

Irritable bowel syndrome and diet: evidence based nutritional strategies

María F. Huerta-de la Torre 

Gastroenterology Service, Private Practice, Hospital Ángeles Torreón, Torreón, Coahuila, Mexico

Abstract

The patients with irritable bowel syndrome (IBS) and other disorders of the gut-brain interaction (DGBI) often identify food as a significant trigger of their gastrointestinal symptoms, which is why guidelines recommend the implementation of first line dietary modifications like the one developed by the National Institute for Health and care Excellence (NICE) and the British Dietetic Association (BDA) for symptom management in this patient group. As a second line therapy, a low Fermentable Oligosaccharide, Disaccharide, Monosaccharide and Polyols (FODMAP) diet can be suggested. This currently represents the dietary intervention with the most scientific evidence for the treatment of IBS and other DGBI. However, it has certain limitations such as its degree of complexity, possible alterations to the intestinal microbiota, and the risk of nutritional deficiencies. For all these reasons, different dietary approaches such as gluten-free, fructose-free, lactose-free, modified fiber, and low-histamine diets, among others, continue to be studied. The search for nutritional strategies that are adapted and can be personalized to each patient, with the aim of achieving good adherence to achieve improvement in symptoms and quality of life, should be our goal in the future.

Keywords: Diet. FODMAP. NICE. Food intolerance. Microbiota. Personalization.

Dietas y síndrome de intestino irritable: estrategias nutricionales basadas en la evidencia

Resumen

Los pacientes con síndrome de intestino irritable (SII) y en general con trastornos de la interacción intestino-cerebro (TIIC) a menudo identifican la comida como un desencadenante importante de sus síntomas gastrointestinales, por lo que las guías postulan como tratamiento de primera línea las modificaciones del estilo de vida propuestas por el National Institute for Health and Care Excellence (NICE) en conjunto con British Dietetic Association (BDA) para el manejo de la sintomatología en estos pacientes. Como segunda línea de tratamiento se puede sugerir la dieta baja en oligosacáridos, disacáridos, monosacáridos y polioles fermentables (FODMAP, *Fermentable Oligosaccharide, Disaccharide, Monosaccharide and Polyols*), que representa actualmente la intervención dietética con más evidencia científica para el tratamiento del SII y otros TIIC; sin embargo, tiene ciertas desventajas, como su grado de complejidad, las posibles alteraciones de la microbiota intestinal y el riesgo de deficiencias nutricionales. Por todo esto, se siguen estudiando diferentes abordajes dietéticos, como las dietas libres de gluten, fructosa y lactosa, modificadas en fibras o bajas en histamina, entre otras. La búsqueda de estrategias nutricionales que se adapten y puedan personalizarse a cada paciente, con la finalidad de que tenga un buen apego para lograr la mejoría de sus síntomas y de su calidad de vida, permanece siendo la meta a lograr en un futuro.

Palabras clave: Dieta. FODMAP. NICE. Intolerancias alimentarias. Microbiota. Personalización.

Correspondence:

María F. Huerta-de la Torre
E-mail: mhuertadelatorre@gmail.com

Date of reception: 01-04-2025

Date of acceptance: 30-04-2025

DOI: 10.24875/CGME.M25000008

Available online: 17-09-2025

Clín. Gastroenterol. Méx. (Eng). 2025;1(1):63-71

www.clinicaspertinentesdemexico.com

3081-7153 / © 2025 Asociación Mexicana de Gastroenterología. Publicado por Permayer. Éste es un artículo *open access* bajo la licencia CC BY-NC-ND (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

Introduction to the role of diet in irritable bowel syndrome

Since 70%-89% of patients with irritable bowel syndrome (IBS) report exacerbation of symptoms with certain specific foods, it is common for them to self-eliminate these foods from their diet, negatively impacting their nutritional status¹. Therefore, diet is a fundamental pillar in the management of IBS. As first-line therapy, the implementation of dietary and lifestyle changes according to the guidelines of the National Institute for Health and Care Excellence (NICE) is recommended (shown in Table 1). As second-line therapy, a restrictive diet such as the low fermentable oligosaccharides, disaccharides, monosaccharides, and polyols (FODMAP) diet is suggested². This dietary intervention represents the approach with the greatest scientific evidence for IBS treatment, but due to its complexity, different nutritional strategies continue to be studied with the goal of finding one that facilitates patient adherence. Less restrictive dietary approaches, without disruption of the microbiota or micronutrient status, are the alternatives currently being proposed.

