foxx-Ornstein, Brandt, & Quigley, 2010). Results were that in all trials, participants reported a statistically significant reduction in pain. In 8 of the trials, 682 patients reported an improvement in bloating, but this was not statistically significant. In six of the trials, 566 patients reported a statistically significant improvement in amount of flatulence, and three trials evaluating 394 patients found improvement in urgency, but this was not statistically significant (Moayyedi, et al., 2010).

**Linaclotide.** An additional dietary agent that has been used in symptom management of IBS is linaclotide. The Food and Drug Administration approved Linaclotide in 2012, and though implicated only in the IBS-C subtype, it has shown promising results in terms of decreasing constipation and difficulties associated with passing stool (Buono, Tourkodimitris, Sarocco, Johnston, & Carson, 2014). IBS-C in particular has been associated with an average work productivity loss of 35.1%, which translated into 730 hours and $22,747 in lost costs annually for each patient employed with IBS-C (Buono, et al., 2014). IBS-C is defined as having >25% of bowel movements as being hard or lumpy and <25% of bowel movements occurring without the use of a laxative (Buono, et al., 2014). Supplementation of linaclotide in IBS-C patients has been associated with improved outcomes and symptom experience. Linaclotide is a minimally absorbed guanylate cyclase-C agonist, and it is a … “first class therapy approved for treatment of adult with IBS…” (Buono, et al., 2014, p.290). It acts by increasing chloride and bicarbonate secretions in the intestine and inhibits absorption of sodium,
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increasing water secretion and therefore improving defecation (*Love, Johnson, and Smith, 2014*).

Both Chey and Rao conducted multi-center studies that used linaclotide in adult patients with IBS-C and in both, significant improvement in abdominal and bowel symptoms was seen (*as cited in Buono et al., 2014*). Buono found that in a study of linaclotide vs. placebo over a 26-week period, treatment with linaclotide led to significant reductions from baseline in presenteeism of symptoms - with 15.7% of patients who received linaclotide reporting continuation of symptoms as compared to 21.5% of patients in the control group. Additionally, after 26 weeks, only 20.1% of the test group reported daily activity impairment as compared to 27.1% of the placebo group, and overall work productivity lost for linaclotide users was at 16.4% compared to 22.6% for the placebo group (*Buono, et al., 2014*). Linaclotide reduced overall work productivity loss by 2.4 hours weekly by week 26, which translates to a reduction in work productivity lost by 156 hours annually (*Buono, et al., 2014*).

An additional placebo-controlled study done by Andresen investigated linaclotide use in 36 patients over a period of 2 weeks, with patient diaries kept during and after treatment with linaclotide. Despite the short time period of treatment, overall ascending colon emptying was significantly improved with the use of 1000 micrograms of linaclotide daily, and time to first bowel movement, stool consistency, and stool passage were significantly improved (*as cited in Love et al., 2014*). Another study done by Johnston that used linaclotide versus placebo groups revealed that the average number of bowel movements experienced after 12 weeks of linaclotide increased to 3.61 as opposed to 1.01 for the placebo group (*as cited in Love, et al., 2014*). Drawbacks to linaclotide use
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include a relatively high price, at approximately $277 per month. However, the mentioned trials demonstrated a statistically significant benefit with improved frequency of bowel movements and resolution of abdominal pain and bloating symptoms (Love, et al., 2014). As side effects are generally mild, linaclotide use has been an important advance in the treatment of IBS-C.

Anti-secretory factor. Other dietary approaches that exist in the literature, though one-of-a-kind studies have not been repeated in recent years, are the separate uses of anti-secretory factor (ASF) and fasting therapy. ASF is a 41-kD protein that was originally studied by researchers in the 1980’s and originally resides in the rat pituitary gland, with both anti-inflammatory and anti-secretory effects (as cited in Ekesbo, Nilsson, & Sjolund, 2008). Though first studied with use in piglets, it was eventually used in treatment of patients with inflammatory bowel disease and showed significant symptom improvement (Ekesbo et al., 2008). Thus, this study sought to evaluate ASF use in IBS patients and evaluate the self-assessed experience of symptoms. 82 patients with IBS who has average minimum pain scores of 40mm based on the Visual Analogue Scale (0-100mm) were evaluated. Half of participants were randomly selected to the test group and half to the control group, with test patients 3 receiving biscuits or crackers augmented with ASF per day and the control patients receiving the same foods equal in taste, but without the added ASF (Ekesbo et al., 2008). Over a period of 8 weeks, results were evaluated and revealed the following: average number of bowel movements decreased from 1.7 to 1.6 per day, with over 40 patients experiencing decreased stool frequency and 26 experiencing increased frequency. These results were not deemed statistically significant due to a high placebo response, but an overall improvement in symptoms was found in both groups
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(Ekesbo, et al., 2008). Thus, though efficacy isn’t confirmed, further research would need to be conducted to rule out ASF as a potential beneficial element in IBS treatment.

