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CLINICAL PRACTICE UPDATE

AGA Clinical Practice Update on the Role of Diet in Irritable Bowel Syndrome: Expert Review

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DESCRIPTION: Irritable bowel syndrome (IBS) is a commonly diagnosed gastrointestinal disorder that can have a substantial impact on quality of life. Most patients with IBS associate their gastrointestinal symptoms with eating food. Mounting evidence supports dietary modifications, such as the low–fermentable oligo-, di-, and monosaccharides and polyols (FODMAP) diet, as a primary treatment for IBS symptoms. The aim of this American Gastroenterological Association (AGA) Clinical Practice Update (CPU) is to provide best practice advice statements, primarily to clinical gastroenterologists, covering the role of diet in IBS treatment. **METHODS:** This expert review was commissioned and approved by the AGA CPU Committee and the AGA Governing Board to provide timely guidance on a topic of high clinical importance to the AGA membership, and underwent internal peer review by the CPU Committee and external peer review through standard procedures of *Gastroenterology*. The best practice advice statements were drawn from reviewing existing literature combined with expert opinion to provide practical advice on the role of diet in treating patients with IBS. Because this was not a systematic review, formal rating of the quality of evidence or strength of the presented considerations was not performed.

BEST PRACTICE ADVICE STATEMENTS

BEST PRACTICE ADVICE 1: Dietary advice is ideally prescribed to patients with IBS who have insight into their meal-related gastrointestinal symptoms and are motivated to make the necessary changes. To optimize the quality of teaching and clinical response, referral to a registered dietitian nutritionist (RDN) should be made to patients who are willing to collaborate with a RDN and patients who are not able to implement beneficial dietary changes on their own. If a gastrointestinal RDN is not available, other resources can assist with implementation of diet interventions. **BEST PRACTICE ADVICE 2:** Patients with IBS who are poor candidates for restrictive diet interventions include those consuming few culprit foods, those at risk for malnutrition, those who are food insecure, and those with an eating disorder or uncontrolled psychiatric disorder. Routine screening for disordered eating or eating disorders by careful dietary history is critical because they are common and often overlooked in gastrointestinal conditions. **BEST PRACTICE ADVICE 3:** Specific diet interventions should be attempted for a predetermined length of time. If there is no clinical response, the diet intervention should be abandoned for another treatment alternative, for example, a different diet, medication, or other form of therapy. **BEST PRACTICE ADVICE 4:** In preparation for a visit with a RDN, patients should provide dietary information that will assist in developing an individualized nutrition care plan. **BEST PRACTICE ADVICE 5:** Soluble fiber is efficacious in treating global symptoms of IBS. **BEST PRACTICE ADVICE 6:** The low-FODMAP diet is currently the most evidence-based diet intervention for IBS. Healthy eating advice as described by the National Institute of Health and Care Excellence Guidelines, among others, also offers benefit to a subset of patients with IBS. **BEST PRACTICE ADVICE 7:** The low-FODMAP diet consists of the following 3 phases: 1) restriction (lasting no more than 4–6 weeks), 2) reintroduction of FODMAP foods, and 3) personalization based on results from reintroduction. **BEST PRACTICE ADVICE 8:** Although observational studies found that most patients with IBS improve with a gluten-free diet, randomized controlled trials have yielded mixed results. **BEST PRACTICE ADVICE 9:** There are limited data showing that selected biomarkers can predict response to diet interventions in patients with IBS, but there is insufficient evidence to support their routine use in clinical practice.

Keywords: Irritable Bowel Syndrome; IBS; Diet; Low-FODMAP Diet; Fiber; Integrated Care.

Irritable bowel syndrome (IBS) is a commonly diagnosed disorder of gut–brain interaction that can substantially impact quality of life (QOL). The multifactorial pathogenesis of IBS is characterized by altered motility, visceral sensation, brain–gut interactions, gut microbiome, intestinal permeability, and mucosal immune activation. Most medical therapies for IBS improve global symptoms in fewer than one-half of patients, with a therapeutic gain of 7%–15% over placebo.[1] Most patients with IBS associate their gastrointestinal (GI) symptoms with eating food. There is mounting evidence to

Abbreviations used in this paper: **AGA, American Gastroenterological Association; ARFID, avoidant/restrictive food avoidance disorder; BPA, best practice advice; CLE, confocal laser endomicroscopy; CPU, clinical practice update; FODMAP, fermentable oligo-, di-, and monosaccharides and polyols; GFD, gluten-free diet; GI, gastrointestinal; IBS, irritable bowel syndrome; IBS-C, irritable bowel syndrome with constipation; IBS-D, irritable bowel syndrome with diarrhea; IBS-SSS, irritable bowel syndrome–Symptom Severity Score; LFD, low-FODMAP diet; MNT, medical nutrition therapy; QOL, quality of life; RCT, randomized controlled trial; RDN, registered dietitian nutritionist.**

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support dietary modifications, such as the low–fermentable oligo-, di-, and monosaccharides and polyols (FODMAP) diet (LFD), as a primary treatment for symptoms of patients with IBS. Before committing patients to a restrictive diet, excluding disordered eating behaviors and eating disorders is critical. When possible, working closely with a GI registered dietitian nutritionist (RDN) can help to optimize outcomes. The aim of this American Gastroenterological Association (AGA) Clinical Practice Update (CPU) is to provide best practice advice (BPA) on the role of diet in the treatment of IBS.

Best Practice Advice 1: Dietary advice is ideally prescribed to patients with IBS who have insight into their meal-related GI symptoms and are motivated to make the necessary changes. To optimize the quality of teaching and clinical response, referral to a RDN should be made to patients who are willing to collaborate with a RDN and patients who are not able to implement beneficial dietary changes on their own. If a GI RDN is not available, other resources can assist with implementation of diet interventions.

Best Practice Advice 2: Patients with IBS who are poor candidates for restrictive diet interventions include those consuming few culprit foods, those at risk for malnutrition, those who are food insecure, and those who have an eating disorder or uncontrolled psychiatric disorder. Routine screening for disordered eating or eating disorders by careful dietary history is critical because they are common and often overlooked in GI conditions.