Low-FODMAP diet: the best strategy?

Principles of the diet and its clinical efficacy

The low-FODMAP diet is a dietary intervention that reduces the intake of fermentable oligosaccharides, disaccharides, monosaccharides, and polyols, aiming to decrease osmotic pressure and bacterial fermentation in the intestine. It is currently the dietary intervention with the strongest scientific support for IBS management.

Multiple meta-analyses have shown significant improvement in global symptoms with a low-FODMAP diet vs traditional diets. One meta-analysis reported a risk ratio of 1.21 (95% confidence interval, 0.98-1.51) for global symptom improvement with the low-FODMAP diet, particularly in abdominal pain and bloating, although with significant heterogeneity among studies ($I^2 = 63\%$)³.

Elimination and reintroduction process

This dietary regimen consists of 3 phases:⁴

1. Elimination phase: All FODMAPs are restricted for approximately 4-8 weeks. The diet is considered low when intake is < 0.5 g per serving or < 3 g/day⁵. Proportions for this restriction are shown in Table 2⁶.

Table 1. General recommendations from the National Institute for Health and Care Excellence (NICE) guidelines

Eat meals regularly
Avoid prolonged fasting (> 4 hours)
Do not skip meals
Drink 8 glasses of water per day
Limit caffeine intake to a maximum of 3 cups per day
Limit fresh fruit consumption to 3 portions per day
Reduce intake of processed foods
Avoid artificial sweeteners (ending in -ol)

Table 2. Proportions of a low-FODMAP diet

< 0.3 g per serving of oligosaccharides (grain-based products, legumes, nuts, and seed oils) or less than 0.2 g per serving of oligosaccharides (legumes, nuts, seeds, fruits and vegetables, grain-based products)
< 0.4 g per serving of total polyols
< 0.4 g per serving of excess fructose
< 1 g per serving of lactose

2. Reintroduction phase: Each FODMAP group is progressively reintroduced in a non-cumulative fashion to avoid additive effects and to identify individual tolerance to each group. When a group or specific food that triggers classic symptoms is identified, it should be removed again, and its definitive elimination considered⁵.
3. Personalization phase: Foods containing FODMAPs may be consumed according to individual tolerance, thereby controlling symptoms⁵. (Table 3)

Long-term benefits and limitations

In a meta-analysis including 6 randomized clinical trials with a total of 182 patients on a low-FODMAP diet and 172 patients on a standard habitual diet, bloating and other GI symptoms were evaluated at baseline and at 3 and 6 weeks⁷. The meta-analysis found a significant reduction in bloating, measured by the IBS Symptom Severity Score (IBS-SSS), in patients on the low-FODMAP diet⁷.

Another meta-analysis of 12 randomized clinical trials assessed the effect of a low-FODMAP diet on GI symptoms, including both objective and subjective bloating, comparing 3-6 weeks of a low-FODMAP diet with any other dietary intervention⁸. The meta-analysis concluded

Table 3. Food Tables according to FODMAP content⁶

	Low	Moderate	High
Vegetables	Swiss chard Alfalfa Arugula Broccoli Pumpkin Chayote Chili Green beans Spinach Soybean sprouts Corn smut (huitlacoche) Jicama Cucumber Peppers Carrot	Eggplant White cabbage Red cabbage Tomato Kale Lettuce	Artichoke Celery Garlic Beet Onion Mushrooms Peas Brussels sprouts Cauliflower Asparagus Fennel bulb Radishes Oyster mushrooms Shallot
Fruits	Blueberries Strawberries Kiwi Lemon Mandarin Melon Orange Papaya Pineapple Dragon fruit (pitaya) Tamarind Grapefruit Grapes	Date (2 pieces) Guava Banana	Cherries (1 cup) Plum Peach Raspberry (1 cup) Pomegranate Fig Mango Apple Nectarine Pear Watermelon (1 cup) Blackberry (2/3 cup) Dried fruit
Dairy	Lactose-free milk Butter Hard cheeses (manchego parmesan) Lactose-free yogurt Greek yogurt	Cottage cheese Fresh cheese	Kefir (200 ml) Condensed milk Whole milk Evaporated milk Cream cheese Regular yogurt
Cereals	Amaranth Rice Oats Corn flakes Sweet potato Corn Popcorn Potato Quinoa Rice cakes Corn tortillas		Barley Rye Couscous Wheat and derivatives (bread flour pasta semolina)
Fats	Vegetable oils (canola sunflower olive) Peanut Mayonnaise Nuts Pumpkin Sunflower and Chia seeds		Avocado Almond Dried coconut Cashew Pistachio
Legumes		Hummus Edamame	White beans Common beans Fava beans Lentils Textured soy Soft tofu