**Fasting therapy.** Fasting therapy has been described as a “…novel and simple psychotherapy…”, and was used in a pilot study in 2006 to look at whether IBS could also be improved by this eastern-style wellness technique (Kanazawa & Fukudo, 2006, p.214). In the study, patients in the traditional combination of pharmacotherapy and psychotherapy wasn’t effective were deemed intractable to treatment, and fasting therapy protocols or control group protocols were initiated.

The control group protocol consisted of the same traditional treatment previously received. A total of 36 individuals were admitted to private hospital rooms for 4 weeks that were part of the fasting group, and 22 individuals were outpatient status and continued to receive traditional treatment. In the fasting group, patients were subjected to 10 days of starvation followed by 5 days of re-feeding (Kanazawa & Fukudo, 2006). Psychotherapy was also continued, and patients drank 1,000-2,000 mL of water each day to stay hydrated; tasteless hepatic and renal supplements were added to the water to prevent injury. Re-feeding began with 225 kcal and eventually increased to 2,100 kcal each day (Kanazawa & Fukudo, 2006). After the treatment period, results were that fasting therapy significantly decreased the scores of abdominal interference with life in general. Thus, out of the 10 symptoms targeted, fasting therapy improved 7 of 10. Improvements in constipation, depression, and somatoform were not statistically significant. With strong evidence of potential in improving IBS symptoms management, fasting therapy is convenient, as it provides a short therapeutic period and doesn’t require special skills on part of the physician. Unfortunately, the evidence in the study needs to
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be strengthened by additional studies, and no other studies of the nature have been conducted. Thus, although a seemingly promising component of IBS management, additional research needs to be completed to strengthen the evidence that fasting therapy is effective. Follow-up assessment was not completed after the study, and so a long-term prospective study would be ideal to examine the comprehensive effects of fasting therapy on IBS symptoms (Kanazawa & Fukudo, 2006).

Peppermint oil. An intervention therapy of additional prospective value is the use of peppermint oil in the treatment of IBS patients. Peppermint is a naturally occurring carminative of the mint family that causes relaxation of the gastrointestinal smooth muscle by blocking calcium channels (Khanna, MacDonald, & Levesque, 2014). Researchers began testing it for effectiveness in treatment of IBS after effectiveness was found in treating tension-type headaches, non-ulcer dyspepsia, and reduction of colon spasms (Merat, Khalili, Mostajabi, Ghorbani, Ansari, & Malekzadeh, 2010).

A primary experiment completed by researchers in a digestive diseases center involved IBS patients consuming peppermint oil extracted from the peppermint plant in enteric-coated capsules, called Colpermin. The double-blind, randomized placebo study utilized 187 mg capsules of Colpermin to be used three times daily 30 minutes before each meal for 8 weeks, while placebo group patients received capsules in indistinguishable boxes and were instructed to take the capsules on the same schedule. Results from 60 patients, 33 in the study group and 27 in the placebo group, revealed statistically significant data (Merat et al., 2010). At week 0, the time of introduction of the study, zero percent of participants reported being free of abdominal pain or discomfort. By week 8, 42.5% of patients in the study group reported being free from
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abdominal pain and discomfort as compared to only 22.2% of the control group (Merat et al., 2010). Additionally, the intensity of abdominal pain and discomfort was significantly reduced in the study group, with a larger percent of study group patients experiencing occasional discomfort- 42% in the Colpermin group versus 22% in the placebo group- and a smaller percent in the study group experiencing persistent discomfort- 15% in the study group versus 52% of the control group (Merat et al., 2010).