Best Practice Advice 3: Specific diet interventions should be attempted for a predetermined length of time. If there is no clinical response, the diet intervention should be abandoned for another treatment alternative, for example, a different diet, medication, or other form of therapy.

When evaluating a patient with IBS, it is important to ask whether GI symptoms, such as abdominal pain, bloating, and altered bowel habits, are triggered or worsened by eating food. Surveys suggest that >80% of patients with IBS associate their symptoms with eating a meal.[2] Although unproven, it is reasonable that such patients may be more open and more likely to adhere to diet modifications.

The most common macronutrients found to trigger IBS symptoms are carbohydrates. In particular, FODMAPs are short-chain, poorly digestible, poorly absorbed sugars that can trigger symptoms in some patients with IBS. Before considering a restrictive diet, it is useful to gauge a patient's intake of culprit foods. For example, if a patient is consuming a diet with minimal FODMAP-containing foods, there is little benefit to trialing the LFD.

There are several practical challenges to operationalizing restrictive diets, such as the LFD, in patients with IBS. Specialty diets require planning and preparation, which may be impractical for some patients. Decreased cognitive abilities and significant psychiatric disease can interfere with a patient's ability to identify reproducible food triggers, adhere to a restrictive diet, or accurately report clinical response. There may be incremental costs to implementing restrictive diets. Patients with limited financial resources or food access may be unable to obtain foods allowed on a specific diet.

Gastroenterologists and other health care providers caring for patients with IBS should familiarize themselves with disordered eating behaviors as well as eating disorders.[3] Disordered eating is common in patients with GI disorders that require extreme or prolonged dietary restrictions. Practical questions to help identify patients with a possible eating disorder are displayed in Table 1.[3] Eating disorders include anorexia nervosa, bulimia nervosa, binge eating disorder, and, of particular importance to gastroenterologists, avoidant/restrictive food intake disorder (ARFID). Patients with ARFID malignantly avoid selected foods or food groups to the point of developing malnutrition, weight loss, and need for nutritional supplements or enteral or parenteral feeding.[4] Recent data suggest that 20% of patients seen in GI practice screen positive for ARFID, but it is important to note that ARFID screening tools have not been validated in patients with GI disorders.[5] Restrictive diets like the LFD should be avoided in patients with an eating disorder.

Screening for malnutrition should be considered before starting a specific diet intervention. The Malnutrition Screening Tool can be used to screen for adult malnutrition (Supplementary Figure 1).[6] It is a validated tool consisting of 2 questions about appetite and weight loss that can be administered by a nurse or medical assistant.[6] A higher score indicates the patient is not appropriate for dietary restrictions and should be referred to a RDN for a comprehensive nutritional assessment.

When advising a restrictive diet for patients with IBS, it is good clinical practice to provide guidance on the expected duration of the treatment trial and not place patients on "open-ended" dietary restrictions. Supplementary Table 1

Table 1. Practical Questions to Investigate a Possible Eating Disorder[3]

General questions:
1. Have you changed your diet recently and, if so, why?
2. What feelings do you have at mealtime or when you look at food? (Anxious or fearful?)
3. How much time to do spend planning out your meals or thinking about food?
For those who volunteer information about their weight loss or appear malnourished:
4. What do you think caused you to lose this much weight?
5. Are you concerned about your weight loss? Has anyone else expressed concern?
6. Has your weight influenced how you feel about yourself?
7. Would you like to go back to your previous weight?
8. How often do you exercise and for how long? (Is it more than 60 minutes per day?)
For those with suspected vomiting/purging/laxative use:
9. How often do you eat to the point that it makes you feel sick?
10. Is the vomiting spontaneous or do you ever force/induce it?
11. Do you use laxatives even when you are not constipated?

NOTE. This is not a validated questionnaire, but the health care provider should use their clinical judgment in referring a patient to a RDN or psychologist and/or psychiatrist with expertise in eating disorders.