(Continues)

Table 3. Food Tables according to FODMAP content⁶ (*continued*)

	Low	Moderate	High
Beverages	Coffee Juices/smoothies (allowed fruits and vegetables) White tea Matcha tea Mint tea Green tea		Commercial coconut water Coffee with whole milk Syrups Fruit juices (apple orange) Kombucha Regular or diet sodas Chai tea Fennel tea
Sugars	White sugar Brown sugar Dark chocolate Glucose Maple syrup Natural stevia	Honey (1 teaspoon) Jams	Milk chocolate Fructose Agave syrup High-fructose corn syrup Mannitol Sorbitol
Animal-based foods	Low content: all (lamb, pork, beef, eggs, seafood, fish, turkey, chicken, veal)		
Condiments	Low content: cilantro, parsley, basil, dill, oregano, cinnamon, clove, cumin, turmeric, curry, mint, mustard, paprika, rosemary, sriracha (1 teaspoon), soy sauce (2 tablespoons), vanilla, vinegars		

Source: Monash University App[®].

that the low-FODMAP diet produced the greatest improvement in bloating vs other dietary interventions⁸.

Certain limitations and disadvantages have been observed, including its impact on intestinal microbiota, low patient adherence, the need for trained health professionals (dietitians or physicians) for its implementation, and the lack of standardization of FODMAP content in foods in Mexico⁹.

Patients on a low-FODMAP diet long-term are at risk of nutrient deficiencies (calcium, iron, zinc, vitamin D, folates, and thiamine). For this and other reasons, management should always be guided by a dietitian or specialist¹⁰.

The patient should always be approached in an individualized manner, avoiding standardized diets, while considering the availability of time and access to foods to foster patient interest and adherence; otherwise, there is a risk of little or no compliance.

Impact on the intestinal microbiota

By restricting a wide variety of foods, the intestinal microbiota is negatively altered, with reductions in *Bifidobacterium* and *Faecalibacterium prausnitzii* and increases in *Clostridium* species. Reduced intake of fiber and antioxidants (flavonoids, carotenoids)² may lower concentrations of certain short-chain fatty acids such as propionic and valeric acids, which are important for intestinal health^{11,12}.

Food intolerances in irritable bowel syndrome

Lactose, fructose, sorbitol, and gluten: common culprits?

In addition to FODMAPs, several foods and dietary patterns are associated with intolerances that may worsen IBS symptoms. Fructose malabsorption—present in fruits, honey, syrups, and processed foods—can cause symptoms due to colonic fermentation when luminal fructose exceeds the absorptive capacity of enterocytes. Humans have a lower absorption capacity for fructose compared with glucose; however, in combination with glucose, absorption is increased due to Na⁺-glucose cotransport.

Fructose malabsorption occurs when free fructose exceeds absorptive capacity, particularly when fructose exceeds glucose. There is wide interindividual variability: between 10% and 55% of healthy individuals do not completely absorb 25 g of fructose, whereas smaller doses are usually well tolerated. Unabsorbed fructose reaches the colon, where it undergoes fermentation¹³.

Diagnostic methods for food intolerances

The clinical utility of breath tests is debated, as patients may improve on a restrictive diet without positive test results, and vice versa. This highlights

diagnostic complexity and the need to evaluate clinical symptoms alongside test results, also considering dietary context and interactions with other carbohydrates¹⁴.

On the other hand, there is insufficient evidence to recommend allergy panels measuring food-specific IgG, despite frequent patient requests. According to current clinical practice guidelines, serum food-specific IgG4 only indicates repeated exposure to food components and does not represent allergy, intolerance, or sensitivity; thus, its use should not be recommended^{14,15}.