The visual analogue scale (VAS) measures quality of life and was also completed by patients throughout the study, and results revealed significant improvement in quality of life for the study group versus the control group. The VAS was measured from 0-10 with 10 being the optimal quality of life. Participants in the study group reported improvement in general quality of life at week 1, but significant improvement wasn’t noted until week 8. Comparing week 0 to week 8, quality of life for the study group had improved from 4.1 to 4.7 and had decreased in the control group from 5.8 to 4.0. Thus, this indicates a statistically significant improvement in bodily pain, general health, social functioning, and role limitation due to emotional problems (Merat et al., 2010). Researchers noted that the significant improvement in abdominal pain the in study group over the 8 week period could be the reason for the improvement in quality of life symptoms as well. From the study, it is concluded the peppermint oil is most effective in treating abdominal pain and subsequent overall quality of life (Merat et al., 2010). An additional meta-analysis on the use of peppermint oil capsules was conducted by researchers at both the Robarts Research Institute and the University of California San Diego (Khanna et al., 2014). Randomized, placebo-controlled trials with a minimum of two weeks duration were considered, and nine studies using 726 patients were identified.
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Five of those studies including 392 patients found a global improvement in IBS symptoms in 69% of patients receiving peppermint oil compared to 31% in the placebo groups (Khanna et al., 2014). Five of the nine studies, including 357 patients, found that 57% of the patients receiving peppermint oil saw an improvement with abdominal pain compared with 27% of placebo patients (Khanna et al., 2014). These results were found to be statistically significant. Those consuming peppermint oil in studies by both Khanna (2014) and Merat (2010) experienced some adverse events, and these included heartburn, headache, and dizziness; however, events were deemed mild and transient in nature. The meta-analysis by Khanna (2014) concluded that the studies showed safety and efficacy of peppermint oil used in patients with IBS but recommended that more long-term studies needed to take place to determine long-term safety and efficacy and to competently compare results with those of pharmacologic approaches, such as anti-spasmodics.

Psychological therapies. Though dietary approaches could be argued as the most logical tactics in treating a gastrointestinal illness like IBS, other methods of treatment, particularly psychological forms, have been explored with encouraging results. Most associated research indicates that although it is unlikely that psychological factors actually cause IBS, they appear to exert a strong influence on the lives of IBS patients. It has also been suggested that evidence of this strong influence indicates that investigating these psychological connections is clinically significant (Sugaya, Nomura, & Shimada, 2012). Psychologically grounded research has been based on knowledge that the autonomic nervous system directly affects the gastrointestinal tract, which may lead to pain exacerbation and an increased feeling of anxiety. Consequentially, one can infer that those with IBS have higher anxiety and depression tendencies due to experience of
chronic, persistent pain (Smith, 2010). Additionally, background support for using psychological means to provide therapy for IBS patients comes from the idea that it treats the whole patient, which is most patient-centered way of care in any setting (Akbar, Desai, Jenkins, Malley, Rampersad-Smith, Read, & Williams, 2013). Multiple psychologically-based therapies have been recommended, including mainly mindfulness practices and cognitive-behavioral therapy.

**Mindfulness.** Mindfulness-based stress reduction (MBSR) is a psychosocial intervention, using biopsychosocial orientation. It consists of meditation practice and gentle hatha yoga stretches used in chronically ill populations. It seeks to cultivate… “conscious awareness in the present moment in an open and nonjudgmental manner…” (Zernicke, Tavis, Campbell, Blustein, Fung, Johnson, Bacon, & Carlson, 2013). It helps target processes such as rumination, worrying, and poor emotional regulation (Zernicke et al., 2013).