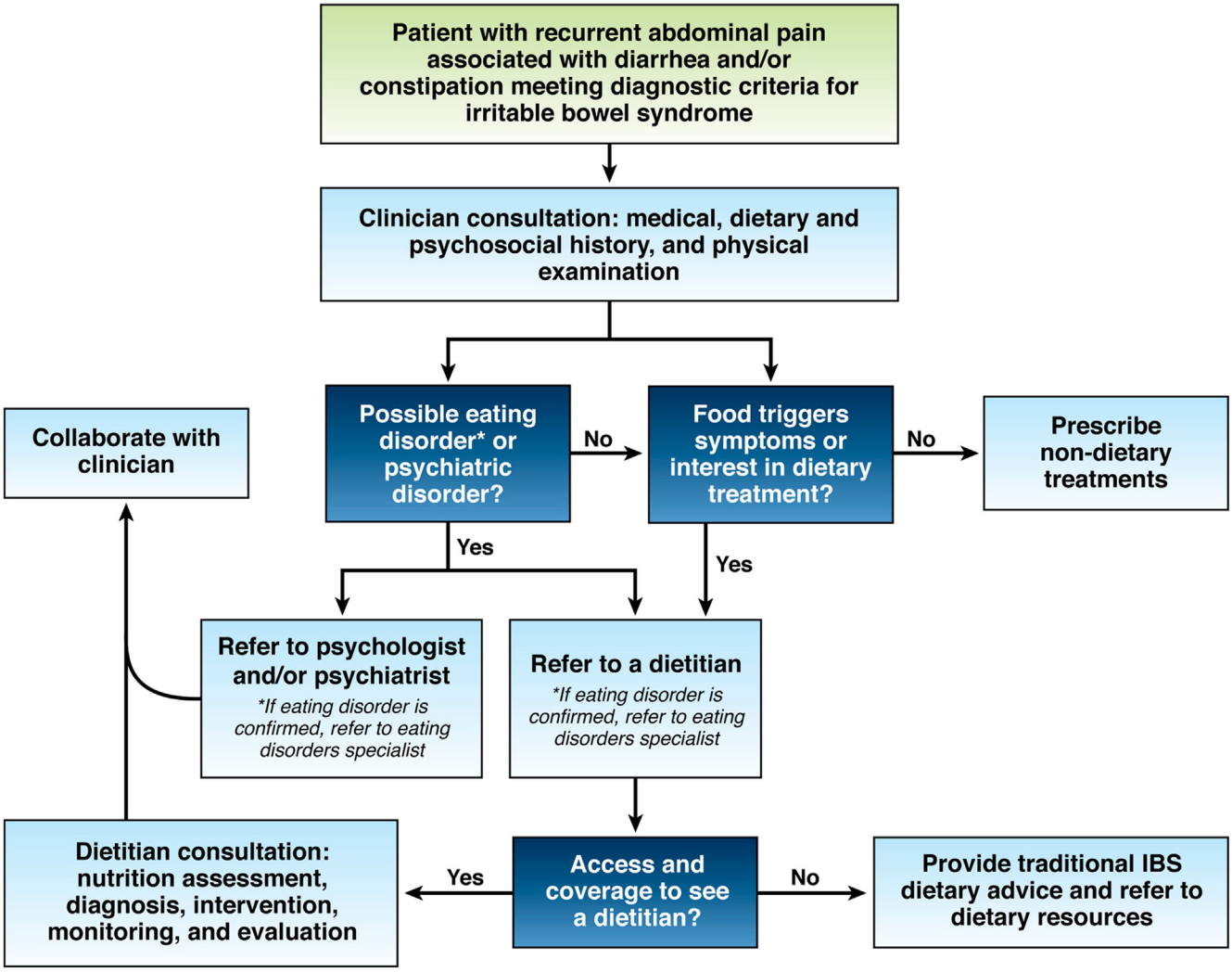

Figure 1. Approach to patients with IBS.

includes the prescribed diets for IBS.[7–11] Numerous clinical trials have found 4–6 weeks of LFD is enough to determine whether a patient with IBS is going to respond.[7] If a patient fails to respond in the prescribed time, they should be instructed to abandon the diet and move on to another treatment option. Setting the duration for a diet trial reduces the risk of complications from prolonged dietary over-restriction. In addition to a risk of developing nutritional deficiencies, it is possible that over-restriction could also promote or exacerbate disordered eating behaviors.[12]

Best Practice Advice 4: In preparation for a visit with a RDN, patients should provide dietary information that will assist in developing an individualized nutrition care plan.

When preparing for an appointment with a RDN, the clinician and patient should provide previous medical and demographic information, including test and procedures results, biochemical data, and anthropometrics. In addition, patients should keep a food diary for a minimum of 3 days and a corresponding symptom chart before their appointment. Online platforms are available to make this task more user-friendly. A RDN then conducts the following 4-step process to assess the patient's nutritional status, which contributes to dietary advice: 1) nutrition assessment information, 2) nutrition diagnosis, 3) nutrition intervention, and 4) nutrition monitoring and evaluation. Ongoing communication and collaboration between the referring physician and RDN is an important step to ensure the patient's care plan is aligned and optimized.

Referral to a RDN for medical nutrition therapy (MNT) is valuable for the patient's care plan in the treatment of IBS (Figure 1). A RDN will help implement the prescribed diet and nutrition care plan in a medically responsible manner and can provide MNT for additional diagnoses. RDNs who use MNT have shown improved outcomes in weight management, diabetes, hypertension, lipid disorders, pregnancy, human immunodeficiency virus

infection, chronic kidney disease, and unintended weight loss in adults.[13] GI practices may elect to have a RDN on staff or have a referral system that allows continuity of care. Payment for nutrition services can be limited, as coverage through public and private insurance varies by plan and by state; however, progress is being made to increase coverage

for MNT in GI diseases and other comorbidities. Medicare currently covers nutrition visits for diabetes mellitus, end-stage renal disease (not on dialysis), and post kidney transplantation, with a specified number of visits per year.

RDNs accepting private insurance have allowed more gastroenterologists to refer their patients to those participating in similar plans (in network). This can increase patient access to care that extends their medical treatment. It is advised for the gastroenterologist to provide a referral for nutrition and use a specific ICD-10 (International Classification of Diseases, Tenth Revision) diagnosis along with stating clearly that the consultation is medically necessary and/or preventative to ensure seamless processing by the RDN and/or patient. It is important to realize that it is out of the scope of practice for a RDN to determine a medical diagnosis and the RDN must use the codes assigned by the physician. Supplementary Table 2 displays the billable codes that are used most often.

Best Practice Advice 5: Soluble fiber is efficacious in treating global symptoms of IBS.

Dietary fiber is defined as a carbohydrate that is not absorbed or digested in the small intestine and that has a degree of polymerization of 3 or more monomeric units. The US Food and Drug Administration recommends that all people should consume 25–35 g of total fiber daily.[14] Soluble fiber is found in psyllium, ispaghula husk, corn fiber, calcium polycarbophil, methylcellulose, oat bran, and the flesh of fruits and vegetables, and insoluble fiber is found in wheat bran, whole grains, and fruit and vegetable skins and seeds. The 2021 American College of Gastroenterology Guidelines on the management of IBS made a strong recommendation for the use of soluble (but not insoluble) fiber for the treatment and improvement of global IBS symptoms.[15] This recommendation is based on a systematic review and meta-analysis of 15 randomized controlled trials (RCTs) that showed that soluble fiber may benefit patients with IBS, while causing only minor adverse effects.[9] Insoluble fiber did not significantly improve IBS symptoms, but may exacerbate bloating and abdominal pain. A recent network meta-analysis evaluating 5 ispaghula husk studies did not show benefit in terms of global IBS symptoms compared with placebo[16]; the 2 excluded studies were positive studies.[15] Selection of soluble fiber should be made specifically among patients with constipation-predominant IBS (IBS-C). It should be noted that there are many characteristics to fiber that impact effectiveness on symptomatology, from viscosity to rate of fermentation.[17]

Best Practice Advice 6: The LFD is currently the most evidence-based diet intervention for IBS. Healthy eating advice as described by the National Institute of Health and Care Excellence Guidelines, among others, also offers benefit to a subset of patients with IBS.

Best Practice Advice 7: The LFD consists of 3 phases: 1) restriction (lasting no more than 4–6 weeks), 2) reintroduction of FODMAP foods, and 3) personalization based on results from reintroduction.