Fiber and irritable bowel syndrome: ally or enemy?

Dietary fibers are plant-based carbohydrates that cannot be digested by the human body and have different impacts depending on their functional characteristics. Fibers can be categorized according to their solubility into two types: soluble and insoluble. They can also be classified by their degree of fermentability, and rapidly fermentable fibers (such as fructans and galactooligosaccharides) may generate symptoms in individuals with visceral hypersensitivity, so their restriction may reduce colonic fermentation and relieve symptoms in IBS and functional dyspepsia. However, limiting colonic fermentation may slightly affect the composition of the microbiota, which can be restored with the gradual reintroduction of fermentation.

Scientific evidence has shown that dietary fiber plays an important role in intestinal inflammation, due to its fermentation into short-chain fatty acids within colonocytes. These short-chain fatty acids contribute to greater diversity in the intestinal microbiota and protect against intestinal dysbiosis¹⁶. Based on this, it is postulated that low-fiber diets promote intestinal inflammation, while high-fiber diets protect against inflammatory processes.

Fibers such as psyllium, wheat bran, nopal fiber, and sugarcane bagasse may benefit IBS patients with constipation-predominant IBS. Psyllium and nopal are poorly fermentable and better tolerated than wheat bran. Nopal fiber improved overall symptoms but did not affect laxation¹⁷. Fermentable fibers, such as fructans, galactooligosaccharides, and polydextrose, have little effect on constipation¹⁷.

Supplementation with fermentable fibers (3–24 g/day) in patients with DGBI, such as IBS, may promote the growth of beneficial bacteria like bifidobacteria. However, this modulation of the intestinal microbiota does not always translate into an improvement in GI symptoms in patients with DGBI.

Gluten-free diet in IBS: valid strategy or passing trend?

In a study of self-reported non-celiac gluten sensitivity, fructans—not gluten—triggered GI symptoms¹⁸. No significant difference was found between gluten and placebo groups, whereas fructans produced greater symptoms. This suggests fructans may be the true triggers in these patients, casting doubt on the need for a gluten-free diet in those self-diagnosed with gluten sensitivity¹⁸.

The available scientific evidence regarding a gluten-free diet for patients with IBS, especially those with diarrhea predominance, is limited and often of low quality to recommend its use. Although some patients may experience symptom improvement with a gluten-free diet, this is insufficient to recommend it in a generalized manner. Further research is needed to better understand the mechanisms and efficacy of such dietary interventions^{19,20}.

Table 4 illustrates the existing evidence on these and other dietary interventions for treating IBS symptoms is summarized.

Role of the microbiota in dietary response **Gut dysbiosis and symptom influence**

Intestinal dysbiosis is associated with IBS through various mechanisms. Several studies have shown that populations with IBS present a characteristic pattern in the intestinal microbiota. Specifically, in constipation-predominant IBS there is an increase in Firmicutes (*Clostridium* spp.), *Alistipes*, and *Butyricimonas*, whereas the diarrhea-predominant IBS subtype shows an increase in *Enterobacteriaceae*, *Acinetobacter*, *Butyricimonas*, and *Odoribacter*, along with a decrease in fecal microbiota diversity.

It has been demonstrated that the fecal microbiota of subjects with IBS differs significantly from that of healthy subjects ($p < 0.0253$) and may influence colonic transit, contributing to alterations in bowel patterns²¹.

Use of probiotics and prebiotics in the dietary management of IBS

The use of probiotics and prebiotics in IBS has variable support depending on the subtype of the disease and the specific strains used. Scientific evidence suggests that probiotics may be effective in improving IBS symptoms, while prebiotics have not yet shown clear benefits.