Burnett and Drossman discuss the idea of a link between the motor, sensory, intestinal, and central nervous systems called the ‘brain gut axis’ (as cited in Zernicke et al., 2013). This implies a relation between sensation in the intestines and intestinal motor responses. Burnett and Drossman also note that since cognitive information and external stressors can affect GI sensations due to existing neural connections, increased GI muscular sensations can cause psychological distress because of amplified cognitive interpretations of these sensations (as cited in Zernicke et al., 2013). Zernicke (2013) cites multiples studies in the articles that have linked stress and exacerbation of IBS symptoms, inferring that emotional stress may trigger neuroimmune and neuroendocrine reactions via the brain gut axis (Zernicke et al., 2013). After a non-randomized trial was
conducted by Kearney that revealed a decrease in IBS-related quality of life and gastrointestinal-specific anxiety after 6 months of MBSR, Gaylord conducted a randomized trial of 75 women to either MBSR or social support (as cited in Zernicke et al., 2013). After 8 weeks, the MBSR group reported significant reductions in symptom severity following the intervention and at a 3-month follow up compared to the control group. Smith subsequently conducted a randomized treatment as usual (TAU) waitlist controlled trial based on these primary studies that tested not only the efficacy of MBSR in reducing stress and improving psychological well-being, but its effect on treating IBS symptoms as well. The trial was 8 weeks long and also consisted of a 6-month follow up period. All participants were currently being treated for IBS and were either assigned to the immediate MBSR intervention group, meaning that they were enrolled in the MBSR program over 8 weeks, or they were assigned to the TAU control group over 8 weeks and was scheduled to receive MBSR after the 6-month follow-up period. It was hypothesized that MBSR patients would experience greater reductions in IBS symptoms severity along with greater reduction in non-GI symptoms of stress, reduction in IBS symptoms, and increased quality of life (QOL) (Zernicke et al., 2013).

Results were that after 8 weeks of therapy for both groups, 50% of the MBSR group had a clinically significant improvement in symptoms as opposed to 21% of the TAU group. The MBSR group also reported a lower symptoms severity overall compared to the TAU group. Change scores were calculated, and the MBSR group experienced a 30.7% reduction in IBS symptom severity immediately after the intervention, compared to only 5.2% of the TAU group (Zernicke et al., 2013). Overall, symptoms severity improvement changed from severe to moderate. This would practically mean that a
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person went from constant, severe pain and frequently interfering pain symptoms with or without bowel distension to only occasionally experiencing these symptoms (Zernicke et al., 2013). However, a notable weakness of the study was a rebound effect in symptoms for the MBSR group over the 6-month follow up period, whereas the control group continued to slowly improve overtime. This would suggest that the immediate effects of the MBSR program far exceed improvement rates without the intervention, but that this rate isn’t necessarily maintained over time if the intervention is stopped (Zernicke et al., 2013). This allows the inference that the MBSR intervention is necessary to incorporate into one’s lifestyle as a long-term practice to maintain symptom improvement. The study also notes that the intervention would only work for those who expect a benefit and agree that stress is a contributing factor in symptom exacerbation of IBS.

**Cognitive behavioral therapy.** Cognitive behavioral therapy (CBT) is a psychological therapy involving talking that is useful for equipping the patient with problem-solving techniques and coping mechanisms (Dainty, 2012). As is applied to IBS, CBT has been thought to be a way of helping patients reason through their symptoms, their interpretation of their symptoms, and what can be done to improve that interpretation- therefore, indirectly improving symptoms. An article written by Ryle dating back to 1928 discusses the theory that IBS could be a physiological manifestation of emotional stress, and thus, the thought of this brain-gut connection is not new, but interventions that target IBS symptoms are recent additional treatment options. (as cited in Dainty, 2012).

Lydiard and Falsetti discussed that 50-90% of patients who have IBS also have a co-existing psychological condition, such as anxiety or depression (as cited in Dainty,
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2012). Multiple studies have connected IBS exacerbations and stressful life events, including anything from a transition to college and being independent to being a victim of sexual or emotional abuse (Dainty, 2012). Therefore, North hypothesized that CBT can help deal with issues like catastrophizing, meaning an irrational or exaggerated thoughts, and negative underlying thought patterns in general (as cited in Dainty, 2012). CBT corrects these maladaptive thought patterns in order to achieve positive changes in behavior and affect. Dainty discusses in his literature review that in 89.5% of the randomized control trials he reviewed (17 of 19 trials), results yielded were in favor of CBT (Dainty, 2012). However, he found lack of power and consistency in terms of reporting results, selecting participants, and measuring outcomes of the randomized trials, and suggests a need for further, consistent research parameters to strengthen the validity of results. Dainty suggests that CBT is a promising treatment in term of helping patients cope with symptoms and the impact of those symptoms on their quality of life but recommends further research (Dainty, 2012).