The impact of different macronutrients on GI function and sensation has been the topic of considerable investigation. For example, fat content and total caloric intake can enhance the gastrocolonic response that contributes to increased sensorimotor bowel dysfunction and symptoms in patients with IBS.[18,19] Patients with IBS use a wide range of diets to eliminate trigger foods, including a gluten-free diet (GFD) and elimination diets based on IgG antibody testing, leukocyte activation testing, and confocal laser endomicroscopy (CLE) after food challenges, although there are few data to support these interventions.[20] Of the available options, the LFD is currently the most evidence-based dietary treatment choice for patients with IBS.[15] A LFD improves symptoms and disease-specific QOL in patients with IBS, particularly diarrhea-predominant IBS (IBS-D).[8,21,22] Although studies assessing the efficacy of the LFD in patients with IBS-C are currently lacking, RCTs have found that patients with IBS-C benefit from a higher intake of soluble fiber.[9] A previous traditional meta-analysis of 7 RCTs found that the LFD significantly reduced global symptoms relative to different control interventions in 397 patients with IBS.[7] A more recent network meta-analysis of 13 RCTs, which provides an indirect comparativeness effectiveness analysis between competing diet strategies, found that the LFD was the most effective diet strategy for relief of global symptoms, abdominal pain, and bloating in patients with IBS.[23] Recent studies reported that short-term FODMAP restriction has little impact on micronutrient intake and, when taught by a RDN, might actually improve overall diet quality relative to the habitual diets of most patients with IBS.[24,25] Long-term effectiveness and adherence data are lacking, but preliminary data from observational studies appear promising.[26,27]

Subsequent to the meta-analysis by Dionne et al,[7] several other RCTs were published. A RCT randomized 100 patients with IBS-D to the LFD or traditional dietary advice based on the National Institute of Health and Care Excellence Guidelines (Supplementary Table 3).[28–30] Although both diets improved IBS-Symptom Severity Score (IBS-SSS) and IBS-related QOL compared with baseline, benefits were greater with LFD for the primary outcome (>50-point reduction in IBS-SSS: LFD 62.7% vs traditional dietary advice 40.8%; $P = .04$). Taken together, it appears that simple changes in dietary behaviors may offer benefits to some patients with IBS.[8,31] Another recent, small, crossover RCT randomized 42 patients with IBS to the LFD, GFD, or a "balanced" diet (ie, Mediterranean diet). All 3 diets significantly improved symptom severity, bloating and abdominal pain, and QOL ($P < .05$), although the results need to be confirmed in a larger trial. The LFD led to significantly greater improvements in bloating but not in other end points, including pain, IBS-SSS, and IBS-related QOL compared with the other diets.[10] Two separate comparative effectiveness trials[32,33] reported similar benefits of the LFD in improving overall IBS symptoms for up to 6 months, compared with gut-directed hypnotherapy or yoga.

Although almost all of the data from clinical trials have focused on the effectiveness of restriction of dietary FODMAPs in patients with IBS, it is critically important to recognize that the LFD is composed of the following 3 distinct phases: 1) restriction, 2) reintroduction, and 3)

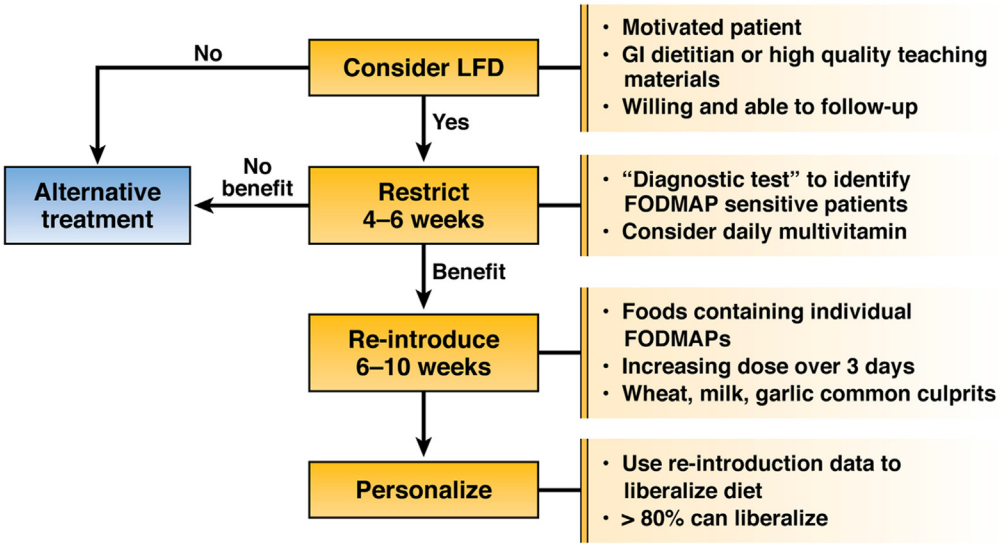

Figure 2. Low-FODMAP diet for patients with IBS.[20]

personalization (Figure 2).[20] In the restriction phase, dietary FODMAP intake is reduced substantially to determine whether symptoms in patients with IBS can be linked to FODMAP intake. This phase should be viewed as a diagnostic test to determine whether a patient with IBS is sensitive to FODMAPs. Patients with IBS who respond to FODMAP restriction typically report symptom improvement in 2–6 weeks.[20] If a patient's symptoms have not improved in that timeframe, FODMAP restriction should be discontinued and the patient should be transitioned to another treatment option. Only patients who respond to the restriction phase proceed to the FODMAP reintroduction phase. During this phase, FODMAP restriction is continued while concurrently challenging patients with foods containing a single FODMAP consumed in increasing quantities over 3 days. All the while, symptoms responses are recorded. By doing so, each patient with IBS gains an understanding of their specific tolerances and intolerances. This information is then used in the personalization phase to diversify FODMAP intake and develop an individualized LFD for long-term use. Data from observational trials suggest that up to 76% of patients with IBS can liberalize their LFD after completion of the reintroduction phase.[20,27,28] Further evidence, preferably from RCTs on the reintroduction and personalization phases, are needed. In addition, recent double-blind, reintroduction trials have identified fructans, mannitol, and galacto-oligosaccharides as the FODMAPs that most commonly trigger recurrent symptoms.[27] Although it is attractive that a simplified version of the LFD may be effective, this remains to be proven in RCTs.