Table 4. Evidence on other diets used to treat irritable bowel syndrome

Type of diet	Description	Evidence
Lactose-free	Avoid any product containing lactose for 2 weeks; if symptoms improve, continue lactose-free diet. If symptoms persist, lactose-containing foods may be reintroduced.	Useful for patients with lactose intolerance; not effective for IBS patients without lactose intolerance.
Low/free fructose	Avoid foods high in fructose and fructans.	Observational studies and randomized clinical trials. Beneficial effects on symptoms, but dependent on adherence. Data limited to IBS patients with breath tests or fructose malabsorption.
Gluten-free	Eliminate wheat, barley, and rye in any form.	Insufficient evidence to recommend in IBS patients.
IgG-based	Eliminates foods with elevated IgG antibody levels.	Compared with healthy controls, IBS patients appear to have higher IgG antibody levels; however, symptom severity does not correlate with antibody titers. On an IgG elimination diet, IBS patients experienced a small symptom reduction, varying with adherence (10–26%) vs a sham diet.
Very low-carbohydrate or ketogenic	< 20 g/day of carbohydrates, 5% of daily calories (vs mean of 55%).	Only one study with 13 IBS patients with diarrhea predominance; 77% noted symptom improvement, specifically in frequency and consistency of bowel movements, quality of life, and pain scores.
Fiber supplementation	Psyllium, gradual increase (2–3 g/day) of soluble fiber intake from diet or supplements.	Several randomized clinical trials and meta-analyses. Soluble fiber is slightly more effective than placebo for IBS symptom management; insoluble fiber is ineffective.
Low-fat	< 27 g/day, based on a 2000 kcal diet.	Some observational studies and uncontrolled trials, but no randomized clinical trials. A high-fat diet can induce symptoms in IBS subjects. Reducing fat intake may benefit patients who associate meals with pain.
Low-fiber	<10-15 g/day.	No available evidence; common practice recommends reducing fiber in patients with diarrhea to increase transit time.
Low-histamine	Reduce intake of histamine-liberating foods: alcohol, eggs, fish, meat, aged cheeses, nuts, certain fruits, chocolate.	No evidence supporting its utility in IBS.

IgG: immunoglobulin G; IBS: irritable bowel syndrome.
Based on Werlang et al.¹

Specifically, the strain *Bifidobacterium infantis* 35624 has been shown to normalize the abnormal ratio of interleukins 10 and 12, and to relieve IBS symptoms, except for stool frequency and consistency, with a dose-dependent effect. Other strains with evidence of improvement in abdominal pain, bowel frequency, and quality of life in patients with diarrhea-predominant IBS are *Lactiplantibacillus plantarum* and *Bacillus coagulans*. In constipation-predominant IBS, administration of *Lactobacillus helveticus* for 1 week improved abdominal symptoms associated with constipation and reduced intestinal transit time²².

Specific strains associated with abdominal pain reduction in IBS include *Bacillus coagulans* MTCC5260,

Saccharomyces boulardii CNCM I-745, *Saccharomyces cerevisiae* CNCM I-3856, and *Lactiplantibacillus plantarum* 299v. However, for abdominal bloating, the level of evidence on the benefit of combining strains was very low²².

Due to study heterogeneity and the low quality of evidence, the American Gastroenterological Association and the American College of Gastroenterology do not formally recommend the use of probiotics and prebiotics for IBS²³.

Despite some promising preclinical studies, clinical evidence does not support the use of prebiotics for IBS, as they have not shown significant improvements in symptoms^{24,25}.

Foods	Amount	Symptoms	Intensity	Date

Foods: break down the ingredients of the meal if applicable. Amount: pieces, cups, tablespoons, grams. Symptoms: pain, bloating, gas, constipation, diarrhea, etc. Intensity: mild, moderate, severe.

Figure 1. Example of a food diary as an assessment tool.

Emerging dietary interventions

There is no available information on the effect of intermittent fasting in patients with IBS. However, a small study with 21 healthy Muslim individuals who practiced Ramadan (a model of intermittent fasting) evaluated the effects on GI motility²⁶. The study concluded that all subjects showed a decrease in weight, body mass index, and waist circumference and with a reduction in subcutaneous and visceral fat, and insulin resistance. After fasting, hydrogen breath tests showed an increase in carbohydrate fermentation and a faster orocecal transit²⁵. Further studies, especially in humans and in the context of disease, are needed to determine its efficacy and mechanism of action in IBS.