Interestingly enough, multiple sources suggested CBT as independent or adjunct therapy in the treatment of IBS, but structured randomized trials over periods longer than 6 months with consistent inclusion parameters have either not been completed or are unpublished in the current literature.

Physical therapy. A final treatment that has been used in recent years to treat IBS, though not yet approved by national health institutes across the world, is a physical therapy called acupuncture for symptom management. Acupuncture is a traditional eastern medicinal approach that utilizes pricking of the skin with needles at various acupoints determined by the therapist.
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It is known for alleviating pain and treating anything from physical, to mental and emotional issues, and is widely used in the Western hemisphere today, though use in IBS has only begun within the past ten years (Acupuncture, 2015).

As of 2012, 24 trials of acupuncture for IBS have been conducted, and results were promising in a majority of studies, but there was debate because of high placebo responses (Stuardi & MacPherson, 2012). A pragmatic randomized controlled trial was conducted with the intention of comparing symptoms severity after use of acupuncture compared with usual care, thought usual care was not explicitly defined (MacPherson, Tilbrook, Bloor, Braby, Cox, Kang’ombe, Man, Stuardi, Togerson, Watt, & Whorwell, 2012). Symptom severity was measured using the IBS Symptom Severity Score (IBS SSS), which ranged numerically from 0-500, with scores less than 75 indicating no presence of IBS, 75-175 indicating mild IBS, 175-300 indicating moderate IBS, and 300-
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500 indicating severe IBS. It was determined that improvements by 50 points of more in the IBS SSS would be considered statistically significant improvements. Nine acupuncturists administered ten sessions of acupuncture each once a week over 10 weeks to the 116 participants in the acupuncture group while the 117 participants of the as usual group managed symptoms as advised by practitioners (MacPherson et al., 2012). Follow-ups after the cessation of the study period were arranged for 3, 6, 9, and 12 months out. Results were that 49% of the acupuncture group experienced statistically significant improvement of symptoms over 10 weeks, compared to only 31% of the as usual group. Overall, the study found that acupuncture provided an adjunct small yet statistically significant benefit in IBS symptom reduction after 10 weeks (MacPherson et al., 2012). This study, implementing follow-ups for up to 12 months, was the most long-term of the studies completed implementing acupuncture in the treatment of IBS. Researchers hypothesized that the benefit seen at three months would remain the same if acupuncture were continued until month 12. Thus, it is recommended that acupuncture be an adjunct part of the therapy ‘cocktail’ for IBS management (MacPherson et al., 2012).

Results

The literature confirms that Irritable Bowel Syndrome doesn’t have a ‘one size fits all’ treatment regimen. Though all treatments are targeted at symptom management, methods vary according to the individual patient.

Pharmacologic, or more conventional methods, target symptom management and include antispasmodics, tricyclic antidepressants and SSRIs, 5-HT receptor and M-receptor antagonists for IBS-D, channel modulators and 5HT-agonists for IBS-C, and
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Laxatives and stool softeners for IBS-C. Most classes of drugs function to alter gut motility, and others, like antidepressants and SSRIs, work to neutralize the relationship between the gut and the brain. Though multiple studies exist that test these drugs, efficacy of prescription drugs is still challenging to confirm.

Alternative therapies are trending, and many patients now are changing their lifestyles in one way or another rather than just taking a daily pill. As a major shift is occurring in western healthcare from treatment of illness to maintenance of wellness, patients are seeking to alter their lifestyles with therapies that are more natural and easier on the body. There are various alternative therapies that are increasingly common among patients with IBS, including diet alteration, psychological interventions, and physical therapies like acupuncture and yoga.