A RDN with GI expertise can assist the medical team with executing a prescribed diet and optimizing outcomes. This is particularly important when prescribing the LFD, which can be complex for patients and is potentially associated with increased food costs. Also, it is not widely appreciated how often patients with IBS with meal-related symptoms are consuming a nutritionally inadequate diet.[24] As many habitual diets of patients with IBS are nutritionally inadequate, particularly when associated with unintentional weight loss, decreased intake, vitamin and mineral deficiencies, or elimination of entire food groups, a referral to a GI RDN can improve diet quality regardless of which specific diet intervention is advised.[24,25,34] GI RDNs can also assist in screening patients with IBS for disordered eating patterns, food allergies, and food intolerances.[35] Gastroenterologist–RDN collaboration optimizes patient care, particularly as part of a multidisciplinary team.[36] When a trained GI RDN is not available, a provider can collaborate with a community RDN with an interest in digestive disorders.

Physicians are encouraged to provide educational materials from reliable sources (Supplementary Table 4) to facilitate responsible implementation of dietary modifications if a RDN is not included in the care plan. Supplemental digital tools, such as mobile apps and websites, can complement the materials provided. Dietary interventions should not be implemented solely on the basis of a brief document or mobile application.

Best Practice Advice 8: Although observational studies found that most patients with IBS improve with a gluten-free diet, randomized controlled trials have yielded mixed results.

Two placebo-controlled, rechallenge trials randomly assigned patients with IBS who had symptomatically responded to a GFD to a gluten-containing diet or placebo.[37,38] Although both studies reported a significant worsening of IBS symptoms with gluten vs placebo, a recent American College of Gastroenterology systematic review and meta-analysis found that the overall difference was not statistically significant (relative risk, 0.46; 95% confidence interval, 0.16–1.28).[1] In another placebo-controlled, crossover rechallenge study, patients with IBS who responded to a GFD followed by a LFD did not experience worsening of symptoms with reintroduction of gluten, suggesting that elimination of gluten does not explain the additional symptom improvement with a LFD.[39] Another study in

individuals with self-reported gluten sensitivity (31% with IBS) on a GFD found that overall GI symptoms and bloating were significantly higher on a diet with fructans compared to that with gluten, although neither group differed from placebo.[40] This study indicated that fructans, and not gluten, induce symptoms in patients with presumed gluten sensitivity. However, a limitation of rechallenge study designs is that they may increase the likelihood of a nocebo response. Two small, uncontrolled studies showed that a GFD improved overall IBS symptoms and a third study found only a significant improvement in stool frequency with a GFD compared with a gluten-containing diet.[41–43]

At present, it remains unclear whether a GFD is of benefit to patients with IBS.

Best Practice Advice 9: There are limited data showing that selected biomarkers may predict response to diet interventions in patients with IBS, but there is insufficient evidence to support their routine use in clinical practice.

Preliminary evidence showed that celiac-related genetic factors (ie, HLA DQ2/8) and serologies may be predictive of individual symptom response in some patients on a GFD. One study found that patients with IBS-D with positive IgG anti-gliadin/anti-tissue transglutaminase antibodies and/or positive DQ2 status were more likely to have normalization of their GI symptom score and stool frequency after a GFD than those with a negative anti-gliadin/anti-tissue transglutaminase antibodies and/or negative DQ2 status.[41] Another study demonstrated that a positive anti-gliadin antibodies status was associated with less diarrhea, but not abdominal pain, after a GFD compared with patients who were negative.[44] Two studies showed that HLA DQ2/8 status predicted significant improvement with only certain individual IBS symptoms (eg, stool frequency or abdominal distension) in response to a GFD.[42,43]

Food sensitivity testing may predict response to an elimination diet, but additional validation is required. There are limited, older data regarding the ability of elevated IgG antibody levels to predict a beneficial response to eliminating foods in patients with IBS. One was a RCT of 150 patients in which a 12-week diet that excluded all foods to which they had elevated IgG antibodies led to a 10% greater reduction in IBS symptoms vs a sham diet.[45] An open-label trial with 20 patients demonstrated that eliminating foods to which they had elevated IgG antibodies was associated with a significant improvement in stool frequency, abdominal pain, and QOL.[46] A cross-sectional study found no significant correlation between IBS symptoms and IgG4 antibody titers to foods.[47] In a RCT comparing an intervention diet that excluded "positive" foods based on leukocyte activation tests with a sham diet that excluded "negative" foods, patients on an intervention diet reported a significant improvement in IBS symptoms compared with a sham diet.[48]

One study used CLE to visualize duodenal mucosal changes to common food antigens injected endoscopically in 36 patients with IBS. Of the 61% of patients with a positive CLE response, 86% had a >50% reduction in symptoms after 4 weeks on an exclusion diet, with further improvement by 12 months. None of the patients with a negative CLE response had a significant reduction in symptom scores.[49,50]

Sucrase-isomaltase variants are more common in patients with IBS and may be associated with a lower response to LFD. Sucrase-isomaltase gene variants resulting in reduced enzyme activity may predispose individuals to having IBS symptoms. In a post-hoc analysis of a subset of patients on a LFD or modified National Institute of Health and Care Excellence diet for IBS,[8] the presence of pathogenic sucrase-isomaltase variants was associated with a 3- to 4-fold reduction in response to either diet, particularly the LFD. However, limitations included a small sample size and lack of mucosal disaccharidase measurements.[51]

Pretreatment fecal microbiome and metabolites may predict response to LFD. Pediatric patients with IBS who were abdominal pain responders to LFD had stool enriched with microbes that had increased carbohydrate-specific enzymes vs nonresponders.[52] Two studies that measured fecal microbial profiles in adults with IBS using the GA-map dysbiosis test yielded different results.[53,54] Both studies found that baseline fecal bacterial profile could discriminate symptom responders vs nonresponders to a LFD, but the discriminating microbial profiles differed between these studies.[53,54] There is preliminary evidence that fecal volatile organic compound patterns at baseline and after a LFD distinguished responders from nonresponders.[55] Although these studies show promise, further studies are clearly needed.