Nutritional assessment tools in irritable bowel syndrome

Since IBS presents as diarrhea-predominant, constipation-predominant, or mixed subtypes, it is essential to identify triggers to guide dietary management. The main tool that can be useful in identifying triggers is a food diary or log, in which the patient is asked to monitor and record foods consumed prior to the onset of symptoms to correlate them. Figure 1 illustrates an example of a log format that the patient can complete. Other options include:

- Bowel movement diary: frequency and appearance of stools are recorded using the Bristol Stool Scale.
- 24-hour recall: assesses all foods consumed the previous day (or a typical day) and allows identification of whether the patient consumes enough fruits and vegetables, whether there is excess intake of processed foods, or if the diet is high in fat, among other aspects.

Patient monitoring should always be carried out by a qualified nutritionist, who can recognize the types of foods and quantities to which the patient may be hypersensitive, and advise on appropriate substitutions. These methods, focused on adapting and personalizing treatment for each individual, reduce the risk of nutritional deficiencies and improve adherence.

Challenges and controversies surrounding dietary interventions

Tuck et al⁴. evaluated responses during each phase of the low-FODMAP diet in 80 patients, observing that 78% adhered during phase 1 (restriction), but adherence decreased by 30% in phase 2 (reintroduction) and by an additional 8% in phase 3 (personalization), resulting in only 40% following all 3 phases adequately. For this reason, an alternative, less restrictive, history-based approach called Bottom-up has been proposed. In this approach, only 1 or 2 specific FODMAP subgroups are initially restricted, the symptomatic response is evaluated, and restrictions are continued only if necessary. It is suggested to begin with fructans, mannitol, and galactooligosaccharides, as these FODMAP subgroups are most frequently reported as triggers (Fig. 2)⁵.

Although this approach has not been well studied, the Bottom-up strategy requires a thorough assessment of the patient's dietary habits to identify likely triggers. For example, if the patient uses artificial sweeteners (in coffee, sodas, or sugar-free drinks, or if they chew gum or consume sugar-free mints, candies, or chocolates) or consumes large amounts of fruit or fruit juices, restricting excess fructose and polyols may yield a good response. Conversely, if the patient consumes large amounts of wheat, onion, or legumes, they may benefit from restricting fructans. Lactose intolerance must also be considered²⁷.

After initial restriction of 1 or 2 foods or subgroups for approximately 2 weeks, symptoms are reassessed, and if they have improved, no further restrictions are needed. If symptoms persist, additional foods or subgroups can be added to the dietary restriction until symptoms resolve or lack of response is observed^{5,27}.

Possible risks of prolonged restrictive diets

An important factor to consider when recommending restrictive or elimination diets is the risk of eating disorders, specifically orthorexia nervosa. Some signs and

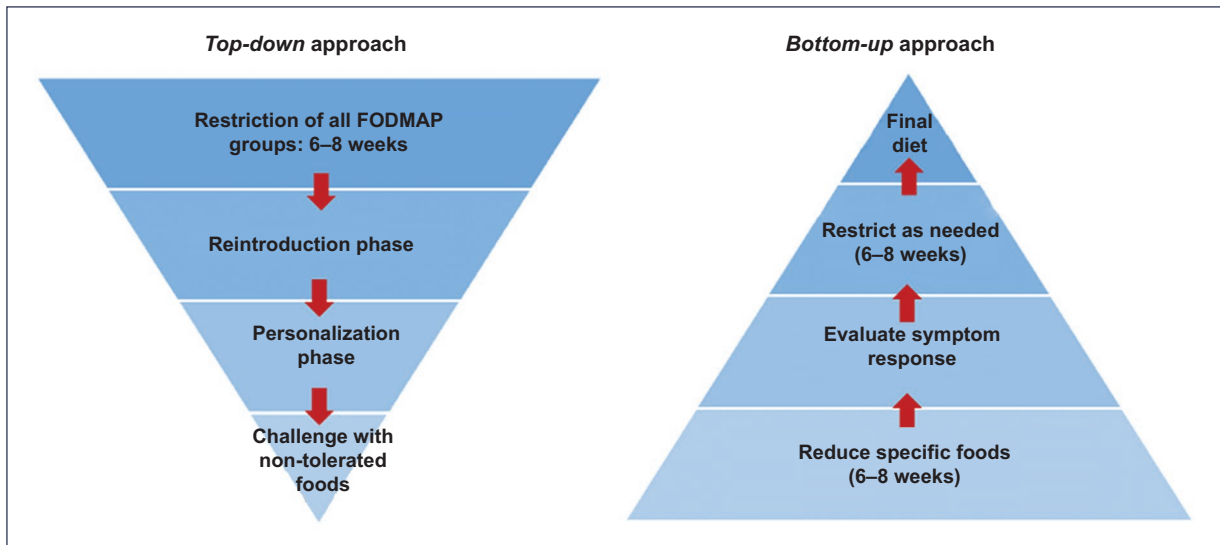


Figure 2. Alternative bottom-up approach to the traditional low-FODMAP diet.¹³

symptoms reported in the literature include compulsively checking nutrition labels, avoiding many food groups, being unable to eat anything that does not appear clean or healthy, and feeling stress related to food.