Diet alteration is one of the increasingly popular methods of symptom management, and includes the low FODMAPS diet, use of probiotics, incorporation of a dietary agent called Linaclotide, introduction of anti-secretory factor, fasting therapy, and the usage of peppermint oil capsules. The low FODMAPS diet eliminates certain types of carbohydrates that cause excess gas and irritation of the gut, and implementation of the diet has resulted in success rates as high as 86% (Medlin, 2012). The diet requires that patients eliminate all FODMAP foods for at least 6 weeks and then slowly reintroduce them to determine which specific foods are irritants. FODMAPS studies revealed significant improvements in the areas of flatulence, bloating, diarrhea, and abdominal pain. Probiotics are also commonly used to manage IBS, and the need for them arises from a state of dysbiosis that occurs in the guts of those with IBS. Probiotics are live organisms that are thought to restore the proper status of microbial biome in the gut. L.
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*plantarum* and *B. infantis* were found to be the most effective probiotics in numerous studies examining IBS patients, with improvements found in bloating, flatulence, pain, and bowel movement satisfaction. The use of dietary linaclotide has also seen promising results. Linaclotide is a treatment designed specifically for patients with IBS-C, and it works to increase water absorption in the gut, adding water to the stool. Studies found that linaclotide created statistically significant improvements for patients with IBS-C, increasing work productivity, decreasing hours of work missed each week, and improving areas like time to first bowel movement, stool consistency, and stool passage.

Anti-secretory factor has limited research backing up its results, but the most recent study from 2008 showed some evidence of effectiveness in treating IBS patients. It is a pituitary protein that, when incorporated into a study of patients with IBS, showed improvement in average number of bowel movements per day. The study wasn’t determined to be statistically significant due to a high placebo effect, but overall symptom improvement was seen in both the experimental and control groups. Fasting therapy is another alternative therapy lacking extensive research, but a pilot study in 2006 used fasting therapy in the form of a 10-day starvation followed by half of that time in refeeding. Compared to a placebo group, patients who fasted experienced significant improvements in abdominal pain, bloating, flatulence, and bowel urgency. One additional dietary mechanism of treatment is the use of peppermint oil capsules for IBS symptom management. Peppermint, as a member of the mint family, relaxes the GI tract, improves dyspepsia, and reduces gut spasms. Results of multiple studies revealed that ingestion of peppermint oil resulted in significant improvement of abdominal pain and discomfort,
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and overall quality of life, with up to 69% of trial participants experiencing improvement in these areas (Khanna et al, 2014).

Psychological approaches have also shown success in symptom management and control in patients with IBS. The two main therapies that have been implemented with significant results include mindfulness therapy and cognitive behavioral therapy. MBSR uses meditation and gentle yoga to provide biopsychosocial orientation, and it focuses on treating rumination, emotional regulation, and worrying. Results of a meta-analysis were that in numerous studies, up to 50% of patients receiving MBSR as compared to a treatment as usual group experienced significant reduction in symptom severity, including psychological well-being and stress reduction. Additionally, of symptoms still remaining, MBSR groups saw up to a 25% larger reduction in severity of remaining symptoms (Zernicke et al., 2013). CBT seeks to improve problem-solving techniques and coping mechanisms of patient with IBS. A meta-analysis of 19 experiments using CBT vs TAU groups in randomized trials revealed that almost 90% of trials had significant improvement in patient symptoms with use of CBT (Dainty, 2012).

An eastern medicinal approach that is also being studied in treatment of patients with IBS is the use of acupuncture. Acupuncture is known to alleviate pain by pricking the skin with needles, and has been known to improve physical, emotional, and mental health. A pragmatic trial studying acupuncture vs a TAU group, resulted in 49% of acupuncture participants experiencing improvement in symptoms after 10 weeks, as opposed to only 31% of the TAU group (MacPherson et al., 2012).

Discussion
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The multitude of symptoms and morbidities experienced by patients with IBS calls for close attention to regimens used to treat patients. From the literary evidence, it is apparent that there is no quick fix for IBS, and patients must be treated individually. Many of the trials cited report weakness in the strength of results used as a solo therapy and recommend that future researchers test treatment ‘cocktails’ instead, using multiple therapies that relieve different symptoms together. As all of the therapies discussed relieve only certain symptoms, it is evident that a combination of treatments, such as dual therapy including dietary and psychological approaches, may in adjunction treat more symptoms and improve quality of life. Additionally, as alternative therapies are increasingly popular, it is important for practitioners to be up-to-date with current literature so that treatment regimens are in sync with best practices. Thus, as there is a variety of evidence available on potentially effective single treatments, future research should focus on trials testing dual or triple therapies. In this way, holistic care of patient is provided, and different mechanisms for control can be implemented together to create the most effective symptom management possible.
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