There is no convincing evidence that fructose breath testing predicts response to a fructose-restricted diet or LFD. Based on the available evidence, a fructose breath test does not appear to predict response to a fructose-restricted, diet but may predict response to a LFD,[56–60] however, further studies are needed.

Conclusions

Diet has assumed an increasingly prominent role in our understanding and treatment of IBS. Identifying the appropriate patients for dietary treatments, particularly elimination diets, is an important first step. Partnering with a RDN to provide integrated, multidisciplinary care is essential for the successful management of IBS symptoms. There are an increasing number of valuable diet-related resources for health care providers and patients with IBS. Soluble fiber can improve overall symptoms of IBS, particularly in those with IBS-C. The LFD is currently the most evidence-based diet intervention for IBS and has been found to reduce overall and individual symptoms in RCTs. However, studies are limited by issues with their methodology, such as lack of blinding and small sample size. There is a lack of strong evidence supporting the efficacy of a GFD in relieving IBS symptoms. Further efforts to identify and validate biomarkers that predict response to dietary interventions are needed to deliver "personalized nutrition."

Supplementary Material

Note: To access the supplementary material accompanying this article, visit the online version of *Gastroenterology* at www.gastrojournal.org, and at http://doi.org/10.1053/j.gastro.2021.12.248.

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Conflicts of interest
These authors disclose the following: William D. Chey: Board member: GI on Demand; Consultant: Biomerica, Cosmo, Mauna Kea Technologies, Nestle, QOL Medical; Grant/Research Support: Biomerica, QOL Medical, Salix; Stock/Stock options: GI on Demand, ModifyHealth. Lin Chang: Consultant: Mauna Kea Technologies, Cosmo. Holds stock options for ModifyHealth. The remaining authors disclose no conflicts.

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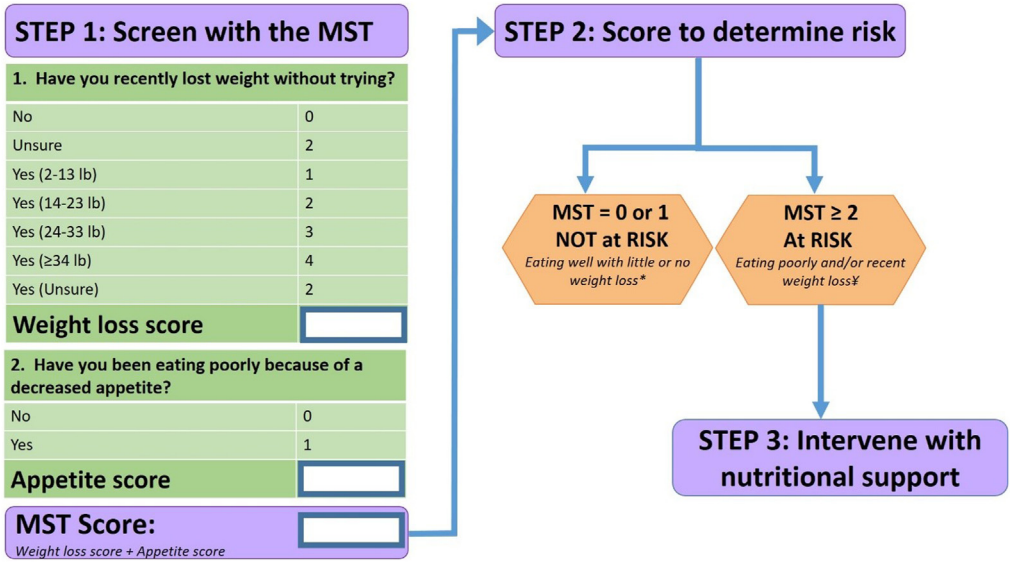

Supplementary Figure 1. Malnutrition Screening Tool.[6] *If length of stay exceeds 7 days, rescreen (to be repeated weekly as needed). ¥Rapidly implement nutrition interventions, perform nutrition consult within 24–72 hours, depending on risk.

Supplementary Table 1. Diet Therapies for Irritable Bowel Syndrome

Diets prescribed for IBS	Diets to consider prescribing (more supportive data needed)	Diets with negative/lacking scientific data
Low FODMAP[8,31,e1]	Balanced/Mediterranean[10]	Dairy-free
NICE[30]	Leukocyte activation test elimination diet[48]	Low-fiber
Increased soluble fibers[15]	Gluten-free[1,37,38]	High insoluble fibers[9,15]
		Paleolithic
		Specific carbohydrate diet
		Elemental
		Inclusion of prebiotic foods
		Mediator release test

NICE, National Institute of Health and Care Excellence.

Supplementary Table 2. Frequently Used ICD-10 Diagnoses Codes for Which Registered Dietitian Nutritionists Can Receive Reimbursement[a]