A particular disorder increasingly observed in IBS patients is avoidant/restrictive food intake disorder (ARFID). This differs from anorexia nervosa in that there is no preoccupation with weight.

Very little literature exists on ARFID in gastroenterology, but it may be more common than clinicians realize. Dr. Chey's group in Michigan reported that of more than 300 patients seen in motility and brain-gut clinics, 20% screened positive for ARFID²⁸.

For this reason, it is important to monitor and avoid extreme or unnecessary dietary restrictions, which may place patients at risk of long-term nutritional deficiencies.

Personalized diet or general guidelines?

In conclusion, there is no standardized diet that will work for all IBS patients. Therefore, a personalized diet adapted to each patient's lifestyle, preferences, beliefs, and socioeconomic status is recommended.

Patients must be reminded and educated that tolerance will largely depend on the amounts consumed and the combinations with other foods. Using a food diary when symptoms occur is advisable, as it allows appropriate adjustments based on recorded information.

Funding

The author declared not having received any funding for this study.

Conflicts of interest

The author declared no conflicts of interest whatsoever.

Ethical considerations

Protection of humans and animals. The author declares that no experiments on humans or animals were conducted for this study.

Confidentiality, informed consent, and ethical approval. The study does not involve patient personal data and does not require ethical approval. The SAGER guidelines do not apply.

Declaration on the use of artificial intelligence. The author declares that no generative artificial intelligence was used in the preparation of this manuscript.

References

1. Werlang ME, Palmer WC, Lacy BE. Irritable bowel syndrome and dietary interventions. *Gastroenterol Hepatol (N Y)*. 2019;15:16-26.
2. Whelan K, Martin LD, Staudacher HM, Lomer MCE. The low FODMAP diet in the management of irritable bowel syndrome: an evidence-based review of FODMAP restriction, reintroduction and personalisation in clinical practice. *J Hum Nutr Diet*. 2018;31:239-55.
3. Yu SJ, Lee HS, Gung HJ, Kim JS, Kim KB, Kwon YH, et al. Efficacy of a restrictive diet in irritable bowel syndrome: a systematic review and network meta-analysis. *Korean J Gastroenterol*. 2022;80:6-16.
4. Tuck CJ, Reed DE, Muir JG, Vanner SJ. Implementation of the low FODMAP diet in functional gastrointestinal symptoms: a real-world experience. *Neurogastroenterol Motil*. 2020;32:e13730.