Medicare Part B MNT benefit	Other diagnosis codes used in MNT practices
Diabetes: type 1 and type 2	No specific diagnosis
E10.1 Type 1 diabetes mellitus	Z71.3 Dietary counseling and surveillance
E10.2 Type 1 diabetes mellitus with ketoacidosis	Diseases of the digestive system
E10.3 Type 1 diabetes mellitus with kidney complications	K21.0 Gastrointestinal reflux disease with esophagitis
E10.4 Type 1 diabetes mellitus with neurological complications	K21.9 Gastrointestinal reflux disease without esophagitis
E10.5 Type 1 diabetes mellitus with circulatory complications	K25 Gastric ulcer
E10.6 Type 1 diabetes mellitus with other specified complications	K27 Peptic ulcer, site unspecified
E10.64 Type 1 diabetes mellitus with hypoglycemia	K29.2 Alcoholic gastritis
E10.65 Type 1 diabetes mellitus with hyperglycemia	K29.5 Unspecified chronic gastritis
E10.8 Type 1 diabetes mellitus with unspecified complications	K29.7 Gastritis, unspecified
E10.9 Type 1 diabetes mellitus without complications	K44 Diaphragmatic hernia
E11._ Type 2 diabetes mellitus	K50.0 Crohn's disease of small intestine
E11.0 Type 1 diabetes mellitus with hyperosmolarity	K50.1 Crohn's disease of large intestine
E11.2 Type 1 diabetes mellitus with kidney complications	K50.8 Crohn's disease of both small and large intestine
E11.3 Type 1 diabetes mellitus with ophthalmic complications	K50.9 Crohn's disease, unspecified
E11.4 Type 1 diabetes mellitus with neurological complications	K51 Ulcerative colitis
E11.5 Type 1 diabetes mellitus with circulatory complications	K57.1 Diverticulosis of small intestine without perforation or abscess
E11.6 Type 1 diabetes mellitus with other specified complications	K57.3 Diverticulosis of large intestine without perforation or abscess
E11.64 Type 1 diabetes mellitus with hypoglycemia	K58 Irritable bowel syndrome
E11.65 Type 1 diabetes mellitus with hyperglycemia	K59 Constipation
E11.8 Type 1 diabetes mellitus with unspecified complications	K59.1 Functional diarrhea
E11.9 Type 1 diabetes mellitus without complications	K70.3 Alcoholic cirrhosis of the liver
Z79.4 Long-term (current) use of insulin	K86.0 Alcohol induced chronic pancreatitis
Kidney disease	K86.1 Other chronic pancreatitis
N18.1 Chronic kidney disease, stage 1	K90.0 Celiac disease
N18.2 Chronic kidney disease, stage 2	K52.2 Allergic and dietetic gastroenteritis and colitis
N18.31 Chronic kidney disease, stage 3a	Weight management
N18.32 Chronic kidney disease, stage 3b	E66.0 obese due to excess calories
N18.4 Chronic kidney disease, stage 4	E66.01 Morbid (severe) obesity due to excess calories
N18.5 Chronic kidney disease, stage 5	E66.1 Drug-induced obesity
Z48.22 Encounter for aftercare following kidney transplant	E66.2 Extreme obesity with aveolar hypoventilation (Pickwickian syndrome)
Z94.0 Kidney transplant status	E66.3 Overweight
Medicare intensive behavioral therapy for obesity benefit	E66.8 Other obesity
Z68.30 BMI 30.0–30.9, adult	E66.9 Obesity, unspecified-obesity NOS
Z68.31 BMI 31.0–31.9, adult	R62.51 Failure to thrive, child
Z68.32 BMI 32.0–32.9, adult	E63.4 Abnormal weight loss
Z68.33 BMI 33.0–33.9, adult	E63.5 Abnormal weight gain- not during pregnancy
Z68.34 BMI 34.0–34.9, adult	E63.6 Underweight
Z68.35 BMI 35.0–35.9, adult	Z68.1 BMI 19 or less, adult
Z68.36 BMI 36.0–36.9, adult	Z68.51 BMI, pediatric, less than 5th percentile for age
Z68.37 BMI 37.0–37.9, adult	Adult malnutrition
Z68.38 BMI 38.0–38.9, adult	E43 Unspecified severe protein – calorie malnutrition
Z68.39 BMI 39.0–39.9, adult	E44.0 Moderate protein-calorie malnutrition
Z68.41 BMI 40.0–44.9, adult	E44.1 Mild protein-calorie malnutrition
Z68.42 BMI 45.0–49.9, adult	E45 Retarded development following protein-calorie malnutrition
Z68.43 BMI 50.0–59.9, adult	E46 Unspecified protein-calorie malnutrition
Z68.44 BMI 60.0–69.9, adult	E64.0 Sequelae of protein-calorie malnutrition
Z68.45 BMI $\geq$70.0, adult	Diseases of the circulatory system
My healthy weight/pediatric weight management	I10 Essential (primary) hypertension
Z68.52 BMI, pediatric 5th percentile to less that 85th percentile for age	I10.0 Hypertensive heart disease with (congestive) heart failure
Z68.53 BMI, pediatric 85th percentile to less that 95th percentile for age	I10.9 Hypertensive heart disease without (congestive) heart failure
Z68.54 BMI, pediatric, greater than or equal to 95th percentile for age	I12 Hypertensive chronic kidney disease
	I25 Chronic ischemic heart disease
	I50 Heart failure
	Endocrine, nutrition, and metabolic diseases

Supplementary Table 2. Continued

Medicare Part B MNT benefit	Other diagnosis codes used in MNT practices
	E78.0 Pure hypercholesterolemia
	E78.1 Pure hyperglyceridemia
	E78.2 Mixed Hyperlipidemia
	E78.3 Hyperchylomicronemia
	E78.4 Other hyperlipidemia
	E78.5 Hyperlipidemia, unspecified
	E78.8 Other disorders of lipoprotein metabolism
	E78.9 Disorders of lipoprotein metabolism, unspecified
	E88.81 Metabolic syndrome
	E03.9 Hypothyroidism, unspecified
	E05.90 Thyrotoxicosis. unspecified
	E16.1 Other hypoglycemia
	E16.2 Hypoglycemia, unspecified
	E28.2 Polycystic ovarian syndrome
	E73.0 Congenital lactase deficiency
	E73.1 Secondary lactase deficiency
	E73.8 Other lactose intolerance
	E73.9 Lactose intolerance, unspecified
	E84 Cystic fibrosis
	M1A.3 Chronic gout due to renal impairment
	M1A.9 Chronic gout, unspecified
	M10.3 Gout due to renal impairment
	M10.4 Other secondary gout
	M10.9 Gout, unspecified
	Diseases of the genitourinary system
	N20.0 Calculus of the kidney
	Mental, behavioral, and neurodevelopmental disorders
	F50.00 Anorexia nervosa, unspecified
	F50.01 Anorexia nervosa, restricting type
	F50.02 Anorexia nervosa, binge eating/purging type
	F50.2 Bulimia nervosa
	F50.8 Other eating disorder
	F50.9 Eating disorder, unspecified
	Pregnancy
	O21.0 Mild hyperemesis gravidarum
	O21.1 Hyperemesis gravidarum with metabolic disturbance
	O21.2 Late vomiting of pregnancy
	O24.01 Pre-existing diabetes mellitus, type 1 in pregnancy
	O24.11 Pre-existing diabetes mellitus, type 2 in pregnancy
	O24.410 Gestational diabetes mellitus, diet-controlled
	O24.414 Gestational diabetes mellitus, insulin-controlled
	O26.00 Excessive weight gain in pregnancy, unspecified trimester
	O26.10 Low weight gain in pregnancy, unspecified trimester
	O99.210 Obesity complicating pregnancy, unspecified trimester
	Disease of the blood
	D50.8 Other iron deficiency anemias (due to inadequate iron intake)
	D50.9 Iron deficiency anemia, unspecified
	D51.3 Other dietary vitamin B12 deficiency anemia (vegan anemia)
	D52.0 Dietary folate anemia
	D53.0 Protein deficiency anemia
	D53.9 Nutrition anemia, unspecified (simple chronic anemia)
	D64.9 Anemia, unspecified
	Disease of the musculoskeletal system
	M81.0 Age-related osteoporosis without current pathological fracture
	M81.8 Other osteoporosis without current pathological fracture
	Diseases of the nervous system
	G47.30 Sleep apnea, unspecified