5. Singh P, Tuck C, Gibson PR, Chey WD. The role of food in the treatment of bowel disorders: focus on irritable bowel syndrome and functional constipation. *Am J Gastroenterol.* 2022;117:947-57.
6. Pessarelli T, Sorge A, Elli L, Costantino A. The low-FODMAP diet and the gluten-free diet in the management of functional abdominal bloating and distension. *Front Nutr.* 2022;9:1007716.
7. Marsh A, Eslick EM, Eslick GD. Does a diet low in FODMAPs reduce symptoms associated with functional gastrointestinal disorders? A comprehensive systematic review and meta-analysis. *Eur J Nutr.* 2016;55: 897-906.
8. Black CJ, Staudacher HM, Ford AC. Efficacy of a low FODMAP diet in irritable bowel syndrome: systematic review and network meta-analysis. *Gut.* 2022;71:1117-26.
9. Catassi G, Lionetti E, Gatti S, Catassi C. The low FODMAP diet: many question marks for a catchy acronym. *Nutrients.* 2017;9:E292.
10. Okawa Y, Fukudo S, Sanada H. Specific foods can reduce symptoms of irritable bowel syndrome and functional constipation: a review. *Biopsy-chosoc Med.* 2019;13:10.
11. Herfindal A, Van Megen F, Gilde M, Valeur J, Rudi K, Skodje G, et al. Effects of a low FODMAP diet on gut microbiota in individuals with treated coeliac disease having persistent gastrointestinal symptoms — a randomised controlled trial. *Br J Nutr.* 2023;130:2061-75.
12. So D, Loughman A, Staudacher H. Effects of a low FODMAP diet on the colonic microbiome in irritable bowel syndrome: a systematic review with meta-analysis. *Am J Clin Nutr.* 2022;116:943-52.
13. Fernández-Bañares F. Carbohydrate maldigestion and intolerance. *Nutrients.* 2022;14:1923.
14. Stapel SO, Asero R, Ballmer-Weber BK, Knol EF, Strobel S, Vieths S, et al.; EAACI Task Force. Testing for IgG4 against foods is not recommended as a diagnostic tool: EAACI Task Force Report. *Allergy.* 2008;63:793-6.
15. Gocki J, Bartuzi Z. Role of immunoglobulin G antibodies in diagnosis of food allergy. *Postepy Dermatol Alergol.* 2016;33:253-6.
16. Hsieh MS, Hsu WH, Wang JW, Wang YK, Hu HM, Chang WK, et al. Nutritional and dietary strategy in the clinical care of inflammatory bowel disease. *J Formos Med Assoc.* 2020;119:1742-9.
17. So D, Tuck C. Innovative concepts in diet therapies in disorders of gut-brain interaction. *JGH Open.* 2024;8:e70001.
18. Skodje GI, Sarna VK, Minelle IH, Rolfsen KL, Muir JG, Gibson PR, et al. Fructan, rather than gluten, induces symptoms in patients with self-reported non-celiac gluten sensitivity. *Gastroenterology.* 2018;154:529-39.e2.
19. Biesiekierski JR, Newnham ED, Irving PM, Barrett JS, Haines M, Doecke JD, et al. Gluten causes gastrointestinal symptoms in subjects without celiac disease: a double-blind randomized placebo-controlled trial. *Am J Gastroenterol.* 2011;106:508-14.
20. Shahbazkhani B, Sadeghi A, Malekzadeh R, Khatavi F, Etemadi M, Kalantri E, et al. Non-celiac gluten sensitivity has narrowed the spectrum of irritable bowel syndrome: a double-blind randomized placebo-controlled trial. *Nutrients.* 2015;7:4542-54.
21. Black CJ, Ford AC. Global burden of irritable bowel syndrome: trends, predictions and risk factors. *Nat Rev Gastroenterol Hepatol.* 2020;17:473-86.
22. Napolitano M, Fasulo E, Ungaro F, Massimino L, Sinagra E, Danese S, et al. Gut Dysbiosis in Irritable Bowel Syndrome: A Narrative Review on Correlation with Disease Subtypes and Novel Therapeutic Implications. *Microorganisms* 2023, 11, 2369.
23. Goodoory V, Khasawneh M, Black C, Quigley E, Moayyedi P, Ford A. Efficacy of probiotics in irritable bowel syndrome: systematic review and meta-analysis. *Gastroenterology.* 2023;165:1206-18.
24. Ooi S, Correa D, Pak S. Probiotics, prebiotics, and low FODMAP diet for irritable bowel syndrome — what is the current evidence? *Complement Ther Med.* 2019;43:73-80.
25. Simon E, Călinoiu L, Mitrea L, Vodnar D. Probiotics, prebiotics, and synbiotics: implications and beneficial effects against irritable bowel syndrome. *Nutrients.* 2021;13:2112.
26. Abdallah H, Khalil M, Farella I, JohnBritto JS, Lanza E, Santoro S, et al. Ramadan intermittent fasting reduces visceral fat and improves gastrointestinal motility. *Eur J Clin Invest.* 2023;53:e14029.
27. Wang XJ, Camilleri M, Vanner S, Tuck C. Review article: biological mechanisms for symptom causation by individual FODMAP subgroups — the case for a more personalised approach to dietary restriction. *Aliment Pharmacol Ther.* 2019;50:517-29.
28. Chey WD. Elimination diets for irritable bowel syndrome: approaching the end of the beginning. *Am J Gastroenterol.* 2019;114:201-3.