Supplementary Table 2. Continued

Medicare Part B MNT benefit	Other diagnosis codes used in MNT practices
	G47.33 Obstructive sleep apnea Abnormal clinical and laboratory findings R73.01 Impaired fasting glucose R73.02 Impaired glucose tolerance test (oral) R73.03 Prediabetes Infectious diseases B20 HIV disease

BMI, body mass index; HIV, human immunodeficiency virus; ICD-10, International Classification of Diseases, Tenth Revision; NOS, not otherwise specified.
[a]This list is not all-inclusive, but rather a representation of commonly used codes for which a patient may be referred to a RDN.

Supplementary Table 3. National Institute for Health and Care Excellence's Guidelines[30]

Dietary and lifestyle advice for adults with IBS
People with IBS should be given information that explains the importance of self-help in effectively managing their IBS. This should include information on general lifestyle, physical activity, diet, and symptom-targeted medication.
Health care professionals should encourage people with IBS to identify and make the most of their available leisure time and to create relaxation time.
Health care professionals should assess the physical activity levels of people with IBS, ideally using the General Practice Physical Activity Questionnaire. People with low activity levels should be given brief advice and counseling to encourage them to increase their activity levels.
Diet and nutrition should be assessed for people with IBS and the following general advice given:
1. Have regular meals and take time to eat
2. Avoid missing meals or leaving long gaps between eating
3. Drink at least 8 cups of fluid per day, especially water or other noncaffeinated drinks, eg, herbal teas
4. Restrict tea and coffee to 3 cups per day
5. Reduce intake of alcohol and fizzy drinks
6. It may be helpful to limit the intake of high-fiber food (such as whole-meal or high-fiber flour and breads, cereals high in bran and whole grains, such as brown rice).
7. Reduce intake of "resistant starch" (starch that resists digestion in the small intestine and reaches the colon intact), which is often found in processed or recooked foods.
8. Limit fresh fruit to 3 portions per day (a portion should be approximately 80 g)
9. People with diarrhea should avoid sorbitol, an artificial sweetener found in sugar-free sweets (including chewing gum) and drinks, and in some diabetic and slimming products.
10. People with wind and bloating may find it helpful to eat oats (such as oat-based breakfast cereal or porridge) and linseeds (up to 1 tablespoon per day).
Health care professionals should review the fiber intake of people with IBS, adjusting (usually reducing) it while monitoring the effect on symptoms. People with IBS should be discouraged from eating insoluble fiber (eg, bran). If an increase in dietary fiber is advised, it should be soluble fiber, such as ispaghula powder or foods high in soluble fiber (eg, oats). People with IBS who choose to try probiotics should be advised to take the product for at least 4 weeks while monitoring the effect. Probiotics should be taken at the dose recommended by the manufacturer.
Health care professionals should discourage the use of aloe vera in the treatment of IBS.
If a person's IBS symptoms persist while following general lifestyle and dietary advice, offer advice on further dietary management. Such advice should:
Include single food avoidance and exclusion diets (eg, a low-FODMAP diet).
Only be given by a health care professional with expertise in dietary management.

Supplementary Table 4. Online Resources for the Treatment of Irritable Bowel Syndrome

Resource	URL
Websites with patient education materials	
American Gastroenterology Association partnership with Academy of Nutrition and Dietetics	www.gastro.org
American College of Gastroenterology	www.gi.org
Gastro Girl	www.gastrogirl.com
International Foundation for Gastrointestinal Disorders	www.iffgd.org/rescorces
Rome Foundation	www.theromefoundation.org
North American Society for Pediatric Gastroenterology, Hepatology and Nutrition	www.gikids.org
Find a dietitian by specialty	www.eatright.org/find-an-expert
Nutrition-specific websites with educational materials	
Monash University low-FODMAP diet	www.monashfodmap.com
Academy of Nutrition and Dietetics	www.eatright.org
Michigan Medicine	www.myginutrition.com
FODMAP Friendly	www.fodmapfriendly.com
FODMAP Everyday	www.fodmapeveryday.com
Kate Scarlata, MPH, RDN	www.katescarlata.com
Patsy Catsos, MS, RDN	www.ibsfree.net
Epicured	www.epicured.com
ModifyHealth	www.modifyhealth.com
Training in GI nutrition management	
Food The Main Course to Digestive Health	ww.foodthemaincourse.com
Monash University Low FODMAP Diet	www.monashfodmap.com
Apps	
Monash University FODMAP app	—
FODMAP Friendly	—
MyGiHealth symptom tracker	—
mySymptoms food and symptom tracker	—
Nerva	—
Virtual care	
GI on Demand, integrated support platform in collaboration with American College of Gastroenterology	www.giondemand.com
Community support for patients	www.ibspatient.org
Food delivery systems	
Epicured	www.epicured.com
ModifyHealth	www.modifyhealth.com

NOTE. Most of the resources are focused in the United States. Locally validated guidance on LFD should be considered depending on your practice location.